Summer Bat Surveys at Proposed Dwelling at Coolinny, Ballyhooly, Co. Cork
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Summary

Following a Preliminary Bat Assessment in February 2024 during which sparse signs of bat roosting were found at a proposed dwelling site in Coolinny, Ballyhooly, Co. Cork, Abbott Ecology was commissioned by Roy Dorgan to conduct this follow-up bat survey during the peak bat activity season. It is proposed to renovate and extend an existing derelict farmhouse, and all ancillary works. The proposed works also include demolition of an existing outhouse.

The principal aim of the survey was to characterise the potential bat roosts on site, assess potential impacts of the development and bat licensing requirements, and propose bat mitigation measures where appropriate. Surveys were carried out during the early part of the main bat active season in suitable weather conditions in late April and May 2024. A variety of methods were used including visual searches of the buildings for tell-tale signs of bats roosting, two dusk emergence surveys, and passive bat detector monitoring of the buildings during a number of consecutive nights in late April to May 2024.

A minor night-roost of Brown Long-eared Bat Bat (*Plecotus auritus*) (one individual), and a minor summer day-roost of Natterer's Bat (*Myotis nattereri*) (two individuals) were found in the outhouse adjacent to the derelict farmhouse that is proposed for demolition. There were no bats roosting in the farmhouse. Other bat species also detected passing through or foraging in single numbers at the site include; Soprano Pipistrelle (*Pipistrellus pygmaeus*) and Common Pipistrelle (*Pipistrellus pipistrellus*). There were no trees with potential roost features for bats on this site.

All Irish bats are protected under national and EU legislation. Both the animals themselves and their roosts are protected and it is an offence to disturb or interfere with them without a licence. Potential impacts of the proposed development on bats and proposed bat mitigation measures are detailed. A bat derogation license application has been submitted to the NPWS in relation to the minor roosts of Brown Long-eared Bat and Natterer's Bat in the outhouse in order to allow the proposed renovation and extension to proceed lawfully.

1. Introduction

1.1 Background and Aims

Following a Preliminary Bat Assessment in February 2024 that detected sparse signs of bat roosting at a proposed dwelling site in Coolinny, Ballyhooly, Co. Cork (report previously submitted to the planning authority), Abbott Ecology was commissioned by Roy Dorgan to conduct this follow-up bat survey during the peak bat activity season. It is proposed to renovate and extend an existing derelict farmhouse, and all ancillary works. The proposed works also include demolition of an existing outhouse (Planning Ref. 23/06008). Bat surveys commenced on 27 April 2024. Cork County Council issued a second Request for Further Information (RFI) on 9 May 2024, which included the following item relating to bat surveys;

> RFI Item No. 3: *"In accordance with the Preliminary Bat Roost Assessment submitted to the Planning Authority on 15/04/2024, the existing dwelling and the outhouse have the potential to support bat roosts. As this is the case you are requested to carry out and submit the findings of a bat survey to the Planning Authority. The purpose of the survey is to establish/identify/characterise bat roosts within any of the buildings on site. It is advised that the survey would be completed in accordance with Bat Conservation Trust and NPWS Guidance - 'Bat Surveys for the Professional Ecologist Good Practice Guidelines (4th edition)' and 'Bat Mitigation Guidelines for Ireland vol. 2'. Likely impacts of the development (both during construction and ongoing) on bats identified to be using the buildings and significance of such impacts should be assessed and mitigation measures proposed where necessary. Mitigation proposal should be fully integrated into the design of the proposed development. Furthermore, operational site lighting should be designed to minimise any potential impacts to bats known to occur within the site, with site lighting designed with input from a bat ecologist. Where the proposed works involve damage to or interference with a bat roost site, a derogation license from the National Parks and Wildlife Service will be required in order for the works to proceed. It is advised that you would indicate whether any such license has been obtained or is in progress with their further information submission where relevant."*

1.2 Statement of Competency

Dr. Isobel Abbott (Principal Ecologist, Abbott Ecology): Isobel is an independent ecological consultant, specialising for >15 years in bat ecology, bat survey, assessment and mitigation. She graduated first in class in Zoology from University College Cork in 2007, and subsequently obtained her PhD on the effectiveness of bat mitigation measures employed on Irish national road schemes in 2012. She has published a number of research papers on bat ecology in scientific journals. She has extensive experience of conducting bat surveys and other multi-disciplinary ecology surveys for Ecological Impact Assessments, Preliminary Ecological Appraisal, and Ecological Constraints and Appropriate Assessment Screening Reports. She has worked on a variety of projects including national bat monitoring programmes, wind farms, solar farms, road construction, bridge repairs, quarries, and residential and industrial developments. Isobel has designed bat mitigation measures and successfully applied for >50 bat derogation licenses from the National Parks and Wildlife Service associated with planning permission applications or research. She currently holds nationwide NPWS licenses to capture and handle bat species, and to disturb bat roosts for the purpose of ecological impact assessment.

1.3 Site Description and Proposed Works

The study site comprises a derelict farmhouse and various farm sheds in a rural setting (Lat. 52.108577, Long. -8.390700, Plate 1, Figure 1). The site is located beside a minor road, within an area of mostly agricultural grassland, with extensive regions of coniferous plantations nearby (Figure 1). While there were some treeline sections and small hedgerows in the fields surrounding the site, there was relatively little cover of trees or hedges around the farmhouse and farmyard.

The proposed works consist of the construction of an extension to the rear and side of an existing dwelling house to include alterations to the existing front facade, demolition of an existing outhouse to the rear of the existing dwelling, a wastewater treatment and percolation area, a borehole well and all ancillary works.

Plate 1. Photographs of the exterior of farmhouse proposed for renovation

Figure 1. Aerial photography showing location of farmhouse at Coolinny (red arrow). Maps epa.ie

1.4 Legal Protection of Bats

Bats comprise one of the most highly diverse mammalian groups. There are over 1,200 species of bat worldwide, with nine confirmed as resident in Ireland to date. Due to sharp declines in many bat populations in recent decades, all bat species in Europe are legally protected under the European Habitats Directive, 1992 (92/43/EEC). The Habitats Directive seeks to "*maintain or restore, at favourable conservation status, natural habitats and species of wild fauna and flora of Community Interest*". It contains lists (in '*Annexes*') of habitats, plant species, and animal species, which are rare or declining on a European scale. It is built around two pillars;

- A **System of Strict Protection** for species of European importance, **including all bat species** (listed under Annex IV, Article 12 of the EU Habitats Directive). This provides protection to the bats themselves, and also prohibits deterioration/destruction of breeding sites and resting places.

- **The Natura 2000 Network of Protected Areas** (Special Areas of Conservation, SACs, and Special Protection Areas, SPAs) (Article 6 of the EU Habitats Directive). The Lesser Horseshoe Bat (*Rhinolophus hipposideros*) is the only Irish bat species listed under Annex II, and for which the Irish government is required to designate SACs. This species occurs almost exclusively in the Atlantic seaboard counties of Cork, Kerry, Limerick, Clare, Galway and Mayo, with sparse records in counties Tipperary, Roscommon, and Sligo.

The domestic legislation, the European Communities (Birds and Natural Habitats) Regulations 2011-2021, (S.I. No. 477 of 2011) ("the Habitats Regulations"), which implements this EU Directive, combined with the Wildlife Acts 1976-2021, ensures that individual bats and their breeding sites and resting places are fully protected in Ireland. A summary of the law in relation to bats in Ireland and the Europe is highlighted in *Text Box 1* below.

Text Box 1. Bats and the Law

As a result of the legislation outlined above, it is an offence to:

1. Deliberately capture, injure or kill a bat.
2. Deliberately disturb a bat, particularly during the period of breeding, hibernating or migrating.
3. Damage or destroy a breeding site or resting place of a bat.
4. Keep, transport, sell, exchange, offer for sale or offer for exchange any bat taken in the wild, other than those taken legally before the Habitats Directive was implemented.

Bat Roost Derogation Licenses

Both pillars, (i) the System of Strict Protection and (ii) the Natura 2000 network of SACs and SPAs, allow for exceptions or "derogations" from the protection regimes under Article 6 and Article 16 of the EU Habitats Directive. A person may apply to the Minister under Regulation 54 of the Habitats Regulations for a derogation license to carry out one or more of these prohibited activities. Firstly, a license can only be granted by the Minister via the NPWS only for the reasons which are specifically listed in Regulation 54 (*Text Box 2*). Secondly, the applicant must demonstrate that there is no satisfactory alternative, and thirdly, that the action will not adversely affect the favourable conservation status of bat species in their natural range. Each case is considered on its particular circumstances, and an application may be refused. Mitigation to reduce or compensate for any impact of development is generally a condition of the licence and should be proportionate to the impact. Mitigation measures may require particular timing of operations, protection of existing roosts or the creation of new roosts to replace ones being lost. Monitoring of the effect of the mitigation is usually required (Marnell *et al*., 2022).

Text Box 2. Regulation 54 Derogation Reasons

(a) In the interests of protecting wild fauna and flora and conserving natural habitats
(b) To prevent serious damage, in particular to crops, livestock, forests, fisheries and water and other types of property
(c) In the interests of public health and public safety, or for other imperative reasons of overriding public interest, including those of a social or economic nature and the beneficial consequences of primary importance for the environment
(d) For the purpose of research and education, of repopulating and introducing these species and for the breeding operations necessary for these purposes, including artificial propagation of plants
(e) To allow, under strictly supervised conditions, on a selective basis and to a limited extent, the taking or keeping of bats

1.5 Bats In Ireland

The nine confirmed resident bat species in Ireland are; Soprano Pipistrelle (*Pipistrellus pygmaeus)*, Common Pipistrelle (*Pipistrellus pipistrellus)*, Nathusius' Pipistrelle (*Pipistrellus nathusii)*, Leisler's Bat (*Nyctalus leisleri)*, Brown Long-eared Bat (*Plecotus auritus)*, Lesser Horseshoe Bat (*Rhinolophus hipposideros)* and three myotid species; Daubenton's Bat (*Myotis daubentonii)*, Natterer's Bat (*Myotis nattereri),* and Whiskered Bat (*Myotis mystacinus)*. Ireland hosts the world population stronghold for Leisler's Bat, and one of the world's population strongholds for Lesser Horseshoe Bat.

There have been confirmed records of a further two species, currently considered vagrant species; Brandt's Bat (*Myotis brandtii)* in Co. Wicklow in 2003 confirmed by DNA analysis (Mullen 2007), and Greater Horseshoe Bat (*Rhinolophus ferrumequinum)* has been confirmed by a single male in Co. Wexford in 2012/2013 (Roche *et al.* 2014), and more recently by acoustic recordings made during June and July 2020 in Glendalough, Co. Wicklow (email communication from Bat Conservation Ireland, 17.7.2020). There have been a few other Irish records of Brandt's Bat, unconfirmed by DNA analysis, and it is possible that Brandt's Bat may have been overlooked because of its close similarity to Whiskered Bat. However, a 2008-2009 re-survey of known Irish sites for Whiskered Bat did not confirm any additional Brandt's Bat through DNA analysis, so it cannot at present be considered a resident species (Boston *et al.* 2010).

Table 1 details the conservation status and legal protection of Irish bat species with respect to; Red List of Terrestrial Mammals (Marnell, Looney & Lawton 2019), the latest assessment of EU protected habitats and species in Ireland (NPWS 2019), the European Communities (Birds and Natural Habitats) Regulations 2011-2021, and the Irish Wildlife Acts (1976 - 2021).

Table 1. Conservation Status, Population Size Estimate and Legal Protection of Irish Bat Species

Bat species	Estimated population size*	Red List Status**	EU Protected Species Assessment***	Habitats Directive	Irish Wildlife Acts
Common Pipistrelle *Pipistrellus pipistrellus*	1.2 -2.8 million	Least Concern	Favourable	Annex IV	Yes
Soprano Pipistrelle *Pipistrellus pygmaeus*	0.5-1.2 million	Least Concern	Favourable	Annex IV	Yes
Nathusius' Pipistrelle *Pipistrellus nathusii*	10,000 - 18,000	Least Concern	Unknown	Annex IV	Yes
Leisler's Bat *Nyctalus leisleri*	73,000 - 130,000	Least Concern	Favourable	Annex IV	Yes
Daubenton's Bat *Myotis daubentonii*	81,000 - 103,000	Least Concern	Favourable	Annex IV	Yes
Natterer's Bat	Unknown	Least Concern	Favourable	Annex IV	Yes

Bat species	Estimated population size*	Red List Status**	EU Protected Species Assessment***	Habitats Directive	Irish Wildlife Acts
Myotis nattereri					
Whiskered Bat *Myotis mystacinus*	Unknown	Least Concern	Favourable	Annex IV	Yes
Brandt's Bat *Myotis brandtii*	Unknown	Data Deficient	Not included (vagrant)	Annex IV	Yes
Brown Long-eared Bat *Plecotus auritus*	64,000 - 115,000	Least Concern	Favourable	Annex IV	Yes
Lesser Horseshoe Bat *Rhinolophus hipposideros*	14,000	Least Concern	Inadequate	Annex II and Annex IV	Yes
Greater Horseshoe Bat *Rhinolophus ferrumequinum*	Unknown, low number	Not included	Not included (vagrant)	Annex II and Annex IV	Yes

** After Roche et al. 2014. ** After Marnell et al. 2019. *** After NPWS 2019*

Bats use different types of roosts during different times of the year and phases of their life cycle (Plate 2) (see summary of roost types in Appendix A). For example, in early summer, pregnant females gather together to form maternity roosts where they give birth to pups and suckle them until they are weaned by late summer. The pups are flightless for a few weeks and are completely reliant on their mothers' milk. Bats spend the summer months mostly hunting for insect prey at night and sheltering by day. In winter when insect food becomes scarce due to low temperatures, bats seek out winter hibernation roosts where they enter into a torpor, reducing their metabolic requirements, thus surviving through the period of low food availability. They are vulnerable to disturbance in winter roosts, as waking up causes them to burn fat reserves that must last until spring, and they are vulnerable to injury when in a torpid state.

Bats also make use of roosts other than their daytime roost. During night-time foraging bouts, they may take temporary shelter from inclement weather or process and digest insect prey in what are called 'night roosts'. These often tend to be close to key foraging areas e.g. for Lesser Horseshoe (Knight & Jones 2009). Wherever a bat lives or rests is a bat roost. However bats need different roosting conditions at different times of the year, and they will often move around to find a roost that meets their needs. Summer maternity roosts, where females gather to give birth and rear pups, are of greater conservation significance than a night roost or an occasional roost used by a single or small number of bats (Marnell, Kelleher & Mullen 2022).

Each bat species tends to have its own particular roost requirements and preferences. For example, Lesser Horseshoe Bats cannot use their limbs to crawl into crevices like other species, and they must instead fly directly into a roost through an opening of sufficient size and hang by their specially adapted feet from a suitable perch. For this reason, this species will not use bat roost boxes as other Irish bat species. Pipistrelle species on the other hand are crevice dwellers. They can land and crawl into very tight spaces through access holes as little as 1.2 x 2 cm. Their roosts can be concealed under ridge tiles, in wall cavities, or between slates and felt for example.

Bats, like other wildlife, tend to use habitat corridors with shelter of trees, hedgerows and woodland to move throughout the landscape. Such wildlife corridors provide connectivity between the various roosts, foraging, and mating sites that bats use during different seasons or phases of their life cycle (Plate 2, and see Appendix A for descriptions of roost types). Linear vegetated features such as tree lines, hedges, riverbanks, and woodland, are often important commuting and foraging habitats for bats. These landscape features provide concentrations of insect prey as well as shelter from wind, rain and predators. However, bats, like any other wildlife, will also move through less sheltered landscapes when exploring new roosting/foraging opportunities or migrating between areas e.g. moving between summer roosts and autumn mating sites or winter hibernation roosts. Loss of connective habitat patches/corridors can however impede bat movements and negatively impact bat populations (Voigt & Kingston 2016).

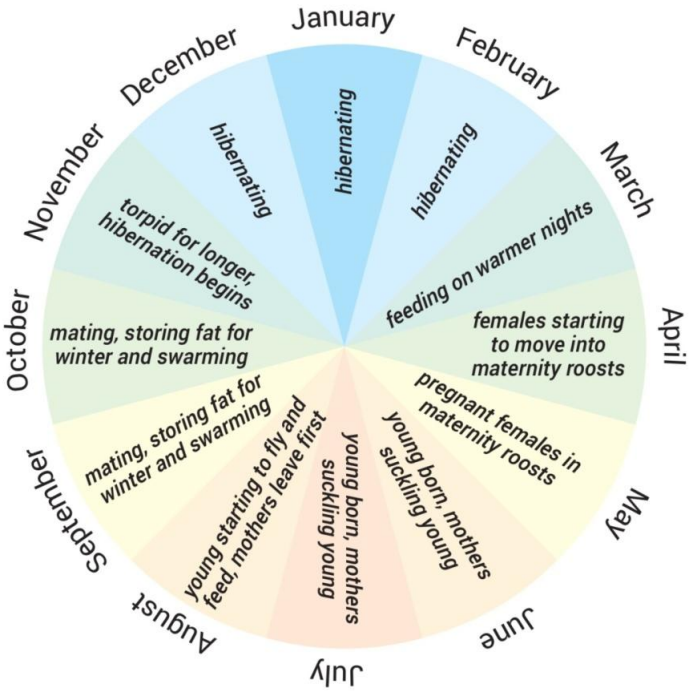

Plate 2. Generalised bat life cycle (from Bat Conservation Trust Survey Guidelines 2023)

2. Methods

2.1 Overview

Bat surveys were undertaken in accordance with current bat survey guidelines *Bat Conservation Trust and NPWS Guidance - 'Bat Surveys for the Professional Ecologist Good Practice Guidelines (4th edition)' and 'Bat Mitigation Guidelines for Ireland vol. 2'*; (Marnell *et al.* 2022; Collins 2023). The overall schedule of site surveys, and relevant weather conditions during surveys, are shown in Table 2.

Table 2. Overall bat survey schedule

Date	Field Survey	Times	Weather Conditions
27/4/2024	- Visual survey. - Deploy 2 x passive bat detectors. - Dusk emergence survey 1 of 2.	Dusk survey: 20:38-22:53 Sunset: 20:53	Temperature 8-7^{o}C; Wind F0-F1, Cloud 6/8 Otkas, Precipitation None
7/5/2024	-Daytime visual survey and collect SD cards from passive bat detectors, and do an interim bat recording analysis. -Dusk emergence survey 2 of 2. - Collect 1 of 2 passive bat detectors.	Dusk survey: 20:50-23:10 Sunset: 21:10	Temperature 11-10^{o}C; Wind F0-F1, Cloud 4/8 Otkas, Precipitation None
19/5/2024	- Collect 2nd passive bat detector from outhouse.	N/A	N/A

2.2 Desktop Review

A desktop review of publicly available ecology/bat data for the development site and locality was undertaken (i.e. National Biodiversity Data Centre NBDC). The NBDC online ecology database holds bat records from Bat Conservation Ireland's national bat database. Other available bat surveys for the area were also reviewed.

2.3 Visual Survey for Potential Roost Sites

Visual surveys of structures were assisted with high powered directional torchlight, close-focusing binoculars, and an endoscope as needed. Searches of the interior and exterior of potential roost structures were undertaken during daylight on in February (preliminary survey) and on the dates in Table 2, searching for signs of bat roosting, including for example;

- Bats, dead or alive
- Bat droppings: these can accumulate under established roosting and access locations.
- Feeding remains: discarded insects parts such as moth wings under feeding perches.
- Fur oil/grease staining: natural oils in bats' fur rubs onto regularly used surfaces.
- Urine staining, or splashes on windows.
- Scratch marks: from bats movements in and out of perching/roosting locations.
- Characteristic smells of bats may sometimes be detectable.
- Audible daytime roost bat chatter.

2.4 Dusk Emergence Surveys

Two dusk emergence surveys were carried out during suitable weather conditions as detailed in the survey schedule in Table 2. Dusk emergence surveys were conducted from c. 15 minutes before sunset until c. 2 hours after sunset. Bat detectors (Magenta Bat5, Wildlife Acoustics EM3+) were used to listen for bats in real time to aid observations during the surveys, and recordings were also made using a static detectors (Wildlife Acoustics Song Meter SM4BATFS with SMM U2 microphone) for later analyses. Recorded bat activity was manually analysed using Wildlife Acoustics Kaleidoscope Viewer Pro, specialist bat call analysis software. A Delmodes 8k 64MP 60 frames per second video camera with infrared (IR) night vision, with two additional IR illuminators (Tonton IR illuminator 8-LEDs c. 5Watts at 850nm, and a Lonnky IR illuminator 30 LEDs c. 15Watts at 850nm) was also used to aid night-time observations during the dusk surveys.

2.5 Automated/Passive Detector Monitoring

Automated bat detectors (Wildlife Acoustics Song Meter SM4BATFS with SMM U1 microphones) were used to record all-night bat activity during 10 full consecutive nights from 27 April 2024 to 7 May 2024 in the attic of the derelict farmhouse, and during 22 full consecutive nights from 27 April 2024 to 19 May 2024 in the outhouse. Detectors were set to automatically record from half an hour before sunset until half an hour after sunrise. The passive monitoring survey schedule is shown in Table 3, and the positions of the two detector microphones are shown in Plate 3.

Passive monitoring involves leaving a suitable bat detector in position with no observer present, and bats which pass sufficiently close to the detector microphone are recorded and their calls are stored for later analysis. Recordings were made in full spectrum, retaining all amplitude and harmonic information from the original signal for subsequent analysis, and were stored in WAV format.

This passive monitoring improves roost characterisation by allowing a more long-term insight into bat activity at a roost, more than the 'snap-shot' of bat activity obtained during an emergence survey. It can also allow insights into bats' night-roosting behaviour that may not be apparent during an emergence survey. Furthermore, passive bat monitoring is an effective method to detect species that have low intensity echolocation calls, such as Natterer's Bat and Brown Long-eared Bat (see note in Section 2.6). Passive detectors were also used to record bat activity for later analyses during the dusk emergence surveys.

Bat sonograms (e.g. Plate 10 and Plate 11) are then manually analysed and identified to species level using specialist software, Wildlife Acoustics Kaleidoscope Viewer Pro, noting the time and date of bat registration files. Activity analysis of recorded bat echolocation was defined as registrations/contacts per species within a 15 s (maximum) file. Multiple passes/calls/pulses of the same species within a (maximum) 15 s file count as a single registration - two species within the same 15 s file count as two registrations. Feeding buzzes (indicating a prey capture attempt by a bat), and social calling of bats (used for communication rather than foraging or orientation) were also noted. A feeding buzz is a shortening of pulse durations and inter-pulse intervals as the bat homes in on prey.

Table 3. Automated Passive Detector Monitoring Schedule

Detector Reference	Microphone Location Notes	Dates Deployed	Nights Running	Nights Analysed
A	Facing into low attic of the derelict farmhouse (Plate 3 left).	27.4.2024 - 7.5.2024	10	10
B	Attached near timber ceiling of the darkest part of the outhouse, above the location where sparse droppings and feeding remains of Brown Long-eared Bat were observed on the floor (Plate 3 right).	27.4.2024 - 19.5.2024	22	22

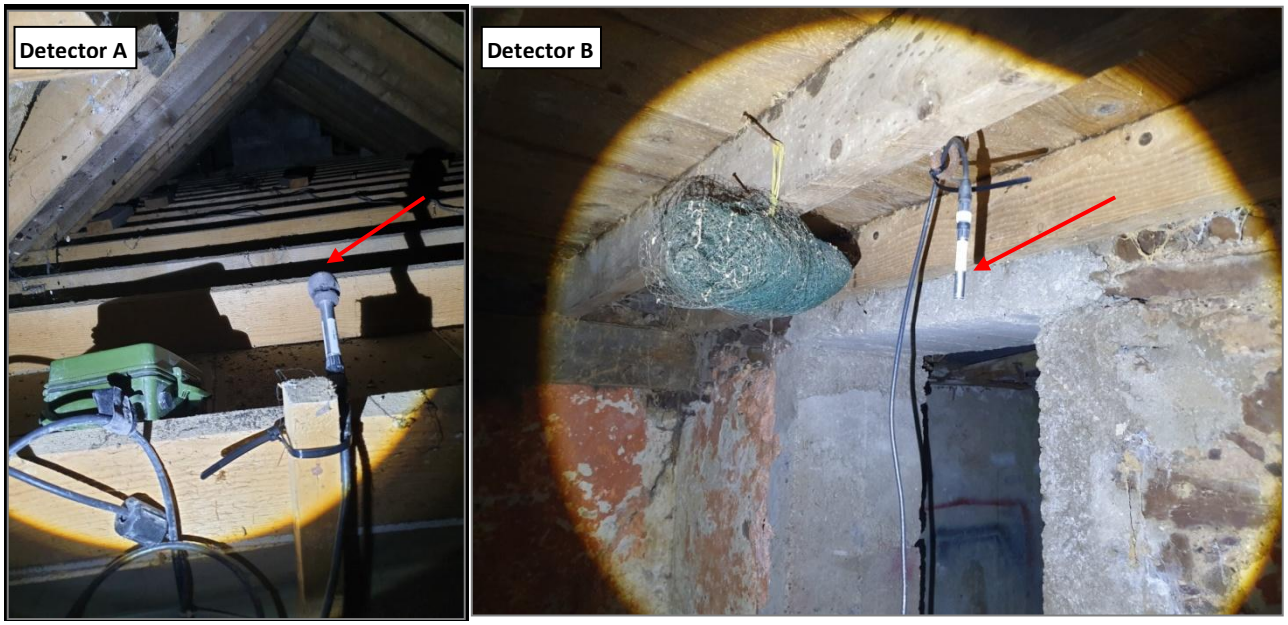

Plate 3. Bat detector microphone positions (red arrows) of detector A in the low attic of the derelict farmhouse (left), and inside the lower part of the outhouse beneath the loft area (right).

2.6 Note on Differences in Bat Species' Acoustic Detectability

Some Irish bat species have much higher intensity of echolocation than others, and can thus be detected from greater distances, e.g. Leisler's Bat (by far the loudest of all the Irish bat species), followed by relatively intense echolocation of Common Pipistrelle and Soprano Pipistrelle. Bat species with quieter echolocation, such as Brown Long-eared Bat and Natterer's Bat, must fly much closer to the microphone to be detected. Information taken from the UK Bat Conservation Trust's bat survey guidelines indicates that Brown Long-eared Bat and Natterer's Bat are among the most difficult to detect bat species (Plate 4, from Collins, 2023). These differences in acoustic detectability are important for interpreting the results of passive detector monitoring. However, Brown Long-eared Bat very often emits a lot of social calls, which are much louder than its echolocation calls (see sonogram in Plate 10 for example), in its roosts, even minor roosts (pers. obs.).

Table 3.8 Number of surveys required to achieve 95% certainty of detection on walked transect surveys in woodland (Scott and Altringham, 2014).

Species	Number of surveys to achieve 95% certainty of detection for walked transect survey
Pipistrelle	1
Brandt's bat	2
Whiskered bat	2
Barbastelle	2
Horseshoe bat	4
Natterer's bat	5
Brown long-eared bat	Up to 9[a]
Bechstein's bat	4–6[b]
Alcathoe	2–3[b]

Plate 4. Table re bat species' acoustic detectability from Bat Conservation Trust Survey Guidelines (Collins, 2023)

2.7 Survey Constraints

The farmhouse was mostly accessible for visual survey, including the attic. Between slates and felt and under ridge tiles and inside soffit boxes was not visible. Most of the sheds were also accessible for visual survey, apart from some areas that could not be accessed because of rotting floor boards or unsafe ceiling materials. These constraints to visual survey were offset by using a range of other complimentary survey techniques at a suitable time of year during the main bat activity season.

3. Results

3.1 Desktop

NBDC Biodiversity Maps for the 2 km grid square in which the site lies (W79H) did not hold any bat records. This likely reflects a lack of survey effort in the area, or lack of submission of records to the database, rather than an absence of bats and bat roosts. The site lies outside of the known range of Lesser Horseshoe Bat (Ireland's only Annex II bat species). Data from various reports of bat surveys within the 10km square in which the site lies indicate the presence of Common Pipistrelle, Soprano Pipistrelle, Leisler's Bat, Daubenton's Bat, Natterer's Bat, and Brown Long-eared Bat. There are no publicly recorded

bat roosts within the 5km area surrounding the site. The owners of the site were not aware of the presence of any current or historical bat roosts at the farmhouse, having grown up there.

3.2 Visual Surveys

Derelict farmhouse:

A visual assessment of the derelict farmhouse from February 2024 was described in more detail, with photographs, in the Preliminary Bat Assessment already submitted to the planning authority. In summary, there were multiple potential access points for bats, and old and sparse pipistrelle bat droppings in the attic and bathroom of the derelict farmhouse. (Abbott Ecology, March 2024). Visual re-surveys in late April and May 2024 indicated that there were no fresh bat droppings or feeding remains in the farmhouse. This is consistent with no bats have been recorded by the automated bat detector in the attic, and no bats having emerged or entered during dusk surveys (Sections 3.4 and 3.5).

Outhouse proposed for demolition:

A visual assessment of the outhouse from February 2024 was described in more detail, with photographs, in the Preliminary Bat Assessment. In summary, there were multiple potential access points for bats, and a sparse scattering of Brown Long-eared Bat feeding remains in one location in the darkest part of the shed which had a timber ceiling, beneath the loft area (Abbott Ecology, March 2024). The upper loft area had no signs of bats, and low day-roost potential because there is ingress of daylight through an open window and numerous holes in the roof, and there was no covering beneath the slates, or cavities in the walls, where bats could hide away from the daylight (Plate 5).

Plate 5. Loft area of outhouse had no signs of bats and low bat roost potential due to ingress of daylight

During visual re-surveys in late April and May 2024 there was a sparse collection of fresh droppings (7) and feeding remains of Brown Long-eared Bat in the same place again, suggesting a night roost of this species. One of the automated bat detectors was placed in this area with the droppings and feeding remains to further characterise this roost (Detector B).

Dusk emergence surveys and automated bat detector monitoring in late April and May 2024 confirmed night-roosting of Brown Long-eared Bat, but also interestingly a small summer day roost of two Natterer's Bat, and night-roosting of Natterer's Bat (see Section 3.4 and Section 3.5). There were no visual signs of the Natterer's Bat roosting in evidence, and the exact roosting location of this species within the outhouse remains unknown. Plate 6 shows the part of the outhouse where the detector that recorded Brown Long-eared Bat and Natterer's Bat was positioned. The Natterer's Bat could possibly have been hidden out of sight behind the large wooden pillars and beams along the walls, as shown in Plate 6, although these areas appeared mostly too damp to provide optimal roosting spaces, and no bats were seen here. This species can sometimes roost in very tight spaces in woodwork, such as mortise joints. Plate 7 shows the other part of the shed, where there is a lot of ingress of daylight through open doors and windows and other gaps. There is a corrugated metal roof on this section, which is also not an optimal material for bat roosting. Natterer's Bat sometimes roost well out of sight in cavity walls even in sheds with a lot of daylight (pers. obs.). However, there were no obvious cavities inside the walls in this case. The usefulness of longer-term deployment of automated bat detectors for acoustically detecting Natterer's Bat roosting is again highlighted by this case, where visual evidence could not be found.

Plate 6. The part of the outhouse where the passive detector detected Brown Long-eared Bat and Natterer's Bat.

Plate 7. Part of outhouse with corrugated metal sheeting roof and ingress of daylight

Other shed on site:

There were no signs of bats roosting in the other shed at the southern side of the courtyard to the rear of the farmhouse (Plate 8). This shed had low roost suitability because it lacked sheltered roost spaces, and had a collapsing corrugated iron roof, and there was ingress of daylight and wind and rain into the shed (Plate 8).

Plate 8. Low bat roost potential and no signs of bat roosting in this other shed on site

3.3 Potential Roost Features (PRFs) in Trees

There were no trees or bushes with Potential Roost Features for bats on the site.

3.4 Dusk Emergence Surveys

During the first dusk emergence survey on 27 April 2024, no bats emerged from the derelict farmhouse. One bat was briefly seen, but not heard or not recorded on a bat detector, flying outside the south of the outhouse at 54 minutes past sunset. An emergence from the outhouse was not observed directly. Given the results of automated bat detector monitoring (Section 3.5), it may in hindsight have been a Natterer's Bat, which have low intensity echolocation. Otherwise, there was a single Common Pipistrelle which had occasional bouts of repetitive foraging behaviour around the house and sheds, but arrived at the site from elsewhere to the west. Soprano Pipistrelle was infrequently recorded passing the site.

During the second dusk emergence survey on 7 May 2024, two Natterer's Bats were confirmed to emerge from roosting in the outhouse. The first Natterer's Bat was observed emerging from the outhouse through a gap in the door, as indicated in Plate 9 at 21:49, 39 minutes past sunset. The second Natterer's Bat emerged through another hole in the shed door as also indicated in Plate 9 at 21:59, 49 minutes after sunset. There were no other emergences of bats observed from this outhouse. Again, no bats emerged from the derelict farmhouse. Like the first dusk survey, there was a single Common Pipistrelle repetitively foraging from time to time around the house and sheds, but arrived at the site from elsewhere. Soprano Pipistrelle was infrequently recorded passing the site. There was no artificial light at the study site or adjacent sites during the dusk surveys.

Plate 9. Red arrows indicate exit points of Natterer's Bat during dusk emergence survey

3.5 Automated All-Night Acoustic Monitoring

Derelict farmhouse:

Detector A inside the attic of the derelict farmhouse detected no bats between 27 April 2024 and 7 May 2024. Greater White-toothed Shrew (*Crocidura russula*), a recently introduced non-native species to Ireland, was detected inside the attic. The detector was removed from the attic after the dusk survey on 7 May 2024.

Outhouse proposed for demolition:

Although the level of acoustic bat activity in the outhouse was relatively low, both Brown Long-eared Bat and Natterer's Bat were fairly consistently recorded inside the outhouse during the 22-night monitoring period between 27 April 2024 and 19 May 2024, as detailed in Table 4 and Table 5 below. No other bat species were detected in the outhouse. The dates and times of Brown Long-eared Bat registrations are shown in Table 4, and the dates and times of Natterer's Bat registrations are shown in Table 5. Example sonograms of Brown Long-eared Bat and Natterer's Bat from inside the outhouse are shown in Plate 10 and Plate 11.

Overall, there were 49 registrations of Brown Long-eared Bat, and 37 registrations of Natterer's Bat over a 22-night period. Brown Long-eared Bat was detected on 12 out of 22 nights, and Natterer's Bat also on 12 out of 22 nights, as shown in Table 4 and Table 5 respectively. The amount and timing of registrations is consistent with what is most likely a single Brown Long-eared Bat night-roosting in the shed quite regularly, and a small number of Natterer's Bat (estimated at 2 from dusk survey observations) day-roosting in the shed, and sometimes visiting for night-roosting also. This is evidenced by the timings of Brown Long-eared Bat being mostly in the middle of the night. The possibility that a single Brown Long-eared Bat day-roosts in the outhouse on some occasions cannot be ruled out, as there were some mornings where this species was inside the outhouse within an hour of sunrise e.g. 55, 56, and 52 minutes before sunrise, as detailed in Table 4.

Natterer's Bat also appears in the middle of the night on some occasions, indicating night-roosting. There is also a fairly consistent pattern of Natterer's Bat being recorded around its typical emergence timeframe (it is a relatively late-emerging species (Collins 2023)). For example, it was recorded at 50, 51, 48, 53, 63, 55, 53 and 65 minutes after sunset, as noted for the various dates shown in Table 5. Note that Natterer's Bat was not recorded inside the shed during the second dusk emergence survey on 7 May 2024, even though two Natterer's Bats were observed emerging and recorded from outside the shed during that survey. This highlights that not all of the activity of these species will be captured by the detector microphone. However, there would typically be orders of magnitude more acoustic registrations if there were maternity roosts of either species inside the shed (pers. obs.). The pattern of acoustic activity of Natterer's Bat is consistent with a small day-roost and small night-roost of this species.

Table 4. Brown Long-eared Bat registrations inside the outhouse during 22 full nights 27.4.2024 - 19.5.2024

Date	Time	Hr	Species	Notes	Night
29/04/2024	00:58:09	0	Brown Long-eared Bat	Flight calls and social calls	2
29/04/2024	01:03:03	1	Brown Long-eared Bat	Social calls	2
29/04/2024	01:03:28	1	Brown Long-eared Bat	Social calls	2
29/04/2024	01:05:32	1	Brown Long-eared Bat	Social calls	2
29/04/2024	01:07:48	1	Brown Long-eared Bat	Clear flight and social calls, long sequence	2
29/04/2024	01:32:51	1	Brown Long-eared Bat	Flight calls and social calls	2
29/04/2024	01:39:27	1	Brown Long-eared Bat	Social calls	2
29/04/2024	01:41:26	1	Brown Long-eared Bat	Flight calls and social calls	2
29/04/2024	01:43:33	1	Brown Long-eared Bat	Social calls	2
29/04/2024	02:03:09	2	Brown Long-eared Bat	Flight calls and social calls	2
29/04/2024	02:06:17	2	Brown Long-eared Bat	Flight calls and social calls	2
30/04/2024	00:59:56	0	Brown Long-eared Bat	Social calls	3
30/04/2024	01:13:31	1	Brown Long-eared Bat	Flight calls and social calls	3
02/05/2024	04:15:27	4	Brown Long-eared Bat	Social calls	5
02/05/2024	04:50:19	4	Brown Long-eared Bat	Social calls. 1 hr 10 mins before sunrise 6:01	5
04/05/2024	00:58:56	0	Brown Long-eared Bat	Social calls	7
04/05/2024	01:30:32	1	Brown Long-eared Bat	Flight calls and social calls	7
06/05/2024	04:38:29	4	Brown Long-eared Bat	Social calls	9
07/05/2024	04:50:40	4	Brown Long-eared Bat	1 hr 2 mins before sunrise 5:52. Social calls	10
09/05/2024	01:32:04	1	Brown Long-eared Bat	Social calls	12
09/05/2024	01:43:03	1	Brown Long-eared Bat	Social calls	12
09/05/2024	01:48:28	1	Brown Long-eared Bat	Flight calls and social calls	12
09/05/2024	03:28:31	3	Brown Long-eared Bat	Flight calls and social calls	12
09/05/2024	03:34:21	3	Brown Long-eared Bat	Social calls	12
09/05/2024	03:49:59	3	Brown Long-eared Bat	Flight calls and social calls	12
09/05/2024	04:49:45	4	Brown Long-eared Bat	Flight calls and social calls	12
09/05/2024	04:52:40	4	Brown Long-eared Bat	Flight calls and social calls	12
09/05/2024	04:53:00	4	Brown Long-eared Bat	Social calls	12
09/05/2024	04:53:25	4	Brown Long-eared Bat	Social calls. 55 minutes before sunrise 5:48	12
14/05/2024	01:08:11	1	Brown Long-eared Bat	Flight calls and social calls	17
14/05/2024	01:38:00	1	Brown Long-eared Bat	Different type of social calls	17
15/05/2024	00:01:32	0	Brown Long-eared Bat	Social calls	18
15/05/2024	00:02:12	0	Brown Long-eared Bat	Flight calls and social calls	18
15/05/2024	00:11:27	0	Brown Long-eared Bat	Flight calls and social calls	18
15/05/2024	02:52:04	2	Brown Long-eared Bat	Flight calls and social calls	18
15/05/2024	02:52:19	2	Brown Long-eared Bat	Flight calls and social calls	18
16/05/2024	04:30:24	4	Brown Long-eared Bat	Social calls	19
16/05/2024	04:41:02	4	Brown Long-eared Bat	56 minutes before sunrise 5:37. Flight calls and social calls	19
18/05/2024	02:40:44	2	Brown Long-eared Bat	Social calls	21
18/05/2024	03:19:50	3	Brown Long-eared Bat	Social calls	21
18/05/2024	03:47:10	3	Brown Long-eared Bat	Social calls	21
18/05/2024	03:58:38	3	Brown Long-eared Bat	Social calls	21
19/05/2024	02:06:01	2	Brown Long-eared Bat	Social calls	22
19/05/2024	02:06:11	2	Brown Long-eared Bat	Flight calls and social calls	22
19/05/2024	02:08:13	2	Brown Long-eared Bat	Social calls	22
19/05/2024	02:16:25	2	Brown Long-eared Bat	Social calls	22
19/05/2024	02:20:45	2	Brown Long-eared Bat	Social calls	22
19/05/2024	04:41:12	4	Brown Long-eared Bat	Social calls	22
19/05/2024	04:41:19	4	Brown Long-eared Bat	52 minutes before sunrise 5:33. Flight calls and social calls	22

Table 5. Natterer's Bat registrations inside the outhouse during 22 full nights 27.4.2024 - 19.5.2024

Date	Time	Hr	Species	Notes	Night
27/04/2024	21:43:38	21	Natterer's Bat	50 mins after sunset 20:53	1
27/04/2024	21:44:05	21	Natterer's Bat	2 individuals flying together	1
27/04/2024	21:46:11	21	Natterer's Bat		1
27/04/2024	21:47:18	21	Natterer's Bat		1
01/05/2024	21:51:17	21	Natterer's Bat	51 minutes after sunset 21:00	5
01/05/2024	21:52:25	21	Natterer's Bat		5
04/05/2024	21:53:02	21	Natterer's Bat	48 minutes after sunset 21:05	8
08/05/2024	03:05:40	3	Natterer's Bat		11
08/05/2024	03:22:39	3	Natterer's Bat		11
10/05/2024	22:07:17	22	Natterer's Bat	53 minutes after sunset 21:14	14
10/05/2024	22:07:46	22	Natterer's Bat	2 individuals flying together	14
10/05/2024	22:08:48	22	Natterer's Bat		14
10/05/2024	22:09:03	22	Natterer's Bat		14
12/05/2024	04:20:36	4	Natterer's Bat		15
13/05/2024	03:23:21	3	Natterer's Bat		16
13/05/2024	22:21:58	22	Natterer's Bat	1 hr 3 minutes after sunset 21:19	17
13/05/2024	22:22:33	22	Natterer's Bat	2 individuals flying together	17
13/05/2024	22:22:54	22	Natterer's Bat	2 individuals flying together	17
13/05/2024	22:49:42	22	Natterer's Bat		17
14/05/2024	03:32:43	3	Natterer's Bat	Feeding buzz	17
14/05/2024	03:32:52	3	Natterer's Bat	Feeding buzz	17
15/05/2024	00:09:58	0	Natterer's Bat		18
15/05/2024	01:23:19	1	Natterer's Bat	Feeding buzz	18
15/05/2024	01:33:16	1	Natterer's Bat		18
15/05/2024	01:33:29	1	Natterer's Bat		18
15/05/2024	01:34:19	1	Natterer's Bat		18
15/05/2024	04:28:05	4	Natterer's Bat	Feeding buzz	18
15/05/2024	04:34:53	4	Natterer's Bat		18
15/05/2024	04:40:21	4	Natterer's Bat	59 minutes before sunrise 5:39. Feeding buzz	18
15/05/2024	22:17:59	22	Natterer's Bat	55 minutes after sunset 21:22	19
16/05/2024	01:52:34	1	Natterer's Bat		19
16/05/2024	03:55:34	3	Natterer's Bat	Feeding buzz	19
16/05/2024	04:06:52	4	Natterer's Bat		19
16/05/2024	22:17:09	22	Natterer's Bat	53 minutes after sunset 21:24	20
17/05/2024	02:22:13	2	Natterer's Bat		20
17/05/2024	02:31:54	2	Natterer's Bat	Feeding buzz	20
18/05/2024	22:32:16	22	Natterer's Bat	1 hr 5 minutes after sunset 21:27	22

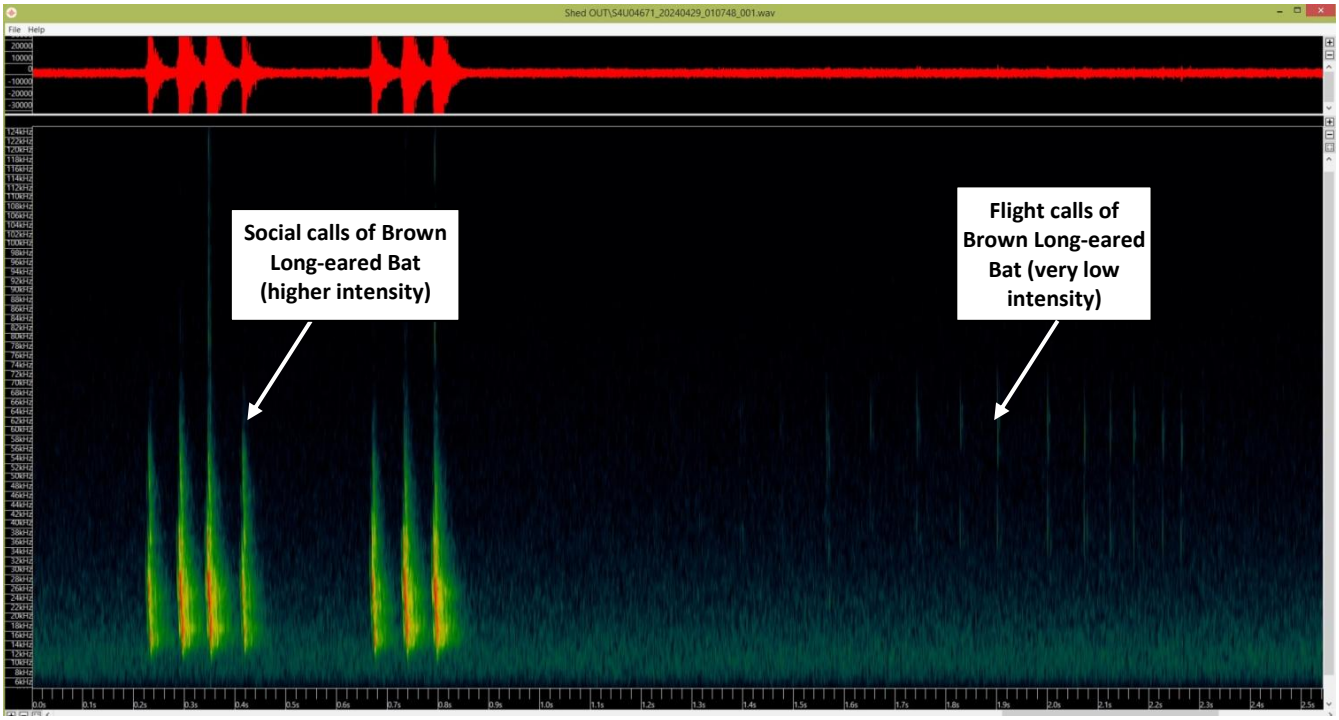

Plate 10. Example of sonogram showing the much higher sound intensity of the social calls of Brown Long-eared Bat in the outhouse, compared to its low intensity flight pulses.

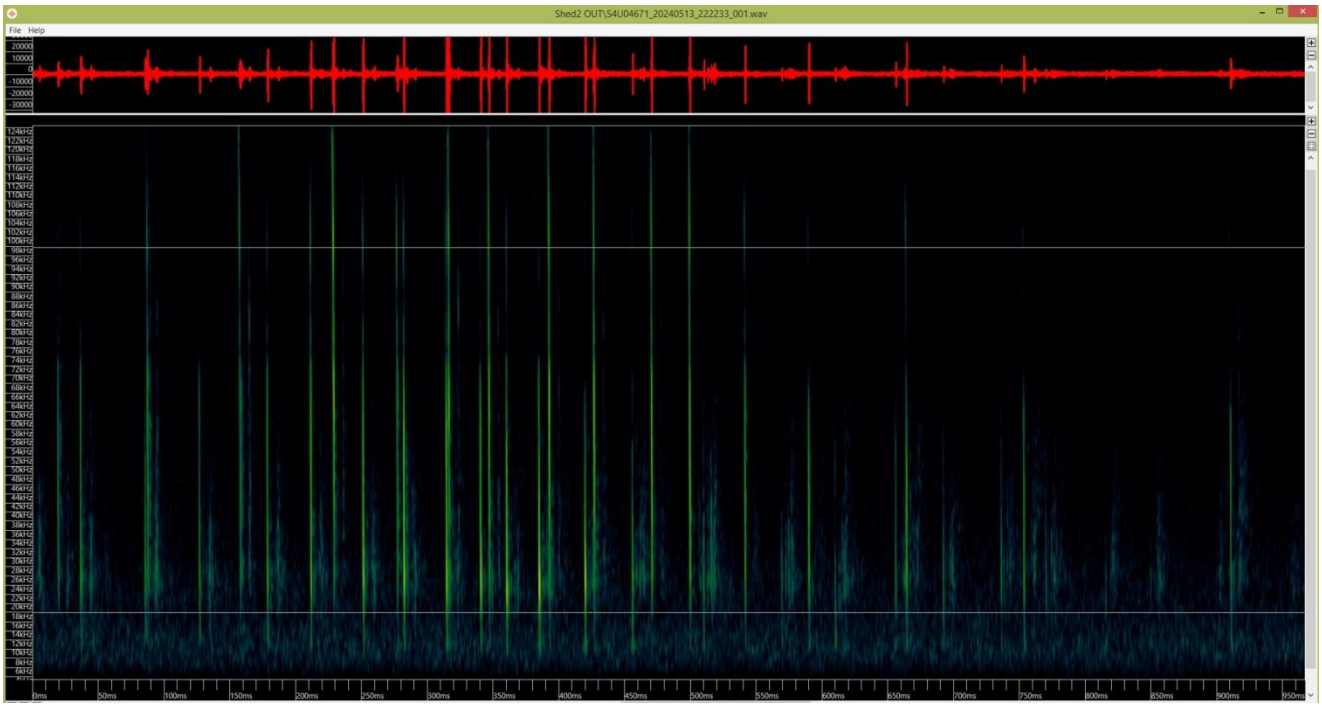

Plate 11. Example of sonogram showing very broadband, steeply frequency-modulated calls of Natterer's Bat inside the outhouse (2 individuals flying simultaneously). Horizontal lines drawn and 20kHz and 100kHz for visual reference.

3.6 Summary and Discussion

Brown Long-eared Bat Roosting Behaviour

It is estimated that just one Brown Long-eared Bat is using the outhouse as a night-roost, based on the low amount of acoustic recordings, and the timing of recordings. There is also a possibility that a single Brown Long-eared Bat may sometimes use the outhouse as a minor day roost, as there were some mornings where this species was still inside less than an hour before sunrise. Both of these minor roost types have relatively low conservation significance (Marnell *et al.* 2022).

Natterer's Bat Roosting Behaviour

Mini Literature Review: Natterer's Bat use many types of day roosts during the summer. These include various forms of tree cavity, bridges, attic apex sites, mortises in attics and barns, soffit boxes at eaves, tops of gable walls, crevices in stone walls and the space within modern cavity walls (Smith 2000). They will also make use of artificial bat boxes (Mortimer 2006). Maternity colonies in the UK are said to comprise between 25-200 adults, mostly females (Smith & Rivers 2008). Smaller maternity colonies of just 4-10 females are found in rock crevice roosts in Bulgaria (Dietz, von Helversen & Nill 2009). Male Natterer's bats often form small colonies close to maternity roosts or single males roost with the maternity roost. However males can also form their own colonies of up to 25 animals (Swift 1997; Dietz *et al.* 2009).

Natterer's Bat breeding colonies do not roost in just a single place during the summer. Instead they regularly switch roosts within a network of roosts. A summer colony may use a network of 25 or more trees or buildings as roosts in a season (Smith & Racey 2005). Some roosts are only used by Natterer's Bat for one day or a few days (Smith, 2000). It is thought that Natterer's Bat may have fission-fusion communities, where a colony divides itself into constantly changing satellite or sub-colonies (Dietz *et al*., 2009). As well as switching roost sites regularly during the summer, Natterer's Bat are also known to change roosting locations within roost buildings quite regularly (Dietz *et al*., 2009).

Despite the high levels of flux in roosting behaviour, Smith & Racey (2005) found that Natterer's Bat colonies exhibited high inter-annual fidelity to roosts. Attic maternity roosts used during late gestation and early lactation were reused for the same function in successive years, as were heavily timbered barns during late lactation and post-lactation. They state that the year to year dependence upon established roosts indicates that these types of maternity roost should be given high conservation priority.

Minor roost in Coolinny outhouse: The Natterer's Bat roost in the outhouse is not a maternity roost, and may be a minor roost of male bats. An estimate of two individuals use the outhouse, based on the observation of two emerging during the second dusk survey, and the relatively sparse amount of acoustic recordings, sometimes with two individuals flying together simultaneously.

Despite the typical roost-switching behaviour of Natterer's Bat within a network of roosts, there was fairly consistent use of the outhouse by this species during the monitoring period. They were confirmed as present on 12 out of 22 nights, with this likely being an under-estimate of frequency of occupation due to possible non-detections due to their low intensity echolocation.

4. Assessment of Potential Impacts on Bats

During these bat surveys, two of the nine resident bat species known to Ireland had minor roosts in the outhouse adjacent to the derelict farmhouse; Brown Long-eared Bat and Natterer's Bat. Bat activity levels at the site were relatively low. A further two bat species, Common Pipistrelle and Soprano Pipistrelle, foraged occasionally at the site or passed through the site. The site was estimated to be mainly used by a small number of individuals, estimated at one or two for each of the four species above. All species recorded are Annex IV species under the EU Habitats Directive and all have favourable conservation status (Table 1). Natterer's Bat would be classed as the rarest of the four bat species recorded, with Brown Long-eared Bat the next rarest.

As there were no bats roosting in the derelict farmhouse, renovation of this building, including re-roofing, would not be expected to have a negative impact on bats.

The proposed demolition of the outhouse at the north side of the courtyard at the rear of the farmhouse would result in the destruction of the minor night-roost, and possible minor day-roost, of a single Brown Long-eared Bat, and the destruction of a minor summer day-roost of Natterer's Bat (estimated at 2 individuals). There would be the same impact of destruction if the outhouse was partly converted, rather than fully demolished, because of the extensive gutting of materials that would be necessary to convert it into a habitable building. Proposals for provision of alternative suitable roosting opportunities within the site are included in Section 5.

Demolition/conversion of the outhouse could also potentially result in injury/death of a bat if they were roosting at the time (see mitigation measures in Section 5 to prevent this).

Potentially increased levels of artificial lighting at the site post-construction may negatively impact on all bat species in terms of roosting, foraging, and commuting through the site, although in this case there are few bats using the site at present. However, the two species with minor roosts in the outhouse, Brown Long-eared Bat and Natterer's Bat, are particularly intolerant of artificial light. Natterer's Bat and Brown Long-eared Bat are among the guild of so-called 'clutter-adapted' bat species, which are adapted by their wing morphology and characteristic low-intensity echolocation to slow manoeuvrable flight at low heights, and foraging close to tree canopies or lower ground vegetation. Natterer's Bat and Brown Long-eared Bat are capable of close-up detection of prey and slow, hovering flight. This allows them to glean prey which is resting on foliage (Swift 1998; Siemers & Schnitzler 2000; Swift & Racey 2002). The adaptations of the clutter-adapted species also make them more averse to artificial lighting (Voigt *et al.* 2021).

Clutter-adapted bat species tend to be much more light-averse than either edge-adapted (e.g. pipistrelle species) or open-adapted species (e.g. Leisler's Bat) (Rowse *et al.* 2016). This is one of the reasons that clutter-adapted species typically emerge later from, and return earlier to, their roosts when it is darker compared to other bat species (Jones & Rydell 1994; Duvergé *et al.* 2000). Natterer's Bat and Brown Long-eared Bat are among the most light-averse of all bat species (Roche *et al.* 2014; Zeale *et al.* 2016; Rydell, Eklöf & Sánchez-Navarro 2017; Rydell *et al.* 2021).

Measures to restrict/minimise artificial lighting at the site are outlined in Section 5.

There is no potential for a loss of foraging opportunities for bats due to the development, other than the potential adverse affect of artificial lighting. The planting of native tree and plant species as part of the landscape plan will ensure that shelter and foraging opportunities for insects and bats are enhanced in the long-term.

There are only a small number of bats using the site at present. With implementation of the mitigation measures below, there is negligible potential for population-level impacts on bats.

5. Bat Derogation Licensing Requirements and Recommended Bat Mitigation Measures

Renovation of the derelict farmhouse itself can proceed as normal without the need for bat mitigation measures (except for minimising artificial lighting), as there were no bats roosting in this building.

The property owner has submitted an **application for a bat roost destruction license to the National Parks and Wildlife Service** in relation to the minor roosts of Brown Long-eared Bat and Natterer's Bat in the outhouse. The bat mitigation measures outlined here form a basis for the bat license application. No works to the outhouse will take place unless such a license is granted by the NPWS.

In the hierarchy of bat roost conservation significance, and proportionate mitigation, presented in the latest Bat Mitigation Guidelines for Ireland (Marnell *et al.* 2022), a night-roost (and possible minor day-roost) of Brown Long-eared Bat is at the

lower end of conservation significance, and a minor day-roost and night-roost of a small number of Natterer's Bat is at the mid- to lower end of conservation significance, as shown in Plate 12 below from those guidelines.

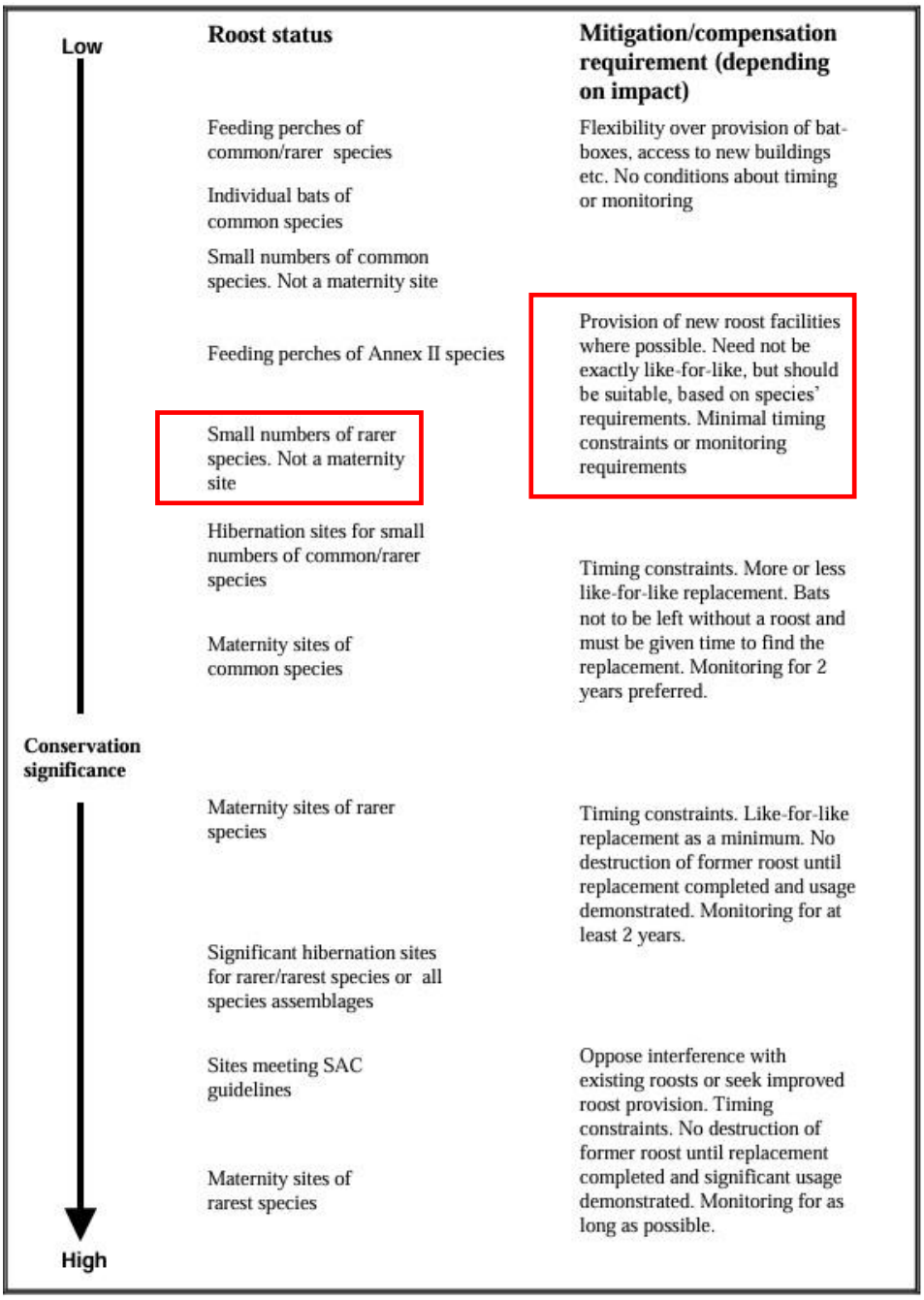

Plate 12. Guidelines for proportionate mitigation. The definition of common, rare and rarest species requires regional interpretation (Marnell *et al.* 2022). Red boxes indicate where a minor Natterer's Bat minor roost fits in this scheme.

Bat Mitigation Measures

The property owner will undertake the following bat mitigation measures (if planning permission is granted);

1. Automated acoustic monitoring of the outhouse prior to the proposed demolition date to gain knowledge of whether bats are likely to be day-roosting in the structure. A dusk emergence or dawn re-entry survey from inside the building to try and pinpoint the hidden roost space would then be recommended if acoustic recordings indicate presence.

2. Hand demolition of the outhouse under supervision of a bat specialist licensed to handle bats. It is recommended to conduct this outside of the coldest months of the year (Dec, Jan, Feb) to avoid the period where bats could potentially be in a vulnerable state of torpor. While it is quite unlikely they would winter-hibernate in this shed, the possibility can't be ruled out. The bats may be more able to find/adapt to alternative roosts and forage outside of this period. Natterer's Bat is one of the most winter-active of bat species in Ireland, probably due to its ability to catch non-flying insects gleaned from surfaces such as caterpillars of moths, spiders and even woodlice, as well as flying insects (Hope *et al.* 2014; Meier *et al.* 2022).

3. Provision of an alternative roosting location for bats in part of the shed at the south of the courtyard at the rear of the farmhouse, as indicated in Plate 13.
   -This alternative bat roost will be completed before the demolition of the outhouse (if planning permission is granted)
   - A new roof of slate and traditional bitumen type 1F felt underlay to be installed on the small shed shown in Plate 13. Breathable roofing membrane (BRM) to be avoided because bats can become entangled and die in BRM threads (Waring *et al.* 2013).
   - Timber slats to be installed under the rafters of the new roof, to create a dark and sheltered roosting location.
   - The existing window on the southern wall (Plate 13) to be left open for bats to fly into the shed beneath the timber slatted compartment.
   - Narrow access space (c. 1.5cm) at the sides of the timber slats to be left for bat access. Roughened timber planks should be fixed to the wall just underneath the slatted timbers, with a gap of c. 1.5 cm below the level of the slats - the purpose of this is so that bats can land on the timber and then crawl upwards into the space above.
   - An alternative access point for bats should be added by creating a lifting slate in the slate roof, with a small hole cut out of the felt underneath the lifting slate. Alternatively a Morris Bat access slate can be installed. Instructions for construction of this have been emailed to the property owner.
   - There should be little or no artificial light spill near this building, particularly at the southern side near the access window.

Plate 13. Small section of stone shed with a slanting roof where alternative bat roost spaces to be created

4. Bat boxes on buildings;
   - Two bat boxes of Schwegler 1FF bat box with built-in wooden rear panels (Plate 14) should be installed on buildings in two of the three optional locations indicated by red arrows in Plate 15.
   - No artificial lighting near these bat boxes.

Plate 14. Schwegler 1FF bat box with built-in wooden rear panels

Plate 15. Proposed options for location (red arrow) of bat boxes

5. Native tree and plants;
   Native tree planting has already been included in the landscape plan. As much native tree and plant planting as possible on the site will improve the foraging and shelter resources for insects bats over the long-term. Refer to documents from Bat Conservation Ireland "Gardening for Bats" and Bat Conservation Trust UK "Encouraging Bats - A Guide for Bat-friendly Gardening and Living" for a list of actions and plant species that support insects and bats.

6. Restriction and Minimisation of Artificial Lighting at the site;
   The potential home owners do not have intentions of up-lighters in the garden, or aesthetic lighting of walls. These would be detrimental to bats using the site. Downward-directed lights above the front door and back door are proposed. These will be switched off at all times at night when not in use. There will be no lighting installed near the bat boxes or the alternative roost shed listed above. Low bollard lighting may be installed along the driveway, and these will be switched off when not in use.

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Appendices

Appendix A: Roost Types Used by Bats

Text adapted from (Hundt 2012)

- **Transitional Roost (generally April-September/October)**
  On waking from hibernation or in the period prior to hibernation, bats search for roosts in which they stay for only a few days or on some occasions several weeks. These transitional roosts can be occupied by a few individuals or occasionally small groups. The transitional roosts used prior to hibernation are generally cool and thus may allow bats to reduce their energy requirements before going into hibernation.
- **Maternity Roost (generally May-August)**
  Breeding females gather together around the beginning of May to form nursery colonies. During this period gestation begins with births typically occurring between June and July. The females and their young remain within the maternity roost until the young are weaned and independent (late July-August). These roosts tend to break up between August and September. Adult males are rarely found within these colonies. However, the adult males of long-eared bats, Daubenton's, Natterer's and lesser horseshoe bats can be found roosting within maternity colonies with their numbers increasing throughout the active season.
- **Satellite Roost (generally May-August)**
  Breeding females may have alternative roost sites in close proximity to the main nursery colony. These are referred to as 'satellite roosts'. The number of bats using these roosts can vary greatly, from a few individuals, to small groups.
- **Mating Roost (generally September-November)**
  All Irish bats are polygynous i.e. males mate with several females. Mating generally takes place from late summer and can continue through the winter. A number of different mating strategies are used by bats, though males of some species establish mating roosts, whereby they defend territory and display/call to females to mate.
- **Hibernation Roost (generally October-March)**
  Depending on the weather and food availability, bats tend to move to hibernation sites from October. Hibernation roosts can vary greatly in terms of the number of individuals and the diversity of species that occupy them. However, they tend to have a constant cool temperature and high humidity, which allows the bats to use less energy regulating their temperature. Bats will wake occasionally during hibernation to drink and feed.
- **Night Roost (generally March-November)**
  Bats may use roosts other than traditional day roosting sites to rest in during the night. These roosts vary in their conservation significance. Night roosts may be used by a single individual on occasion or they could be used regularly by the whole colony. Studies have shown that night roosts may be of particular importance to some species such as the lesser horseshoe bat, providing key resting places within core foraging areas.
- **Day Roost (generally March-November)**
  These roosts are used during the day to rest in. Males of most Irish species spend the summer roosting alone or in small groups with other males in such roosts. Bats may regularly use a number of day roosts, switching between them on a daily basis, though conversely they may occupy the same roosting site for several weeks.
- **Feeding Roost (generally May-November)**
  These roosts can be occupied by a single animal or a few individuals throughout the active season. They vary in their significance as they may be used by the whole colony or just a few individuals to feed, to shelter from the weather or to rest temporarily. Feeding roosts are often used by Plecotus and Rhinolophus species.
- **Swarming Sites**
  Swarming takes place between August and November, whereby large numbers of bats from several species gather, generally around caves and mines. They are often dominated by the Myotis species and appear to be important mating sites with some bats travelling tens of kilometres to reach these areas. A proportion of the bats that travel to these sites will remain to hibernate.