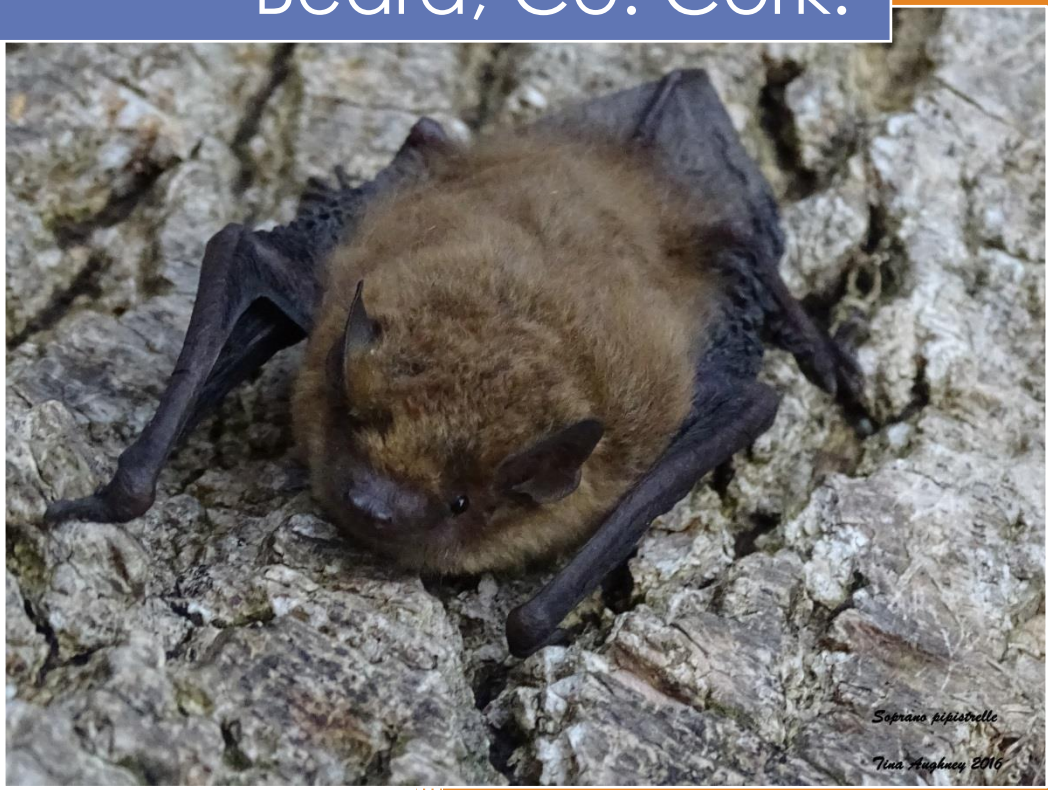
2022

Bat Assessment: Ardgroom Inward, Beara, Co. Cork.



Dr Tina Aughney

Bat Eco Services

Bat Eco Services, Ulex House, Drumheel, Lisduff, Virginia, Co. Cavan. A82 XW62.

Licensed Bat Specialist: Dr Tina Aughney [redacted]
NPWS licence C13/2020 (Licence to handle bats, expires 31st December 2022);
NPWS licence 08/2020 (Licence to photograph/film bats, expires 31st December 2022) ;
NPWS licence DER/BAT 2022-36 (Survey licence, expires 24th March 2025).

Statement of Authority: Dr Aughney has worked as a Bat Specialist since 2000 and has undertaken extensive survey work for all Irish bat species including large scale development projects, road schemes, residential developments, wind farm developments and smaller projects in relation to building renovation or habitat enhancement. She is a monitoring co-ordinator and trainer for Bat Conservation Ireland. She is a co-author of the 2014 publication *Irish Bats in the 21st Century*. This book received the 2015 CIEEM award for Information Sharing. Dr Aughney is a contributing author for the Atlas of Mammals in Ireland 2010-2015.

All analysis and reporting is completed by Dr Tina Aughney. Data collected and surveying is completed with the assistance of a trained field assistant.

Mr. Shaun Boyle (Field Assistant) NPWS licence DER/BAT 2022-37 (Survey licence, expires 24th March 2025).

Client: Cillian and Maeve Barry

Project Name & Location: Ardgroom Inward, Beara, Co Cork, Eircode P75F342.

Report Revision History

Date of Issue	Draft Number	Issued To (process of issuing)
10th October 2022	Draft 1	By email
19th October 2022	Draft 2	By email
27th October 2022	Final	By email
27th January 2023	Final A – minor adjustment	By email

Purpose

This document has been prepared as a Report for SFD Architects. Only the most up to-date report should be consulted. All previous drafts/reports are deemed redundant in relation to the named site.

Bat Eco Service accepts no responsibility or liability for any use that is made of this document other than by the client for the purposes for which it was originally commissioned and prepared.

Carbon Footprint Policy

It is the policy of Bat Eco Services to provide documentation digitally in order to reduce carbon footprint. Printing of reports etc. is avoided, where possible.

Bat Record Submission Policy

It is the policy of Bat Eco Services to submit all bat records to Bat Conservation Ireland database one year post-surveying. This is to ensure that a high level bat database is available for future desktop reviews. This action will be automatically undertaken unless otherwise requested, where there is genuine justification.

Executive Summary

Project Name & Location: Ardgroom Inward, Beara, Co Cork, Eircode P75F342.

Proposed work: Renovation of existing buildings.

Bat Survey Results - Summary

Bat Species	Roosts	Foraging	Commuting
Common pipistrelle *Pipistrellus pipistrellus*	√	√	√
Soprano pipistrelle *Pipistrellus pygmaeus*	√	√	√
Nathusius' pipistrelle *Pipistrellus nathusii*			
Leisler's bat *Nyctalus leisleri*		√	√
Brown long-eared bat *Plecotus auritus*		√	
Daubenton's bat *Myotis daubentonii*			
Natterer's bat *Myotis nattereri*	√	√	
Whiskered bat *Myotis mystacinus*			
Lesser horseshoe bat *Rhinolophus hipposideros*	√	√	√

Bat Survey Duties Completed (Indicated by red shading)

Tree PBR Survey	◯	Daytime Building Inspection	◯
Static Detector Survey	◯	Daytime Bridge Inspection	◯
Dusk Bat Survey	◯	Dawn Bat Survey	◯
Walking Transect	◯	Driving Transect	◯
Trapping / Mist Netting	◯	IR Camcorder filming	◯
Endoscope Inspection	◯	Other	◯
		Thermal Imagery filming	

Citation: Bat Eco Services (2022) Bat assessment of proposed development at Ardgroom Inward, Beara, Co. Cork. Unpublished report prepared for SFD Architects.

Contents

1. Introduction

Bat Eco Services was commissioned to undertake a bat survey of private site located at Ardgroom Inward, Beara, Co Cork, Eircode P75F342.

1.1 Relevant Legislation & Bat Species Status in Ireland

1.1.1 Irish Statutory Provisions

A small number of animals and plants are protected under Irish legislation (Nelson, *et al.,* 2019). The principal statutory provisions for the protection of animal and plant species are under the Wildlife Act 1976 (as amended) and the European Communities (Birds and Natural Habitats) Regulations 2011, as amended. The Flora (Protection) Order 2015 (S.I. no. 356 of 2015) lists the plant species protected by Section 21 of the Wildlife Acts. See www.npws.ie/ legislation for further information.

The codes used for national legislation are as follows:

- WA = Wildlife Act, 1976, Wildlife (Amendment) Act, 2000 and other relevant amendments
- FPO = Flora (Protection) Order, 2015 (S.I. No. 356 of 2015)

1.1.2 EU Legislation

The Birds Directive (Directive 2009/147/EC) and Habitats Directive (Council Directive 92/43/EEC) are the legislative instruments which are transposed into Irish law, *inter alia,* by the European Communities (Birds and Natural Habitats) Regulations 2011 (S.I. No. 477 of 2011) ('the 2011' Regulations), as amended.

The codes used for the Habitats Directive (Council Directive 92/43/EEC) are:

- Annex II Animal and plant species listed in Annex II
- Annex IV Animal and plant species listed in Annex IV
- Annex V Animal and plant species listed in Annex V

The main aim of the Habitats Directive is the conservation of biodiversity by requiring Member States to take measures to maintain or restore natural habitats and wild species listed on the Annexes to the Directive at a favourable conservation status. These annexes list habitats (Annex I) and species (Annexes II, IV and V) which are considered threatened in the EU territory. The listed habitats and species represent a considerable proportion of biodiversity in Ireland and the Directive itself is one of the most important pieces of legislation governing the conservation of biodiversity in Europe.

Under Article 11 of the 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 status for 59 habitats and 60 species. There are three volumes with the third listing details of the species assessed.

Article 12 of the Habitats Directive requires Member States to take measures for the establishment of a strict protection regime for animal species listed in Annex IV(a) of the Habitats Directive within the whole territory of Member States. Article 16 provides for derogation from these provisions under defined conditions. These provisions are implemented under Regulations 51 and 54 of the 2011 Regulations.

1.1.3 IUCN Red Lists

The International Union for the Conservation of Nature (IUCN) coordinates the Red Listing process at the global level, defining the categories so that they are standardised across all taxa. Red Lists are also produced at regional, national and subnational levels using the same IUCN categories (IUCN 2012, 2019). Since 2009, Red Lists have been produced for the island of Ireland by the National Parks and Wildlife Service (NPWS) and the Northern Ireland Environment Agency (NIEA) using these IUCN categories. To date, 13 Red Lists have been completed. The Red Lists are an assessment of the risk of extinction of each species and not just an assessment of their rarity. Threatened species are those species categorised as Critically Endangered, Endangered or Vulnerable (IUCN, 2019) – also commonly referred to as 'Red Listed'.

1.1.4 Irish Red List - Mammals

Red Lists in Ireland refer to the whole island, i.e. including Northern Ireland, and so follow the guidelines for regional assessments (IUCN, 2012, 2019). The abbreviations used are as follows:.

- RE Regionally Extinct
- CR Critically Endangered
- EN Endangered
- VU Vulnerable
- NT Near Threatened
- DD Data Deficient
- LC Least Concern
- NA Not Assessed
- NE Not Evaluated

There are 27 terrestrial mammals species in Ireland, which includes the nine resident bat species listed. The terrestrial mammal, according to Marnell *et al.,* 2019, list for Ireland consists of all terrestrial species native to Ireland or naturalised in Ireland before 1500. The IUCN Red List categories and criteria are used to assess that status of wildlife. This was recently completed for the terrestrial mammals of Ireland. Apart from the two following two mammal species (grey wolf *Canis lupus* (regionally extinct) and black rat *Rattus rattus* (Vulnerable)), the remaining 25 species were assessed as least concern in the most recent IUCN Red List publication by NPWS (Marnell *et al*., 2019).

1.1.5 Irish Bat Species

All Irish bat species are protected under the Wildlife Act (1976) and Wildlife Amendment Acts (2000 and 2010). Also, the EC Directive on The Conservation of Natural habitats and of Wild Fauna and Flora (Habitats Directive 1992), seeks to protect rare species, including bats, and their habitats and requires that appropriate monitoring of populations be undertaken. All Irish bats are listed in Annex IV of the Habitats Directive and the lesser horseshoe bat *Rhinolophus hipposideros* is further listed under Annex II. Across Europe, they 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, enacted 1983) was instigated to protect migrant species across all European boundaries. The Irish government has ratified both these conventions.

Also, under existing legislation, the destruction, alteration or evacuation of a known bat roost is an offence. The most recent guidance document is "Guidance document on the strict protection of animal species of Community interest un the Habitats Directive (Brussels, 12.10.2021 C(2021) 7391 final".

Regulation 51(2) of the 2011 Regulations provides –

(*"(2) Notwithstanding any consent, statutory or otherwise, given to a person by a public authority or held by a person, except in accordance with a licence granted by the Minister under Regulation 54, a person who in respect of the species referred to in Part 1 of the First Schedule—*

(a) deliberately captures or kills any specimen of these species in the wild, (b) deliberately disturbs these species particularly during the period of breeding, rearing, hibernation and migration,

(c) deliberately takes or destroys eggs of those species from the wild,

(d) damages or destroys a breeding site or resting place of such an animal, or

(e) keeps, transports, sells, exchanges, offers for sale or offers for exchange any specimen of these species taken in the wild, other than those taken legally as referred to in Article 12(2) of the Habitats Directive,

shall be guilty of an offence."

The grant of planning permission does not permit the commission of any of the above acts or render the requirement for a derogation licence unnecessary in respect of any of those acts.

Any works interfering with bats and especially their roosts, may only be carried out under a derogation licence granted by National Parks and Wildlife Service (NPWS) pursuant to Regulation 54 of the European Communities (Birds and Natural Habitats) Regulations 2011 (which transposed the EU Habitats Directive into Irish law).

There are eleven recorded bat species in Ireland, nine of which are considered resident on the island. Eight resident bat species and one of the vagrant bat species are vesper bats and all vespertilionid bats have a tragus (cartilaginous structure inside the pinna of the ear). Vesper bats are distributed throughout the island. Nathusius' pipistrelle *Pipistrellus nathusii* is a recent addition while the Brandt's bat has only been recorded once to-date (Only record confirmed by DNA testing, all other records has not been genetically confirmed). The ninth resident species is the lesser horseshoe bat *Rhinolophus hipposideros*, which belongs to the Rhinolophidea and has a complex nose leaf structure on the face, distinguishing it from the vesper bats. This species' current distribution is confined to the western seaboard counties of Mayo, Galway, Clare, Limerick, Kerry and Cork. The eleventh bat species, the greater horseshoe bat, was only recorded for the first time in February 2013 in County Wexford and is therefore considered to be a vagrant species. A total of 41 SACs have been designated for the Annex II species lesser horseshoe bat (1303), of which nine have also been selected for the Annex I habitat 'Caves not open to the public' (8310).

Irish bat species list is presented in Table 1 along with their current status.

Table 1: Status of the Irish bat fauna (Marnell *et al.,* 2019).

Species: Common Name	Irish Status	European Status	Global Status
Resident Bat Species ^			
Daubenton's bat *Myotis daubentonii*	Least Concern	Least Concern	Least Concern
Whiskered bat *Myotis mystacinus*	Least Concern	Least Concern	Least Concern
Natterer's bat *Myotis nattereri*	Least Concern	Least Concern	Least Concern
Leisler's bat *Nyctalus leisleri*	Least Concern	Least Concern	Least Concern
Nathusius' pipistrelle *Pipistrellus nathusii*	Least Concern	Least Concern	Least Concern
Common pipistrelle *Pipistrellus pipistrellus*	Least Concern	Least Concern	Least Concern
Soprano pipistrelle *Pipistrellus pygmaeus*	Least Concern	Least Concern	Least Concern
Brown long-eared bat *Plecotus auritus*	Least Concern	Least Concern	Least Concern
Lesser horseshoe bat *Rhinolophus hipposideros*	Least Concern	Least Concern	Least Concern
Possible Vagrants ^			
Brandt's bat Myotis brandtii	Data deficient	Least Concern	Least Concern
Greater horseshoe bat *Rhinolophus ferrumequinum*	Data deficient	Near threatened	Near threatened

^ Roche *et al.,* 2014

1.2 Relevant Guidance Documents

This report will draw on guidelines already available in Europe and will use the following documents:

- NPWS & VWT (2022) Lesser Horseshoe Bat Species Action Plan 2022- 2026. National Parks and Wildlife Service, Department of Housing, Local Government and Heritage, Ireland.
- National Roads Authority (2006) Best Practice Guidelines for the Conservation of Bats in the Planning of National Road Schemes
- Collins, J. (Editor) (2016) Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd edition). Bat Conservation Trust, London
- McAney, K. (2006) A conservation plan for Irish vesper bats, Irish Wildlife Manual No. 20 National Parks and Wildlife Service, Department of Environment, Heritage and Local Government, Dublin, Ireland.
- Marnell, F., Kelleher, C. & Mullen, E. (2022) Bat mitigation guidelines for Ireland v2. Irish Wildlife Manuals, No. 134. National Parks and Wildlife Service, Department of Housing, Local Government and Heritage, Ireland (Version 1: Kelleher & Marnell, 2006).
- The status of EU protected habitats and species in Ireland: Conservation status in Ireland of habitats and species listed in the European Council Directive on the Conservation of Habitats, Flora and Fauna 92/43/EEC. National Parks and Wildlife Service, Department of Environment, Heritage and Local Government.
- Bat Conservation Trust (2018) Bats and artificial lighting in the UK: bats and the built environment series. Guidance Note 08/2019. BCT, London.
- Guidance document on the strict protection of animal species of Community interest un the Habitats Directive (Brussels, 12.10.2021 C(2021) 7391 final.

- EPA (2017) Guidelines on the information to be contained in Environmental Impact Assessment Reports.

Collins (2016) is the principal document used to provide guidance in relation to bat survey effort required but the level of surveying is assessed on a case-by-case basis taking into consideration the historical bat records for the survey area, presence of built, structures and trees potentially suitable for roosting bats and the presence of suitable bat habitats for foraging and commuting. Additional reference is made to this document in relation to determining the value of buildings, trees etc. as bat roosts. The tables referred to from this document are described in the following section and in the section on methodology.

Marnell *et al.* (2022) is referred to for guidance in relation to survey guidance (timing and survey design), derogation licences and mitigation measures.

1.2.1 Bat Survey Requirements & Timing

With reference to Collins (2016) and Marnell *et al.* (2022), the information presented in this section is used to determine the bat survey requirements for the proposed development site. Collins (2016) provides a trigger list in relation to determining if a bat survey is required and this is presented Appendix 3 (Figure B) for reference. In addition, Chapter 2 of Collins (2016) discusses that a bat survey is required when proposed activities are likely to impact on bats and their habitats. The level of surveying is to be determined by the ecologist and these are influenced by the following criteria:

- Likelihood of bats being present;
- Type of proposed activities;
- Scale of proposed activities;
- Size, nature and complexity of the site;
- Species concerned;
- No. of individuals.

Collins (2016) also provides the following table detailing when different survey components should be undertaken.

Table 2.2 Recommended UK survey times for survey types described in these guidelines.

Survey type	Month											
	J	F	M	A	M	J	J	A	S	O	N	D
Preliminary ecological appraisal - fieldwork												
Preliminary roost assessment – structures[a]												
Emergence/re-entry survey for maternity or summer roosts[b]												
Emergence/re-entry[c] survey for transitional roosts[b]												
Emergence survey for mating roosts[b]												
Hibernation survey – structures[a]												
Preliminary ground level roost assessment - trees[d]												
Potential roost feature (PRF) inspection survey - trees												
Ground level bat activity survey – transects and automated/static												
Pre-, during and post-hibernation – automated/static bat activity survey												
Swarming survey												
Back-tracking survey												
Trapping survey[e]												
Radio tagging and tracking survey[e]												

= optimal period

= sub-optimal period

= weather or location dependent (i.e. may not be suitable due to spring and autumn conditions in any one year or in more northerly latitudes). Note that October surveys are not acceptable in Scotland.

Figure 1a: Table 2.2 reproduced from Collins (2016).

1.2.1.1 Buildings

In Marnell *et al.* (2022), Table 3 (The applicability of survey methods) provides information on the type of surveys that can be undertaken according to the different seasons.

Marnell *et al.* (2022) states that it is more suitable to survey buildings in the summer months. The following is a summary of the principal points:

1. The presence of a significant bat roost (invariably a maternity roost) can normally be determined on a single visit at any time of year, provided that the entire structure is accessible and that any signs of bats have not been removed by others. However, a visit during the summer or autumn has the advantage that bats may be seen or heard.
2. Roosts used by a small number of bats, as opposed to maternity sites, can be particularly difficult to detect and may require extensive searching backed up (in summer) by bat detector surveys or emergence counts.
3. If the entire building is not accessible or signs of bats may have been removed by others, or by the weather, bat detector or exit count methodologies may be required to back up a limited search.

Table 3. The applicability of survey methods.

Season	Roost type	Inspection	Bat detectors and emergence counts
Spring (Mar – May)	Building	Suitable (signs, perhaps bats)	Limited, weather dependent
	Trees	Difficult (best for signs before leaves appear)	Rarely useful
	Underground	Suitable (signs only)	Static detectors may be useful
Summer (June-August)	Building	Suitable (signs and bats)	Suitable
	Trees	Difficult	Limited; use sunrise survey
	Underground	Suitable (signs only)	Rarely useful
Autumn (September –November)	Building	Suitable (signs and bats)	Limited, weather dependent
	Trees	Difficult	Rather limited weather dependent; use sunrise survey?
	Underground	Suitable (signs, perhaps bats)	Static detectors may be useful
Winter (December-February)	Building	Suitable (signs, perhaps bats))	Rarely useful
	Trees	Difficult (best for signs after leaves have gone)	Rarely useful
	Underground	Suitable (signs and bats)	Static detectors may be useful

Figure 1b: Table 3 reproduced from Marnell *et al.* (2022).

The following table is used to determine the level and timing of surveys for buildings/structures with reference to the surrounding habitat. Buildings are assessed to determine their suitability as a bat roost and are described using the parameters Negligible, Low, Medium or High suitability in view of Table 2 from Marnell *et al.* (2022). The level of suitability informs the level of surveying and timing of surveys required based on Table 7.3 of Collins, 2016 (Note: These two tables are presented in Appendix 1 but a summary is provided in the table below).

Table 2a: Building Bat Roost Classification System & Survey Effort (Adapted from Collins, 2016 and Marnell *et al.*, 2022).

Suitability Category	Description (examples of criteria)	Survey Effort (Timings)
Negligible	Building have no potential as a roost site Urban setting, heavily disturbed, building material unsuitable, building in poor condition etc.	No surveys required.
Low	Building has a low potential as a roost site. No evidence of bat usage (e.g. droppings)	One dusk or dawn survey.
Medium	Building with some suitable voids / crevices for roosting bats. Some evidence of bat usage Suitable foraging and commuting habitat present.	At least one survey in May to August, minimum of two surveys (one dusk and one dawn).
High	Building with many features deemed suitable for roosting bats. Evidence of bat usage. Largely undisturbed setting, rural, suitable foraging and commuting habitat, suitable roof void and building material.	At least two surveys in May to August, with a minimum of three surveys (at least one dusk survey and one dawn survey).

1.2.1.2 Trees

Marnell *et al.* (2022) recommends the following in relation to detecting roosts in trees:

- "The best time to carry out surveys for suitable cavities is between November and April, when the trunk and branches are not obscured by leaves. If inspection suggests that the tree has suitable cavities or roost sites, a bat detector survey at dusk or dawn during the summer may help to produce evidence of bats, though the nomadic nature of most tree-dwelling species means that the success rate is very low.
- It can also be difficult to pinpoint exactly which tree a bat emerged from. A dawn survey is more likely to be productive than a dusk one as swarming bats returning to the roost are much more visible than those leaving the roost. Because tree-dwelling bats move roosts frequently, a single bat-detector survey is unlikely to provide adequate evidence of the absence of bats in trees that contain a variety of suitable roosting places.
- Several dawn or dusk surveys spread over a period of several weeks from June to August will greatly increase the probability of detecting significant maternity roosts and is recommended where development proposals will involve the loss of multiple trees".

As a consequence, the BTHK (2018) Potential Roost Features (PRFs) list and the classification system adapted from Collins (2016) is recommended as part of the daytime inspection of trees to determine their PBR or Potential Bat Roost value. Details of the methodology followed is presented in Section 3.2.2.

1.2.1.3 Underground Structures

Marnell *et al.* (2022) recommends the following in relation to underground structures:

1. Underground structures are used mainly for hibernation, so surveys should generally be carried out during the winter.

1.2.2 Evaluation & Assessment Criteria

Based on the information collected during the desktop studies and bat surveys, an ecological value is assigned to each bat species recorded based on its conservation status at different geographical scales (Table 2b). For example, a site may be of national ecological value for a given species if it supports a significant proportion (e.g. 5%) of the total national population of that species.

Table 2b: The six-level ecological valuation scheme used in the CIEM Guidelines (2016) Ecological Value

Ecological Value	Geographical Scale of Importance
International	International or European scale
National	The Republic of Ireland or the island of Ireland scale (depending on the bat species)
Regional	Province scale: Leinster
County	County scale: County Dublin
Local	Proposed development and immediate surroundings
Negligible	None, the feature is common and widespread

If bat roosts are recorded, their roost status is determined using Figure 20 from Marnell *et al.* (2022). This figure is presented below (Figure 1c). This figure is also used to determine the conservation significance of the roost in order to prepare appropriate bat mitigation measures.

Impacts on bats can arise from activities that may result in:

- Physical disturbance of bat roosts e.g. destruction or renovation of buildings
- Noise disturbance e.g. increase human presence, use of machinery etc.
- Lighting disturbance
- Loss of roosts e.g. destruction or renovation of buildings
- Modifications of commuting or foraging habitats
- Severance or fragmentation of commuting routes
- Loss of foraging habitats.

It is recognised that any development will have an impact on the receiving environment, but the significance of the impact will depend on the value of the ecological features that would be affected. Such ecological features will be those that are considered to be important and potentially affected by the proposed development.

The guidelines consulted recommend that the potential impacts of a proposed development on bats are assessed as early as possible in the design stage to determine any areas of conflicts. In particular the Table 4 (presented as Figure 1d below) and Figure 20 (presented as Figure 1c) from Marnell *et al.* (2022) are referenced during this process.

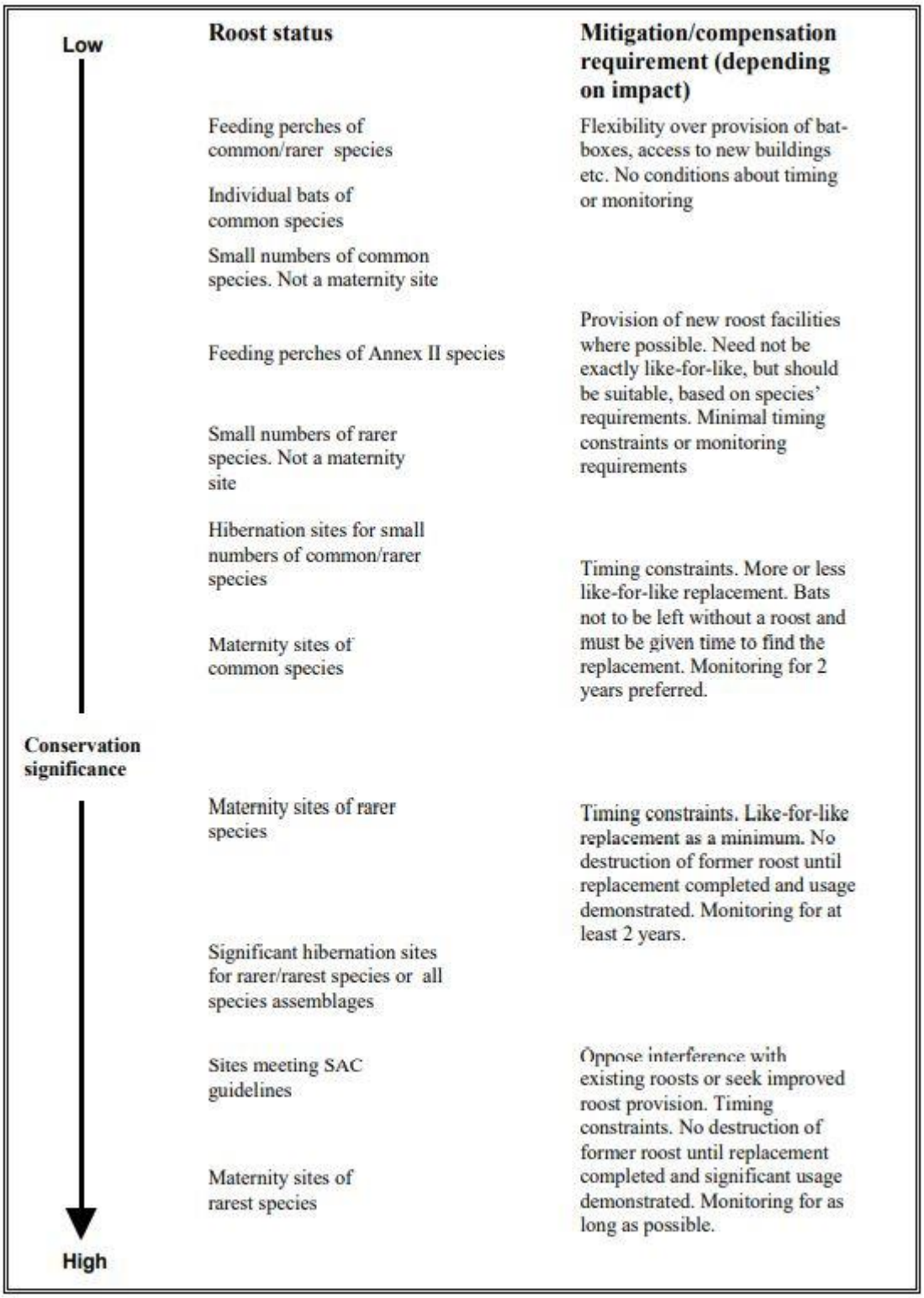


Figure 20 Guidelines for proportionate mitigation. The definition of common, rare and rarest species requires regional interpretation.

Figure 1c: Figure 20 (p 46) Reproduced from Marnell *et al.* (2022).

Table 4 The scale of main impacts at the site level on bat populations. [**NB** This is a general guide only and does not take into account species differences. Medium impacts, in particular, depend on the care with which any mitigation is designed and implemented and could range between high and low.]

Roost type	Development effect	Scale of impact		
		Low	Medium	High
Maternity	Destruction			✓
	Isolation caused by fragmentation			✓
	Partial destruction; modification		✓	
	Temporary disturbance outside breeding season	✓		
	Post-development interference			✓
Major hibernation	Destruction			✓
	Isolation caused by fragmentation			✓
	Partial destruction; modification		✓	
	Temporary disturbance outside hibernation season	✓		
	Post-development interference			✓
Minor hibernation	Destruction			✓
	Isolation caused by fragmentation			✓
	Partial destruction, modification		✓	
	Modified management		✓	
	Temporary disturbance outside hibernation season	✓		
	Post-development interference		✓	
	Temporary destruction, then reinstatement	✓		
Mating	Destruction		✓	
	Isolation caused by fragmentation		✓	
	Partial destruction	✓		
	Modified management	✓		
	Temporary disturbance	✓		
	Post-development interference	✓		
	Temporary destruction, then reinstatement	✓		
Night roost	Destruction	✓		
	Isolation caused by fragmentation	✓		
	Partial destruction	✓		
	Modified management	✓		
	Temporary disturbance	✓		
	Post-development interference	✓		
	Temporary destruction, then reinstatement	✓		

Figure 1d: Table 4 (p 44) Reproduced from Marnell *et al.* (2022).

Different parameters are considered for the overall assessment of the potential impact(s) of a proposed development on local bat populations.

The overall impacts of the proposed project on local bat populations is assessed using the following criteria:

- Impact Quality using the parameters Positive, Neutral or Negative Impact (based on EPA, 2022, Table 3.4)

Table 2c: Criteria for assessing impact quality based on EPA, 2022.

Quality of Effect	Criteria
Positive	A change which improves the quality of the environment (for example, by increasing species diversity; or the improving reproductive capacity of an ecosystem, or by removing nuisances or improving amenities).
Neutral	No effects or effects that are imperceptible, within normal bounds of variation or within the margin of forecasting error.
Negative	A change which reduces the quality of the environment (for example, lessening species diversity or diminishing the reproductive capacity of an ecosystem; or damaging health or property or by causing nuisance).

- Impact Significance of potential impact parameters on specific bat species in relation to particular elements (e.g. roosting sites, foraging area and commuting routes) are assessed with reference to the following:
    - Table 4 of Marnell *et al.* (2022) (Figure 1a);
    - the known ecology and distribution of the bat species in Ireland;
    - bat survey results including type of roosts (if any recorded), pattern of bat usage of the survey area, level of bat activity recorded etc.
    - and bat specialist experience.
- Impact Significance of the proposed development on local bat populations maybe determine, where applicable, using the parameters listed in Table 2d (based on EPA, 2022, Table 3.4).

Table 2d: Criteria for assessing significance of effects based on EPA, 2022.

Significance of Effects	Definition
Imperceptible	An effect capable of measurement but without significant consequences.
Not significant	An effect which causes noticeable changes in the character of the environment but without significant consequences.
Slight	An effect which causes noticeable changes in the character of the environment without affecting its sensitivities.
Moderate	An effect that alters the character of the environment in a manner that is consistent with existing and emerging baseline trends.
Significant	An effect which, by its character, magnitude, duration or intensity alters a sensitive aspect of the environment.
Very Significant	An effect which, by its character, magnitude, duration or intensity significantly alters most of a sensitive aspect of the environment.
Profound	An effect which obliterates sensitive characteristics

The following terms will be used, where possible and applicable, when quantifying the probability and duration of the potential effects (selected from EPA, 2022, Table 3.4):

Describing the Probability of Effects Descriptions of effects should establish how likely it is that the predicted effects will occur so that the CA can take a view of the balance of risk over advantage when making a decision.	**Likely Effects** The effects that can reasonably be expected to occur because of the planned project if all mitigation measures are properly implemented.
	Unlikely Effects The effects that can reasonably be expected not to occur because of the planned project if all mitigation measures are properly implemented.
Describing the Duration and Frequency of Effects 'Duration' is a concept that can have different meanings for different topics – in the absence of specific definitions for different topics the following definitions may be useful.	**Momentary Effects** Effects lasting from seconds to minutes.
	Brief Effects Effects lasting less than a day.
	Temporary Effects Effects lasting less than a year.
	Short-term Effects Effects lasting one to seven years.
	Medium-term Effects Effects lasting seven to fifteen years.
	Long-term Effects Effects lasting fifteen to sixty years.
	Permanent Effects Effects lasting over sixty years.
	Reversible Effects Effects that can be undone, for example through remediation or restoration.
	Frequency of Effects Describe how often the effect will occur (once, rarely, occasionally, frequently, constantly – or hourly, daily, weekly, monthly, annually).

Figure 1e: Criteria for assessing significance of effects based on EPA, 2022 (Taken from Table 3.4),

This table continues to provide terminology in relation to “Describing the Types of Effects” as presented below.

Describing the Types of Effects	**Indirect Effects (a.k.a. Secondary or Off-site Effects)** Effects on the environment, which are not a direct result of the project, often produced away from the project site or because of a complex pathway.
	Cumulative Effects The addition of many minor or insignificant effects, including effects of other projects, to create larger, more significant effects.
	'Do-nothing Effects' The environment as it would be in the future should the subject project not be carried out.
	'Worst-case' Effects The effects arising from a project in the case where mitigation measures substantially fail.
	Indeterminable Effects When the full consequences of a change in the environment cannot be described.
	Irreversible Effects When the character, distinctiveness, diversity or reproductive capacity of an environment is permanently lost.
	Residual Effects The degree of environmental change that will occur after the proposed mitigation measures have taken effect.
	Synergistic Effects Where the resultant effect is of greater significance than the sum of its constituents (e.g. combination of SOx and NOx to produce smog).

Figure 1f: Criteria for assessing significance of effects based on EPA, 2022 (Taken from Table 3.4),

1.2.3 Bat Mitigation Measures

1.2.3.1 Bat Houses

The NPWS Survey and Mitigation Guidelines (Marnell *et al.* 2022) provides some general guidelines in relation to the provision of alternative roosts but states that critical issues "are the size and suitability of the final roost and the disposition of the entrances and flight paths, including the location of any exterior lighting or vegetation".

1.2.3.1.1 Bat Houses – Effective Mitigation Measures

The principal bat species that the bat house is designed for is lesser horseshoe bat with provision for common pipistrelles, soprano pipistrelles and Natterer's bat. The design of the alterations to Building 3 (see mitigation section) have taken into account the guidelines provided by VWT document (Schofield, 2008) and according to the authors experience relation to bat house design (please see Aughney *et al.,* 2021 scientific paper relation to renovation of Garryland Lodge).

The wall mounted bat boxes proposed for inside the bat house are specific for common pipistrelles which Collins *et al.* (2020) reported as the type of bat box preferred by this species. The Lighting and Landscape plans have been designed to facilitate movement of bats to and from Building 3, according to the guidelines of Marnell *et. al.* (2022).

1.2.3.2 Bats & Lighting

All European bat species, including Irish bat species, are nocturnal. Light levels as low as typical full moon levels, i.e. around 0.1 LUX, can alter the flight activity of bats (Voigt *et al.* 2018). Any level of artificial light above that of moonlight can mask the natural rhythms of lunar sky brightness and, thus, can disrupt patterns of foraging and mating and might, for instance, interfere with entrainment of the circadian system.

Artificial light pollution is an increasing global problem (Rich and Longcore, 2006) and Artificial light at night (ALAN) is considered a major threat to biodiversity, especially to nocturnal species. As urbanisation expands into the landscape, the degree of street lighting also expands. Its ecological impacts can have a profound effect on the behaviour of nocturnal animals including impacts on reproductive behaviours, orientation, predator-prey interaction and competition among others, depending on the taxon and ecosystem in question (Longcore and Rich 2004). It is considered by Hölker *et al.* (2010) to be a key biodiversity threat to biodiversity conservation. In relation to bats, the potential impacts of artificial night lighting can result in habitat fragmentation (Hanski, 1998), delay in roost emergence (Downs *et al.,* 2003) and a reduction in prey items.

In the context of behavioural ecology, lights can work to attract or repel certain animals. Many groups of insects, including moths, lacewings, beetles, bugs, caddisflies, crane flies, midges, hoverflies and wasps, can be attracted to artificial light (Eisenbeis and Hassel 2000; Frank 1988; Kolligs 2000). Attraction depends on the spectrum of light. In the context of street lights, white (mercury vapour) lamps emit a white light that includes ultraviolet. High pressure sodium lights (yellow) emit some ultraviolet, while low pressure sodium lamps (orange) emit no ultraviolet light (e.g. Rydell 2006). As a result of the attractiveness of lights to aerial invertebrates, swarms of insects often occur in and around street lights and, particular bat species such as aerial insect predators, can exploit the swarming insects to their advantage. Such attraction can also take prey items away from dark zones where light sensitive species are foraging, thus reducing their likelihood of feeding effectively.

Rydell (2006) divides bats into four categories in terms of their characteristic behaviours at street lamps. The four categories are based on bat size, wing morphology and echolocation call characteristics which were highlighted by Norberg and Rayner (1987) to determine flight speed, manoeuvrability, and prey detection capabilities of bats. Rydell (2006) stated that the large, fast flying bats, which are confined to open airspace, fly high over lit areas and are rarely observed near ground level. None of these, typically large free-tailed bats (e.g. large species of the family Molossidae), are found in Ireland. The second category are the medium-sized fast flying species, including the *Nyctalus* species, which patrol the street well above the lights and can be seen occasionally as they dive for prey into the light cone. This group includes the Leisler's bat, which is found in Ireland. Rydell's third category describes the small but fast flying bats that are manoeuvrable enough to forage around light posts or under the lights, and includes the small *Pipistrellus* species of the old world, three of which are found in Ireland. The fourth category includes broad-winged slow flyers, most of which are seldom or never observed at lights. Slow flying bat species may be more vulnerable to predation by diurnal birds of prey and this may restrict their exploitation of insects around artificially illuminated areas (e.g. Speakman 1991). There are also the concerns that some bat species are more light sensitive and therefore actively avoid lit up areas. This is particularly relevant for lesser horseshoe bats. Therefore from this, we can categorise the suite of Irish bats species as follows (please note that the sensitivity category is the author's description):

Table 3: Potential light sensitivity of the Irish bat fauna using categories described by Rydell, 2006.

Species: Common Name	Rydell Category	Sensitivity
Daubenton's bat *Myotis daubentonii*	Category 4	Light sensitive
Whiskered bat *Myotis mystacinus*	Category 4	Light sensitive
Natterer's bat *Myotis nattereri*	Category 4	Light sensitive
Leisler's bat *Nyctalus leisleri*	Category 2	Light tolerant
Nathusius' pipistrelle *Pipistrellus nathusii*	Category 3	Semi-tolerant
Common pipistrelle *Pipistrellus pipistrellus*	Category 3	Semi-tolerant
Soprano pipistrelle *Pipistrellus pygmaeus*	Category 3	Semi-tolerant
Brown long-eared bat *Plecotus auritus*	Category 4	Light sensitive
Lesser horseshoe bat *Rhinolophus hipposideros*	Category 4	Light sensitive

The ability of different bat species to exploit insects gathered around street lights varies greatly. Gleaning species such as *Myotis* bats rarely forage around street lights (Rydell and Racey, 1995). The ecological effects of illuminating aquatic habitats are also poorly known. Moore *et al.* (2006) found that light levels in an urban lake, subject simply to sky glow and not direct illumination from lights, reached the same order of magnitude as full moonlight.

All European bat species, including Irish bat species, are nocturnal. As a consequence, the scientific literature provides evidence that artificial lighting does impacts on bats. The degree of impact depends on the light sensitivity of the bat species and the type of luminaire. Lesser horseshoe bats are light sensitive and therefore adversely effected by the presence of lighting in all aspects of their life strategies (e.g. foraging, commuting, drinking and roosting).

The potential impacts of street lighting can be summarised as follows:

- Attracting Prey Items

Lights can work to attract or repel certain animals. Many groups of insects can be attracted to artificial light and this attraction depends on the spectrum of light. As a result of the attractiveness of lights to aerial invertebrates, swarms of insects often occur in and around street lights. Such attraction can also take prey items away from dark zones where light sensitive species, such as lesser horseshoe bats, are foraging, thus reducing their likelihood of feeding effectively.

- Reducing Foraging Habitat

The research documents state that there is less bat species diversity foraging in habitats lit up by artificial lighting. Only bat species considered to be light tolerant are generally able to exploit habitats with lighting present, but overall, all bat species activity tends to be less in lit up habitats compared to non-lit up habitats.

- Fragmenting The Landscape

Scientific evidence shows that lighting is a barrier to the movement of light sensitive bat species, such as lesser horseshoe bats. Light sensitive bat species will actively seek dark corridors to commute along and therefore the presence of lighting in commuting habitats will restrict their movement of such species in the landscape.

- Reducing Drinking Sites

There is increasing evidence that drinking sites for bats is an essential component for local bat population survival and that the presence of artificial lighting at waterbodies prevents bats from availing of this resource.

Lighting, including street lights come in an array of different types but for street lights they typically include High Pressure Sodium, Low Pressure Sodium, Mercury Vapour and the more modern Light Emitting Diodes (LED). An array of field-based research has been undertaken to document the potential impact of lighting on bat flight activity. LED lighting is predicted to constitute 70% of the outdoor and residential lighting markets by 2020. While the use of LEDs promotes energy and cost savings relative to traditional lighting technologies, little is known about the effects these broad-spectrum "white" lights will have on wildlife, human health, animal welfare, and disease transmission. As a consequence, a large array of research has been undertaken recently on the potential impact of LED on bats.

Stone *et al.* (2012) undertook research in relation to "Cool" LED street lights on an array of local bat species in England. Overall the presence of LED street lights had a significant negative impact on lesser horseshoe bats and *Myotis* spp. for all light treatments investigated while there was no sign impact of light treatment type on *Pipistrellus pygmaeus* (soprano pipistrelle – a common Irish bat species) or *Nyctalus* (Leisler's bats is part of this bat family and is a common Irish bat species)/*Eptesicus* species. This research paper also documented behavioural changes for the different bat species. Lesser horseshoe bats and *Myotis* spp. did not avoid lights by flying along the other side of the hedge but altered their commuting behaviour altogether. It was concluded that LEDs can fragment commuting routes causing bats to alter their behaviour with potentially negative conservation consequences. Lesser horseshoe bat activity was significantly lower during high intensity treatment than medium, but at all treatment levels (even as low as 3.6 LUX), activity was significantly lower than unlit control (LUX level measurements were taken at 1.7m at the hedge below the light).

Russo *et al.* (2017) investigated the impact of LED lighting on drinking areas for bats in Italy. Drinking sites are considered to be important components for the survival of local bat populations. Drinking sites were illuminated with a portable LED outdoor light emitting (48 high-power LEDs generated a light intensity of 6480 lm (4000–4500 K) at 25°C, two peaks of relative luminous flux at 450 and 590 nm). *Plecotus auritus* (brown long-eared bat – resident in Ireland), *Pipistrellus pygmaeus* (soprano pipistrelle – resident in Ireland) and *Rhinolophus hipposideros* (lesser horseshoe bat – resident in Ireland) did not drink when troughs were illuminated.

Rowse *et al.* (2018) researched the impacts of LED lights (portable lights, 97W 4250K LED on 10m high poles) in England on local bat populations. Treatments were either 100% light intensity; dimmed (using pulse width modulation) at 50% or 25% light intensity; and unlit. Sites were in suburban areas along busy roads but with vegetation and tree lines adjacent. High light levels (50% & 100% light treatments) increased activity of opportunistic *Pipistrellus pipistrellus* (common pipistrelle – resident in Ireland) but reduced activity of *Myotis* species group. Conversely 25% and unlit sites had no difference from each other. The research paper conclude that dimming could be an effective strategy to mitigate ecological impacts of street lights.

Wakefield *et al.* (2017) stated that an important factor to be aware of in relation to LED is the direction of the light projected. Therefore it is recommended that highly focused/shielded LEDS designed to filter out short wavelengths of light should be used as they attract relatively fewer insects. Less insects attracted to street lights means less insects leaving dark zones where light sensitive bat species primarily feed.

Martin *et al.* (2021) showed that LED street lights lead to a reduction in the total number of insects captured with light traps in a wide range of families. Coleoptera and Lepidoptera orders were the most sensitive groups to ecological light pollution in the study area. The paper suggested that LED was the least attractive light system for most of the affected groups both because of its very little emitted short-wavelength light and because of its lower light intensity. They also concluded that reduction in insect attraction to LED could be even larger with current LED technologies emitting warmer lights, since other research showed that LED emitting “warmer white” colour light (3000 K) involves significantly lower attraction for insects than “colder white” LED (6000 K).

Wilson *et al.* (2021) investigate the impact of LED on biting insects and concluded because LED is highly malleable with regard to spectral composition, they can be tailored to decrease or increase insect catches, depending on situation. Therefore this design control of LED could greatly assist in reducing impact of street lighting on local bat populations.

Stone *et al*. (2015) reviewed the impacts of ALAN on bat roosts and flight paths in order to provide recommendations in relation to street lighting. The principal recommendations were to avoid lighting places where bats are present and to ensure that there are interconnected light exclusion zones and variable light regimes with reduced intensity of light in specific areas (e.g. important foraging and commuting habitats) as responses to street lighting may vary between species. It recommends that there should be a 'light threshold'.

1.2.3.2.1 Lighting Guidelines – Effective Mitigation Measures

As a consequence of this extensive amount of research there are two principal guideline documents available for best practice for effective mitigation relating to outdoor lighting.

EUROBATS (Voigt *et al.,* 2018) guidelines recommends the following:

- ALAN should be strictly avoided, and artificial lighting should be installed only where and when necessary coupled with the following:
    - Dynamic lighting schemes, where possible.
    - Use a minimal number of lighting points and luminaires on low positions in relation to the ground for minimising light trespass to adjacent bat habitats or into the sky.
    - Use focused light, e.g. by using LED or shielded luminaires which limit the light flux only to the required areas and prevent light trespass into adjacent bat habitats.
    - Create screens, either by erecting walls or by planting hedgerows or trees, to prevent light trespass, e.g. from illuminated roads, to surrounding bat habitats.
    - Exits of bat roosts and a buffer zone around them should be protected from direct or indirect lighting to preserve the natural circadian rhythm of bats.

This BCT (2018) guidelines provides a list of recommendations in relation to luminaire design, which is based on the extensive research completed to-date on the potential impact of lighting on bats, and therefore provides best practice mitigation measures. These recommendations are the basis of mitigation measures pertaining to bats listed in this report and are summarised as follows:

- All luminaires used should lack UV/IR elements to reduce impact.

- A warm white spectrum (<2700 Kelvins should be used to reduce the blue light component of the LED spectrum).
- Luminaires should have a peak wavelengths higher than 550nm to avoid the component of light most disturbing to bats.
- Only luminaires with an upward light ratio of 0% and with good optical control should be used.
- Luminaires should be mounted on the horizontal, i.e. no upward tilt.
- Column heights should be carefully considered to minimise light spill. The shortest column height allowed should be used where possible.
- Bollard lighting should be considered for pedestrian, parks and greenway areas, if deemed necessary.

1.2.3.3 Bat Box Schemes

Bat Boxes are frequently used as part of bat mitigation to retain local bat populations within an area proposed to be development. The NPWS Bat Mitigation Guidelines (Marnell *et al.* 2022) considers that where roosts of low conservation significance (Figure 20, Marnell *et al.* (2022)) are to be lost due to a development, bat boxes may provide an appropriate form of mitigation and the effectiveness depends on the type of bat box provided, which should be appropriate to the bat species (Figure 1f).

Table 7 The types of bat box used by different species.

Species	Summer/ maternity	Summer/non breeding	Hibernation*	Notes
Rhinolophus hipposideros	N/A	N/A	N/A	Horseshoe bats cannot use bat boxes
Myotis daubentonii	H	H		
Myotis mystacinus	H	H		
Myotis nattereri	H	?		
Pipistrellus nathusii	H	H		
Pipistrellus pipistrellus	C	C/H	C	H are rarely used as maternity roosts.
Pipistrellus pygmaeus	C	C/H	C	
Nyctalus leisleri	H	H	H?	
Plecotus auritus	H	H		Maternity roosts

Key

* Large well-insulated hibernation boxes may be more successful

N/A -not applicable; bat boxes should not be considered as replacement roosts

H – tree hollow-type box, providing a void in which bats can cluster

C – tree crevice-type box, with 25-35mm crevices

? – few data on which to base an assessment

Figure 1f: Table 7 (p 58) Reproduced from Marnell *et al.* (2022).

1.2.3.3.1 Effectiveness of Bat Boxes as a Mitigation Measure

Two publications that provide good scientific advise in relation to the effectiveness of bat boxes are presented below. McAney & Hanniffy (2015) reviewed the use of bat boxes in Ireland in relation to the bat usage of the following bat box schemes: 62 Schwegler boxes of three models erected in Portumna Forest Park (Bat box scheme consisted of 30x 1FF design, 30x 2FN design and 2x 1FW

design); 50 2FN boxes erected in Coole-Garryland Nature Reserve and 50 2FN boxes erected in Knockma Nature Reserve of which 40 were later transferred to Glengarriff Nature Reserve County Cork. The bat box schemes were set up in March 1999 and data was collected up to 2015. Eight of the nine resident bat species were recorded roosting in bat boxes (lesser horseshoe bats cannot use bat boxes due to their need to fly, rather than crawl, into roosts). The main summary points are as follows:

- Leisler's, brown long-eared and *Pipistrellus* spp. were recorded in boxes at all three Galway woods, Daubenton's bat was only recorded in Garryland, Natterer's bat was only recorded in Glengarriff and whiskered/Brandt's was recorded just twice.
- There was a 31% chance of encountering a bat at Portumna Forest Park compared to 11.5% and 10% at Coole-Garryland Nature Reserve and Knockma Nature Reserve respectively.
- Pipistrellus spp. preferred 1FF boxes as this bat box design offer crevice-like roosting conditions. This species group also showed a seasonal preference with more bats present later in the season (visual observations confirmed the bats were using the boxes as mating roosts) and their numbers increased from the time that the bat box scheme was originally established.
- Brown long-eared bats preferred 2FN boxes that mimic holes in trees, the natural roosting sites for this species. This species also showed no seasonal pattern to their occurrence in the boxes. However one aspect of 2FN boxes that this report mentions is the high occupancy by birds which can be an issue in relation to nesting material reducing the availability of bat boxes for roosting bats.
- Leisler's bat showed no preference for box model but showed a seasonal preference with more bats present later in the season.
- Aspect was not a significant factor for occupancy but most boxes received dappled sunshine for part of the day.
- The other factor that proved significant was the length of time the boxes were in place, with occupancy rates increasing for all three species, although in the case of pipistrelles this increase appears to have stabilised. So, although the boxes were occupied very quickly, it took several years before they were regularly occupied and before clusters of bats were formed and breeding was confirmed.

Collins *et al.* (2020) investigated the implementation and effectiveness of bat roost mitigation, which included bat boxes, in building developments completed between 2006 and 2014 in England and Wales. The bat species studied were: common and soprano pipistrelle, brown long-eared bat and *Myotis* species, all of which are present in Ireland. A summary of the main points relating to bat boxes are as follows:

- Bat boxes were the most frequently deployed roosting provision (i.e. alternative roosts), being installed at 64% (n = 71) of sites surveyed as a compensation or enhancement measure.
- Box frequencies ranged from 1 to 41 at sites where they were installed, with an average of 6.6 boxes per site.
- Bats, or evidence of bats, were recorded in 20% of these bat boxes.
- Bat boxes mounted externally on buildings showed the highest occupation rate regardless of species while Common pipistrelle showed a preference for these over tree mounted boxes; the opposite was true for soprano pipistrelle.
- The four most popular bat box models used by consultants in the study were all Schwegler woodcrete bat boxes. Bat presence was highest in the 1FF bat box design (32%, n = 53) and lowest for birds (8%). The tree-mounted 2F and wall-integrated 1FR/2FR models both demonstrated similar bat presence rates of 23% (n = 43) and 25% (n = 32) respectively.

The 2FN tree-mounted model showed the lowest presence rate for bats (11%, n = 19) and the highest for birds (58%). There were also 26 timber bat boxes, none of which were used by bats.

The author has also erected a number of bat box schemes and, where possible, has completed occasional monitoring visits. One such example is a bat box scheme erected in Kileshandra, Co. Cavan which consists of 8 Schwegler woodcrete bat boxes of various designs. The bat boxes were erected on mature trees located in a linear woodland adjacent to a river. This bat box scheme was erected in 2012 as part of mitigation for the demolishment of a large derelict building where small satellite roosts were recorded for *Pipistrellus* spp. and Daubenton's bat. Two site visits have been completed since 2012 and during these visits the bat boxes were checked for evidence of bat usage. The first site visit was on 25/8/2015 and one bat box was occupied by a single Leisler's bat while the additional seven bat doxes had evidence of bat droppings (*Pipistrellus* spp. and *Myotis* spp.). During the second site visit (27/7/2019) four bat boxes were occupied by bats (Soprano pipistrelle x1 individual (adult male), Leisler's bat x1 individual (adult male) and two bat boxes with x16 Daubenton's bats and x10 Daubenton's bats respectively). Biometrics was recorded for the 12 of the bats (which included 10 of the Daubenton's bats recorded in the bat box with 16 individuals) and five of these Daubenton's bats were lactating females with the remaining five Daubenton's bats recorded as juveniles, thereby indicating that this bat box was used as a maternity roost. The remaining four bat boxes all had droppings within for *Pipistrellus* spp and Leisler's bats. This bat box scheme, while just one example, demonstrates that when bat boxes are erected in an area with good bat habitat (bat survey documented a high level of bat activity for the named bat species), a high level of occupancy of bat boxes will occur.

In relation to bat boxes, Marnell *et al.* (2022), a document that provides guidelines that are considered to be practical and effective based on past experience, recommends that the design life of potential bat boxes, including essential maintenance, should be about 10 years, as this would be comparable with the lifespan of the tree roosts that bat boxes are designed to mimic. The guidelines continues by stating that the "This lifespan can be achieved with good quality wooden boxes and exceeded by woodcrete bat boxes or other types of construction that ensure any softwoods are protected from the weather and attack by squirrels" (note – this includes woodstone bat boxes).

In relation to the number of bat boxes recommended to be erected, Lintott & Mathews (2018) found that the greater the number of bat boxes deployed, the greater the probability of at least one of the boxes becoming occupied and that the odds of bats occupying at least one box increased by approximately 7% with each additional bat box that was deployed. Bat boxes are erected, as part of this proposed development, to mitigate for the loss of potential roosts in trees. Therefore the number of bat boxes are calculated according to the number of trees with additional boxes added for greater bat conservation value.

Therefore Schwegeler woodcrete bat boxes are recommended as a bat mitigation measure and the authors preference to use 1FF designs as this box is open at the bottom which reduces build-up of droppings (i.e. it is a self-cleaning bat box). Both McAney & Hannify (2015) and Collins *et al.* (2020) demonstrated that usage of this bat box design by bat species recorded in this survey report. This bat box is also less likely to be used by birds and therefore retaining it for bat usage between monitoring visits. To increase occupancy of bat boxes by bats it is important to erect bat boxes 4m or higher (to ensure that bat boxes are out of reach from disturbance by humans and predation by other mammals) and that they should be located where bats have been documented foraging and commuting. The aspect of the bat box is not an influencing factor in relation to occupancy. These recommendations have all been included in this report.

1.2.3.4 Landscaping For Bats

Bats depend on the landscape for foraging, roosting and commuting. Different bat species will travel different distances, to and from their principal roosting sites, depending on their morphology, life stage and preferred foraging areas. Bats in Ireland are insect eating mammals and feed on an array of insects, whose populations are ultimately supported by vegetation. Areas of rich vegetation habitat tend to support higher abundances of insect populations and therefore a higher abundance of bats. In addition, many bat species rely on continuous linear habitats (e.g. treelines and hedgerows) to commute along. As a consequence landscaping as part of a proposed development project is an important element to the goal of retaining local bat populations.

The Bat Conservation Trust publication "Landscape and Urban Design for bats and biodiversity" (Gunnell *et al.,* 2012) is a resource for planning landscape design in our urban areas. This resource encourages measures to enhance existing bat foraging habitat, create water features such as ponds (drinking sites for bats and as a source of emerging insects), manage species rich grassland and planting of tall vegetation to ensure that exiting treelines and hedgerows are linked. It also recommends that use of landscaping as a means to creating dark zones or dark corridors for this mammal group to fly along in our lit urban areas. This is also support by the BCT Lighting Guidelines (BCT, 2018) where landscape design can be utilised to buffer potential light spillage from developments.

1.2.3.5 Seasonality of Bat Mitigation Measures

The NPWS Bat Mitigation Guidelines (Marnell *et al.* 2022) provides best practice guidance in relation to the timing of bat mitigation measures. It states that the most common and effective method of avoiding potential harm to a bat is to carry out the work at an appropriate time of the year. The following table provides a summary of timings.

Table 5 Optimum season for works in different types of roosts.

Bat usage of site	Optimum period for carrying out works (some variation between species)
Maternity	1st October – 1st May
Summer (not a proven maternity site)	1st September – 1st May
Hibernation	1st May – 1st October
Mating/swarming	1st November – 1st August

Figure 1e: Table 5 (p 50) Reproduced from Marnell *et al.* (2022).

Timing of bat mitigation measures is relevant to the proposed tree felling of Potential Bat Roosts (PBRs). Felling is recommended outside the principal maternity season and during mild weather conditions (to avoid cold weather that would encourage bats to hibernate). This coupled with dusk/dawn surveys and additional daytime inspections is best practice to ensure that tree felling is completed without causing harm to potentially roosting bats. The preferred tree felling months also avoids the bird nesting season.

1.3 Lesser Horseshoe Bat

1.3.1 Lesser Horseshoe Bats – Morphology & Ecology

The lesser horseshoe bat is a relatively small sized species of *Rhinolophus.* Typically it weighs between 4-8g and has a wingspan of 225-250mm (McAney, 2016). It is easily distinguishable from other Irish bat species by the fleshy, circular nose-leaf structure surrounding the nostrils. This species echolocation call is a distinctive melodic warble when heard on a bat detector tuned to 110 kHz.

This bat species will typically feed on a range of insects including midges, craneflies, caddisflies, lacewings and moths (McAney, 2016). The BCIreland Landscape Model indicates that the species' habitat preference is for areas with broadleaf and mixed woodland and that a mosaic of habitats is important (Roche *et al.,* 2014). It tends to commute along distinct linear habitat features such as stonewalls and hedgerows and avoids flying out in the open. It travels short distances from summer roosts to foraging areas, typically 2km.

Females form maternity colonies in buildings from April to September with a single pup born in June or July. The knowledge of roosting sites for this species is extensive as a result of an intensive survey completed in six Counties by the Vincent Wildlife Trust between 1994 and 2004 (McAney *et al*., 2013). In general, this species has a preference for buildings constructed prior to the 1900s, built of stone with slate rooves (Schofield, 2008). Such sites are also relatively undisturbed and uninhabited by people. Kelleher (2006) documented a demise in the quality of buildings used by lesser horseshoe bats in Ireland. Many summer roosting sites are now in one-storey buildings often roofed with corrugated iron and this may be an indication that optimal sites are less available to the species (McAney *et al.,* 2013).

Hibernation typically occurs from October to March and hibernation sites in Ireland are typically found underground, although at a number of buildings have been recorded as hibernation sites. The bats have been recorded hibernating in ground storey rooms during the winter months and there is a general trend in such hibernacula towards greater numbers of bats in buildings with two storeys or more (Roche *et al*., 2012).

1.3.2 Lesser Horseshoe Bats – Global Status & Status in Ireland

The lesser horseshoe bat is distributed across Europe from Portugal and Ireland to the Ukraine and Poland. It is present in northern Africa and parts of the middle east (Csorba *et al.,* 2003).

The lesser horseshoe bat is mainly found in counties on Ireland's western seaboard (Mayo, Galway, Clare, Limerick, Kerry and Cork) and its strongholds are found in County Kerry, west Cork and County Clare. A single animal has also been recorded in Co. Roscommon in 2004 (B. Keeley, pers. comm.) and bat droppings were recorded in Tubercurry, Co. Sligo (C. Kelleher, pers. comm.). A single bat (male) was also recorded in Ballina, Co. Tipperary in 2015 (pers. comm, Dr Áine Lynch, NPWS). The lesser horseshoe bat is Ireland's only Annex II-listed bat species (EU Habitats Directive [92/43/EU]). As a consequence, a roost monitoring scheme is operated by NPWS and managed by Bat Conservation Ireland (BCIreland). BCIreland carried out analysis of the lesser horseshoe bat database in 2012, and concerns were expressed about the state of deterioration of many of its roosting sites (McAney, 2014; Roche *et al.*, 2015) as well as the finding that there are genetically distinct clusters within the Irish population (Dool *et al.*, 2013) that are likely to have arisen due to landscape connectivity constraints.

As discussed previously, the modelled Core Area for lesser horseshoe bat is a relatively small area restricted to the Counties on the western seaboard (5,993km^2). Given this small range, significant impacts on this species may occur even with small levels of habitat modification or changes to roost availability (Roche *et al,* 2014).

According to Roche *et al,* 2014 the primary concerns for this species is as follows:

- Increased urbanisation;
- Mono cultural landscape (e.g. large swathes of coniferous forestry and high intensity farmed landscapes);
- Roost due to deterioration, demolition or renovations;
- Street lighting;
- Recreational cave visits etc to hibernation sites;
- Natural flooding of underground site.

1.3.2.1 Lesser Horseshoe Bat Population Trends & Distribution Gaps

Research present by Dr Andrew Harrington on the population genetics of lesser horseshoe bat in Ireland (Dr Harrington's Ph.D. thesis Title: The Development of Non-Invasive Genetic Methods for Bats of the British Isles, July 2018) examined the lesser horseshoe bat's range across Ireland with DNA samples from 21 colonies examined. This was to determine the level of interbreeding and possible risk of inbreeding within this population. One aspect of the study was to determine the sex ratio of colonies examined (Harrington *et al.,* 2017). Previously, it was assumed that 25% of the maternity roost colonies was comprised of 25% males. However, Dr Harrington's work showed that in reality the percentage of males can be much higher with a range of 14.2% to 74.3% recorded. As a result the estimated population of lesser horseshoes in Ireland is considered to be lower than previously reported (14,010 individuals as reported by Roche *et al.,* 2012).

Lesser horseshoe bat roosts are counted by NPWS and VWT staff as part of the Lesser Horseshoe Bat Roost Monitoring (managed by Bat Conservation Ireland under the Irish Bat Monitoring Programme). This involves annual winter and summer counts and using the summer roost and hibernacula count data BCIreland have analysed population trends for the species to winter and summer 2021.

Counts of lesser horseshoe bats in hibernaculum was undertaken at 156 sites and contribute to the winter trend analysis was completed as part of the Lesser Horseshoe Bat Roost Monitoring. The trend has been increasing since the start of the survey with the exception of a five year period between 2007 and 2011 when numbers were stable. Over the past 20 years (2002-2021), the trend index increased by 81.5%, which is equivalent to a 3% annual increase (Aughney *et al.,* 2022). Similar to the increasing trend in hibernation counts, there has been a significant increase in lesser horseshoe bats in summer. Between 1992 and 2021 the index increased by 98%. Over the past 20 years the index has increased by 2.98% per annum. Over the past six years the annual increase in summer has been 2.1%, which is slightly lower than that seen in winter sites (Aughney *et al.,* 2022).

However, while the current population trend is favourable, the NPWS & VWT (2022) emphasises that there is growing evidence that lesser horseshoe populations are becoming isolated. For example studies undertaken by the VWT have indicated that a gap of over 45km had opened between the still occupied roosts in Rathkeale (Limerick) and those at Castleisland and Tralee (north Kerry) and this increased to 70km between roosts with more than 25 bats (Lyons, 2014). Another VWT GIS study completed by Finch & McAney (2020) to investigate the interaction between all roosts in all regions at landscape scale with specific emphasis on the following regions: between the northern and central regions, between the central and southern regions and between roosts in south Limerick

and east Kerry. The results of this study indicate there are high levels of local connectivity between roosts within each of the three regions but limited connectivity between the regions (NPWS & VWT, 2022). The high level of artificial illumination (e.g. outdoor street lighting) associated with the cities of Galway and Limerick may be a barrier to movement by this species (Finch & McAney, 2020) and therefore this is a concern in relation to urban developments.

Genetic studies over the last decade has also highlighted the concern relating population isolation. One such study undertaken by Harrington (2018) examined the population genetics of the species, focusing on the northern part of its range, using DNA extracted from droppings collected at roosts. This study confirmed that there is consistent genetic structuring within the Irish lesser horseshoe bat population that has created three subpopulations described as southern (Cork/Kerry), central (Limerick, Clare and south Galway) and northern (north Galway and Mayo) (see figure below). As a consequence, distribution gaps are leading to genetic sub-populations within the range of the lesser horseshoe bat in Ireland, from Harrington (2018). Harrington *et al. (*2019) at All Ireland Mammal Symposium (AIMS) stated that maintaining the gene flow within the Irish population is essential to "prevent the future risk of inbreeding depression or local extinctions". As a consequence, this means that this species is in serious risk of negative effects of operations that increase barriers to dispersal to these current sub-populations. The study further identified that the point separating the North Galway-Mayo population from the Clare-South Galway population is an area to the south-east of Galway City (the Galway Gap).

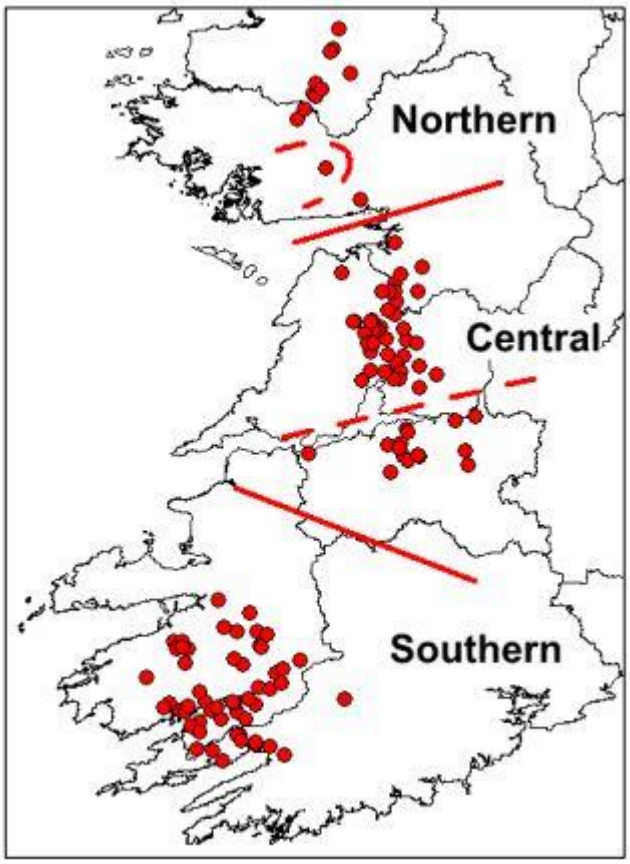


Figure 1g: Taken from NPWS & VWT (2022).

One of the principal issues for lesser horseshoe bats commuting in the landscape is the need for continuous linear habitats to fly along (i.e. flight corridors). The Vincent Wildlife Trust (VWT) prepared a map of potentially important flight paths for lesser horseshoe bats in the Limerick landscape, linking the Curraghchase SAC to the south of the county. The VWT (McAney *et al*.,

2013) reported that a gap of over 45km has opened up between the roosts at Rathkeale in Co. Limerick and those at Castleisland and Tralee in north Co. Kerry. A distance of over 70km was measured between roosts that are used by more than 25 bats. While the lesser horseshoe bat population for the county is only several hundred and is confined to a small number of sites, Co. Limerick is key to ensuring connectivity between populations in the north and south. As a consequence, the VWT has concerns about this phenomenon, which they describe as the 'Limerick Gap', is likely to have arisen as a result of habitat fragmentation and roost loss. Information on where to focus future conservation actions to enable the species to recolonise this area is essential if future range decline is to be prevented. The VWT have recommend that two areas be targeted for conservation of the lesser horseshoe bat (Figure 1h).

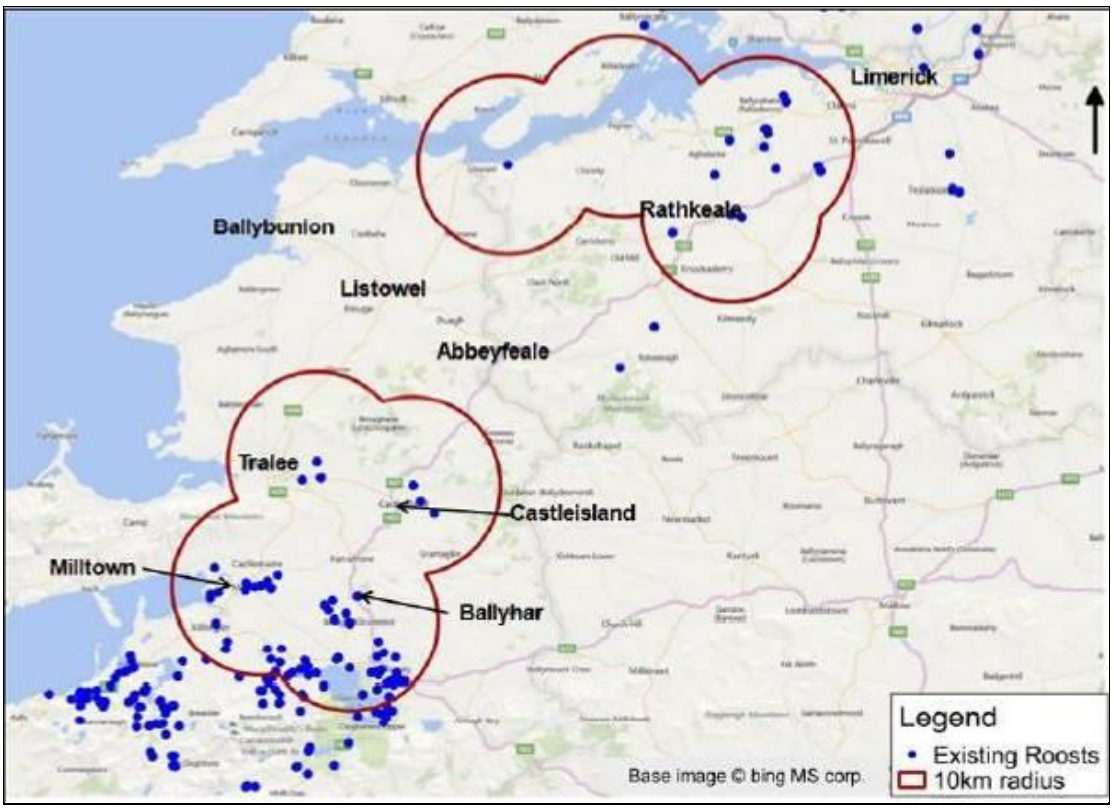


Figure 1h: Conservation target areas for Lesser horseshoe bat (McAney *et al*., 2013)

2. Proposed Development Description

2.1 Site Location

The proposed development site is located at Ardgroom Inward, Beara, Co. Cork. A total of four buildings were surveyed, one of which is outside the red line boundary as presented below.

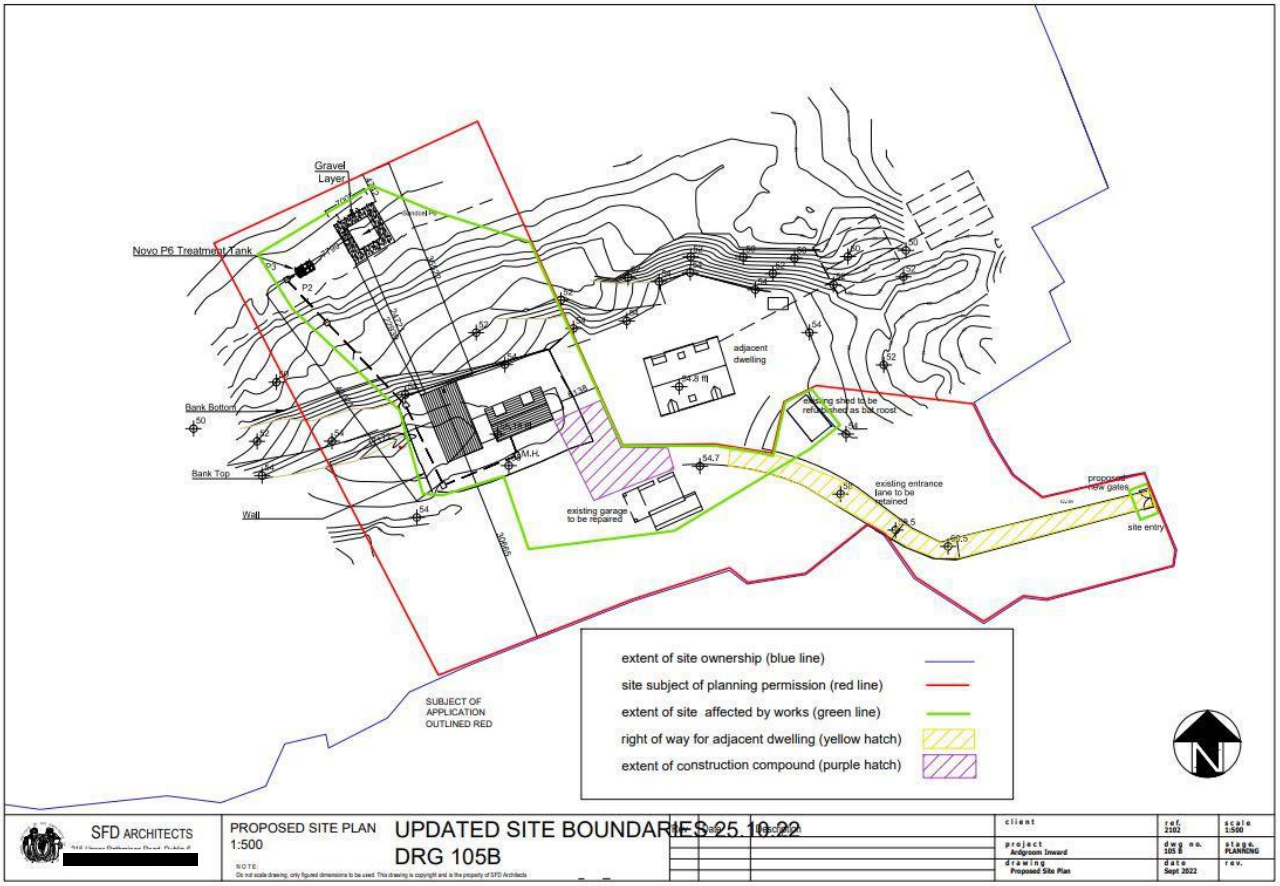


Figure 2: Layout of buildings in proposed development site.

2.2 Proposed Project

Planning permission is sought by Cillian and Maeve Barry for demolition of single storey rear extension, refurbishment of existing dwelling with new dormer window to the rear roof and new photovoltaic panels to front roof, construction of a single storey extension to the side, construction of a separate garden room/ gym, a new wastewater treatment system, re-roofing and repairs to existing garage, alterations to existing stone shed and associated site works at dwelling house at Ardgroom Inward, Beara, Co Cork, Eircode P75F342. An Ecological Impact Assessment report and a Natura Impact Statement are included with the application.

3. Bat Survey Methodology

3.1 Daytime Inspections

One purpose of daytime inspections is to determine the potential of bat roosts within the survey area. Due to the transient nature of bats and their seasonal life cycle, there are a number of different type of bat roosts. Where possible, one of the objectives of the surveys is to be able to identify the types of roosts present, if any. However, the determination of the type of roost present depends on the timing of the survey and the number of bat surveys completed. Consequently, the definition of roost types, in this report, is based on the following:

Table 4: Bat Roost Types (adapted from Collins 2016).

Roost Type	Definition	Time of Survey
Day Roost	A place where individual bats or small groups of males, rest or shelter in the daytime but are rarely found by night in the summer.	Anytime of the year
Night Roost	A place where bats rest or shelter in the night but are rarely found in the day. May be used by a single bat on occasion or it could be used regularly by the whole colony.	Anytime of the year
Feeding Roost	A place where individual bats or a few bats rest or feed during the night but are rarely present by day.	Anytime of the year
Transitional Roost	A place used by a few individuals or occasionally small groups for generally short periods of time on waking from hibernation or in the period prior to hibernation.	Outside the main maternity and hibernation periods.
Swarming Site	Where large numbers of males and females gather. Appear to be important mating sites.	Late summer and autumn
Mating Site	Where mating takes place.	Late summer and autumn
Maternity Site	Where female bats give birth and raise their young to independence.	Summer months
Hibernation Site	Where bats are found, either individually or in groups in the winter months. They have a constant cool temperature and humidity.	Winter months in cold weather conditions
Satellite Roost	An alternative roost found in close proximity to the main nursery colony and is used by a few individuals throughout the breeding season.	Summer months

3.1.1 Building & Structure Inspection

Structures, buildings and other likely places that may provide a roosting space for bats are inspected during the daytime for evidence of bat usage. Evidence of bat usage is in the form of actual bats (visible or audible), bat droppings, urine staining, grease marks (oily secretions from glands present on stonework) and claw marks. In addition, the presence of bat fly pupae (bat parasite) also indicated that bat usage of a crevice, for example, has occurred in the past. Inspections are undertaken visually with the aid of a strong torch beam (LED Lenser P14.2) and endoscope (General DC5660A Wet / Dry Scope).

Buildings were assessed to determine their suitability as a bat and described using the parameters Negligible, Low, Medium or High suitability in view of Table presented in the previous section.

Survey Dates: 16th & 21st July 2022

3.1.2 Tree Potential Bat Roost (PBRs) Inspection

Trees that may provide a roosting space for bats were classified using the Bat Tree Habitat Key (BTHK, 2018) and the classification system adapted from Collins (2016). The Potential Roost Features (PRFs) listed in BTHK (2018) were used to determine the PBR value of trees.

Trees identified as PBRs were inspected during the daytime, where possible, for evidence of bat usage. Evidence of bat usage is in the form of actual bats (visible or audible), bat droppings, urine staining, grease marks (oily secretions from glands present) and claw marks. In addition, the presence of bat fly pupae (bat parasite) also indicated that bat usage of a crevice, for example, has occurred in the past.

A Phase 1 inspection was undertaken to make a list of trees within the proposed development site that may be suitable as roosting sites for bats. Inspections were undertaken visually with the aid of a strong torch beam (LED Lenser P14.2) during the daytime searching for PRFs, if visible. To aid this Phase 1 inspection, tree reports, where available, were consulted to supplement the data collected.

Survey Date: 21st July 2022

Table 5: Tree Bat Roost Category Classification System (adapted from Collins, 2016).

Tree Category	Description
1 High	Trees with multiple, highly suitable features (Potential Roosting Features = PRFs) capable of supporting larger roosts
2 Moderate	Trees with definite bat potential but supporting features (PRFs) suitable for use by individual bats;
3 Low	Trees have no obvious potential although the tree is of a size and age that elevated surveys may result in cracks or crevices being found or the tree supports some features (PRFs) which may have limited potential to support bats;
4 Negligible	Trees have no potential.

3.1.3 Bat Habitat & Commuting Routes Mapping

The survey site was assessed during daytime walkabout surveys, in relation to potential bat foraging habitat and potential bat commuting routes. Such habitats were classified according to Fossit, 2000 (Appendix 1, Table 1.B) while hedgerows were classified according to BATLAS 2020 classification (Bat Conservation Ireland, 2015) (Appendix 1, Table 1.A). Bat habitats and commuting routes identified were considered in relation to the wider landscape to determine landscape connectivity for local bat populations through the examination of aerial photographs.

Survey Date: 21st July 2022

3.2 Night-time Bat Detector Surveys

3.2.1 Dusk & Dawn Bat Surveys

Dusk Emergence Surveys were completed from 10 minutes before sunset to at least 110 minutes post sunset and the surveyors position themselves adjacent to the building / structure to be surveyed to determine if bats are roosting within, location of roost(s), number of bats, bat species etc.

Survey Date: 21st July 2022

Dawn surveys were completed from 110 minutes before sunrise to 10 minutes after sunrise. Surveys are completed during mild and dry weather conditions with air temperature 8°C or greater. All bat encounters are noted during surveys.

Survey Date: 22nd July 2022

The following equipment was used:

Surveyor 1 (Principal surveyor): Anabat Walkabout Full Spectrum Bat Detector and Petersson D200 Heterodyne Bat Detector.

3.2.2 Filming

A Sony Camcorder (with night shot capability) filming assisted with Infra-red lamps (connected to 12 volt batteries) was used to capture potential emerging bats from potential roosting sites. This was completed from 10 minutes before sunset till at least 110 minutes after sunset. Captured film was watched post-survey and any emerging bats were noted.

Survey Dates: 21st & 22nd July 2022

A Guide TrackIR Pro25 thermal imagery scope filming was also deployed to capture potential emerging bats from potential roosting sites. This was completed from 10 minutes before sunset till at least 120 minutes after sunset and 110 minutes before sunrise to 10 minutes after sunrise. Captured film was watched post-survey and any emerging bats were noted.

Survey Dates: 21st & 22nd July 2022

Bat detectors were attached to the filming units to aid species identified: Anabat Scout Full Spectrum Bat Detector and Pettersson D200 Heterodyne Bat Detector.

3.2.3 Passive Static Bat Detector Survey

Passive Static Bat Surveys were completed from 16th to 22nd July 2022 and four units were deployed within the survey area.

A Passive Static Bat Surveys involves leaving a static bat detector unit (with ultrasonic microphone) in a specific location and set to record for a specified period of time (i.e. a bat detector is left in the field, there is no observer present and bats which pass near enough to the monitoring unit are recorded and their calls are stored for analysis post surveying). The bat detector is effectively used as a bat activity data logger and the habitat type of where the bat detector is location is noted to allow interpretation of the results (e.g. Open verses Edge verses Closed habitat types – see table below). Static surveillance results in a far greater sampling effort over a shorter period of time. Bat detectors with ultrasonic microphones are used as the ultrasonic calls produced by bats cannot be heard by human hearing.

The microphone of the unit was positioned horizontally to reduce potential damage from rain. Wildlife Acoustics Song Meter SM4 Bat FS and Mini Bat FS Platform Units use Real Time recording as a technique to record bat echolocation calls and using specific software, the recorded calls are identified. It is these sonograms (2-d sound pictures) that are digitally stored on the SD card (or micro SD cards depending on the model) and downloaded for analysis.

The recordings are analysed using Wildlife Acoustics Kaleidoscope Pro. The Auto-Id function is used for all sound files but manual verification is used to ensure the auto-id function is accurate. This is particularly important for less common bat species and cryptic bat species such as *Myotis* species. In addition, "Noise" and "Unidentified" sound files are also checked. Each sequence of bat pulses are noted as a bat pass to indicate level of bat activity for each species recorded. This is either expressed as the number of bat passes per hour or per survey night.

Audio files are a maximum of 15 seconds long and each audio file is taken as a bat pass for each bat species recorded within the audio file. Each bat pass does not equate to the number of individuals of bats flying in vicinity of the recording device but is representative of bat activity levels. Some species such as the pipistrelles will continuously fly around a habitat and therefore it is likely that a series of bat passes within a similar time frame (i.e. separate audio files within a small time frame) is one individual bat. On the other hand, Leisler's bats tend to travel through an area quickly and therefore an individual sequence of echolocation calls or bat pass is more likely to be indicative of individual bats.

The following static units were deployed during this static bat detector survey:

Table 6a: Static Bat Detectors deployed during Static Bat Detector Surveys.

Static Unit Code	Bat Detector Type	Recording Function	Microphone
SM4 Units	Wildlife Acoustics SongMeter 4 Bat FS	Passive Full Spectrum	SMM-U2, 4m cable

Bats produce different types of echolocation calls and each bat species family have a characteristic bat echolocation call depending largely on their morphology and preferred habitat type. The different types of echolocation calls (i.e. CF or Constant Frequency call verses a FM or Frequency Modulated call) provides different types of information and therefore are used to detect prey items or for orientation in different habitat types. These can be broadly defined as in the table below.

Table 6a: Bat Habitat Types definitions for Passive Static Bat Detector Surveys.

Bat Habitat	Definition	Example
Open	Large open space require bat to produce calls that are loud and therefore will travel far in order to detect prey items in the open sky. This is typically where Leisler's bats will forage.	Grassland field
Edge	Linear habitat features where bats produce echolocation calls that allow them to detect the linear habitat and the adjacent open space of a field for example. This is typically where *Pipistrellus* species will forage.	Hedgerows and treelines

Closed	To fly within a closed habitat of a woodland (i.e. the clutter of branches and leaves), bats produce a quite calls that provides very detailed information. This is typically where brown long-eared bats will forage.	Woodland interior
Water	This is a specific Bat Habitat Type for Daubenton's bats which produced bat echolocation calls in the same manner as a bats would produce bat echolocation calls when flying within a Closed Bat Habitat Type. Daubenton's bats typically fly 30cm above water surface and as a consequence produce echolocation calls to detect the "Clutter" of the closeness of their flight to the water surface.	Rivers

4. Bat Survey Results

A bat survey is comprised of a number of different elements. The results of these different types of surveys are presented below in a step-wise fashion and summarised at the end of the section. It is important that the whole section is read in order to gain a full impression of the potential bat value of the survey area.

4.1 Daytime Inspections

4.1.1 Building & Structure Inspection

The following buildings / structures were inspected on 16th, 21st and 22nd July 2022. Four buildings are located within the survey area and three were checked on the 16th July 2022 while access to the dormer bungalow allowed an internal inspection on the 21st July 2022 (please note that this building is not part of the current planning application but was surveyed due to its location). The results of these inspections are presented below and Plate 1 a & b indicates the building code for each structure surveyed.

Table 7a: Buildings / Structures inspection results.

Building Code	Description	Roost Type / Suitability	Bat Species
2-storey Farm house Building 1	Slate roof, concrete walls	High – (one open window)	Lesser horseshoe bat droppings in hot press on first floor.
Modern dormer bungalow Building 2	Tile roof, roofing felt	Medium to High	No evidence of bat usage in main attic space.
Stone Shed Building 3	Slate roof, natural stone walls, open windows and doorway	High – crevices and suitable roof void	Scatter of bat dropping on floor and surfaces: lesser horseshoe bat & *Pipistrellus* spp.
Garage with green house Building 4	Corrugate roof, natural stone walls	Medium – crevices in stone walls	No bat evidence.

Plate 1a & b: Buildings surveyed within and adjacent to the proposed development site.

The principal request for the bat survey was due to the presence of lesser horseshoe bat droppings in the hot press of the farm house (Building 1). The floor in the hot press was examined on the 16/7/22 and droppings were noted but no bats were presented. This floor was cleaned on the 16/7/2022 in order to determine if fresh droppings accumulate over the five nights until the author's return on the 21/7/22. Fresh droppings were recorded on the evening of 21/7/22 (Plate 1). An additional seven droppings were counted on the morning of the 22/7/22 indicating that a lesser horseshoe bat was present during the night of the 21/7/22. A static unit was located in the hot press from the 16/7/22 to the 22/7/22 recording nightly.

During this static surveillance, lesser horseshoe bats were recorded during four of the six nights of surveillance. The time stamps indicate that individuals of this species are using the hot press as a night roost only (i.e. there is no bats roosting during the daytime because there are no time stamp recordings at sunset or sunrise times). The number of individuals roosting in the hot press is likely to be low due to the small number of bat recordings and the small number of droppings noted (i.e. one or two individuals).

Table 7b: Static surveillance results inside hot press of farm house (LHB = Lesser horseshoe bat).

Date	Time	Species	Night No.
18/07/2022	00:02:22	LHB	Night 2
18/07/2022	00:02:30	LHB	Night 2
19/07/2022	01:17:27	LHB	Night 3
19/07/2022	03:00:39	LHB	Night 3
19/07/2022	03:00:46	LHB	Night 3
21/07/2022	00:58:10	LHB	Night 5
21/07/2022	01:40:43	LHB	Night 5
21/07/2022	01:40:48	LHB	Night 5
21/07/2022	01:40:59	LHB	Night 5
22/07/2022	02:18:55	LHB	Night 6
22/07/2022	02:19:27	LHB	Night 6

Plate 2: Lesser horseshoe bat droppings on floor of hot press in Building 1 (farm house - 21/7/22).

Plate 3a b: Building 1 (farm house) and Building 2 (modern dormer bungalow) located within the survey area – Yellow Circle is the location of the exit point for common pipistrelle roost.

4.1.2 Tree Potential Bat Roost (PBRs) Inspection

There are trees and scrub growth within the survey site but none of the trees were considered to be Potential Bat Roosts (PBRs).

4.1.3 Bat Habitat & Commuting Routes Mapping

The habitat types, with reference to Fossit (2000) were recorded both within the survey area and adjacent to the survey area on 16th July 2022. The principal "Bat Habitats" are presented in the tables below.

Table 8a: Habitat types present within survey area.

Habitat	Yes	Habitat	Yes	Habitat	Yes	Habitat	Yes
Cultivated land		Salt marshes		Exposed rock		Fens/flushes	
Built land	√	Brackish waters		Caves		Grasslands	√
Coastal structures		Springs		Freshwater marsh		Scrub	√
Shingle/gravel		Swamps		Lakes/ponds		Hedges/treelines	√
Sea cliffs/islets		Disturbed ground	√	Heath		Conifer plantation	
Sand dunes		Watercourse		Bog		Woodland	

Table 8b: Habitat types present adjacent to survey area.

Habitat	Yes	Habitat	Yes	Habitat	Yes	Habitat	Yes
Cultivated land		Salt marshes		Exposed rock		Fens/flushes	
Built land	√	Brackish waters		Caves		Grasslands	√
Coastal structures	√	Springs		Freshwater marsh		Scrub	√
Shingle/gravel		Swamps		Lakes/ponds		Hedges/treelines	√
Sea cliffs/islets		Disturbed ground	√	Heath		Conifer plantation	
Sand dunes		Watercourse		Bog		Woodland	

4.2 Night-time Bat Detector Surveys

4.2.1 Dusk & Dawn Bat Survey

The following table summarises the results of the bat detector surveys completed on 21st July 2022 (Dusk Survey - weather conditions: 14oC, full cloud, dry and calm) and 22nd July 2022 (Dawn Survey – weather conditions: 12oC, full cloud cover, dry and calm). The Infra-Red camera system was set up to record any emerging bats from the open window to the rear of Building 1 (farm house) while the thermal imagery camera (Pro 19mm) was set to record the gable wall of Building 1. During the dusk survey, common pipistrelles were noted emerging from Building 2 so a second thermal imagery camera (Pro 25mm) was set up to continue recording this roost in order to accurately count the number of bats in the roost.

Table 9: Buildings / Structures survey results.

Building Code	Roost Type & Location	Bat Species (No. of bats)	Access Points
Building 1	Night Roost (LHB) – hot press Day Roost (SP, CP) – roof void	LHB = lesser horseshoe bat SP = soprano pipistrelle x1 CP = common pipistrelle x1	LHB – open window at rear SP – facia/soffit of gable facing dormer bungalow

	Night Roost (SP, CP) – roof void		
Building 2	Maternity Roost (CP)	CP = common pipistrelle x44 individuals	Dormer window (on RHS)
Building 3	Day Roost (LHB) – roof void Night Roost (LHB) – roof void Day Roost (SP, CP) – roof void	Concentration of surveying was undertaken in relation to Buildings 1 & 2. Details of roosts for this building relates to static info (Static 2).	Open windows and door
Building 4	Night Roost (LHB) Day Roost (Natterer's bat)	Concentration of surveying was undertaken in relation to Buildings 1 & 2. Details of roosts for this building relates to static info (Static 4a).	Gaps around door frame

During the dusk survey, the principal bat activity noted was the emerging common pipistrelles from Building 2. The post-survey viewing of the film footage provided evidence of a single bat emerging from the facia/soffit of Building 1 (Figure 4). In addition, it was noted that bats were entering Building 3 during the dusk and dawn surveys and static surveillance provides greater detail of the bat usage of this building. The dawn survey recorded common pipistrelles swarming around the entrance point of Building 2 (Plate 5). The bats are roosting in the small attic space associated with this dormer section of the building.

Plate 4: Screenshot of thermal imagery filming of gable end of Building 1 (arrow – emerging bat).

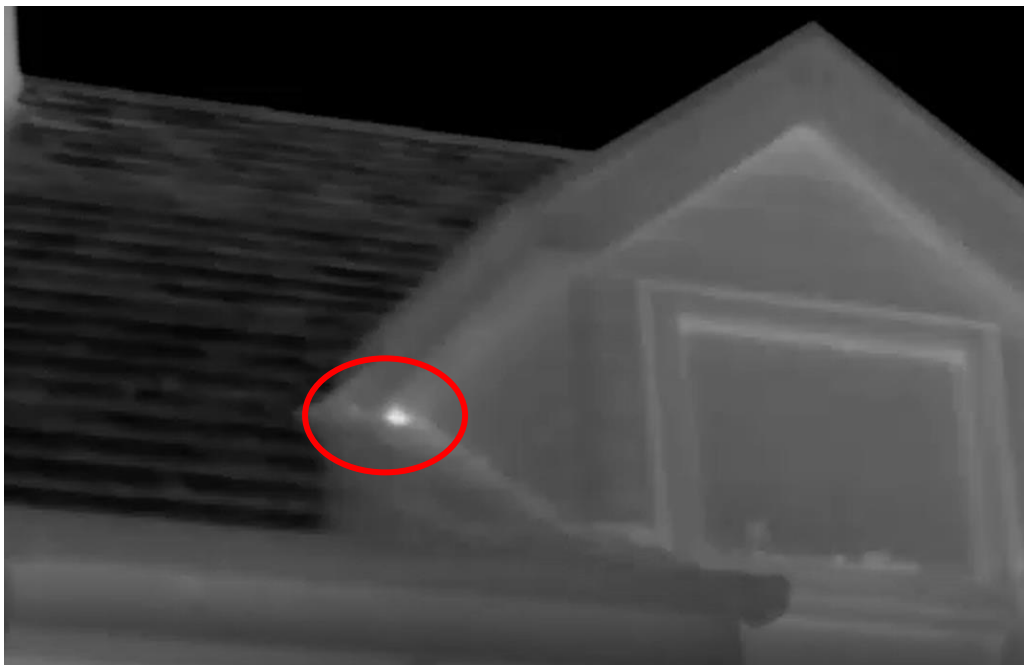


Plate 5: Screenshot of thermal imagery filming of common pipistrelle roost exit point of the front dormer window of Building 2 (bright section – emerging bat).

4.2.2 Passive Static Bat Detector Survey

The following table summarises the results recorded on the static units deployed within the survey area and a summary of the bat species recorded on the static units during the surveillance period. A total of six bat species was recorded during the static surveillance: Lesser horseshoe bat, common pipistrelle, soprano pipistrelle, Leisler's bat, brown long-eared bat and Natterer's bat.

Table 10: Results of Static Bat Detectors deployed during Static Bat Detector Surveys.

Static Code	Location Description / Bat Habitat Type	Survey Period	Bat Species
Static 1	Located in hot press of Building 1 This static indicates the bat species likely to be entering the structure to roost.	16/7/22 to 22/7/22	Lesser horseshoe bat, soprano pipistrelle, common pipistrelle
Static 2	Located in Building 3 This static indicates the bat species likely to be entering the structure to roost.	16/7/22 to 22/7/22	Lesser horseshoe bat, soprano pipistrelle, common pipistrelle
Static 3	Located on tree within the survey area This static unit indicates the bat species foraging and commuting through the survey area.	16/7/22 to 2/7/22	Lesser horseshoe bat, soprano pipistrelle, Leisler's bat, common pipistrelle, brown long-eared bat and Natterer's bat.
Static 4a	Located in Building 4	16/7/22 to 21/7/22	Lesser horseshoe bat, soprano pipistrelle, common pipistrelle and Natterer's bat.

	This static indicates the bat species likely to be entering the structure to roost.		
Static 4b	Located in the main attic of Building 2 (for 1 night)	21/7/22 to 22/7/22	No bats recorded on unit

As described in 4.1.1, there were lesser horseshoe bats roosting in the hot press of the Building 2 (Farmhouse). Soprano pipistrelle (n=29 bat passes) and common pipistrelle (n=64 bat passes) bat calls were also recorded inside the building. An examination of the time stamps (Static 1) on the bat echolocation calls indicate that common pipistrelles primarily use Building 2 as a night roost but a day roost was recorded on 21/7/2022. A similar pattern was noted for soprano pipistrelles with a Day Roost recorded on the 17/7/22 and night roosts for all other surveillance dates.

Three species of bat were recorded on the static unit (Static 2) in Building 3 (Shed) with a particularly high level of lesser horseshoe bat calls. During Night 1 (16/7/22) the first lesser horseshoe bat was recorded at 23:45 hrs with the majority of calls 00:00 to 02:00 hrs indicating that the structure is was used as a night roost. Night 2 (17/6/22) the first lesser horseshoe bat was recorded at 22:47 hrs with the majority of calls 23:00 to 03:00 hrs. During Night 3 (18/7/22) the first lesser horseshoe bat was recorded at 23:10 hrs but calls were recorded throughout the night with the last call recorded at 04:52 hrs which is around sunrise for this date. Therefore, if a lesser horseshoe bat used the structure as a day roost, it would be expected to recorded calls from this species around sunset on the 19/7/22. This was the case with calls recorded from 22:39 hrs while the last call was recorded at 02:36 hrs. During Night 5 (20/7/22) a similar pattern was recorded to Night 1 with the first call recorded at 23:10 hrs and last call at 02:59 hrs. On the final night of surveillance (21/7/22) the first call recorded at 22:50 hrs and last call at 03:24 hrs. This pattern of activity indicates that the Building 3 was used as a night roost for five of the six nights of surveillance while a day roost was recorded during the day of the 19/7/2022.

The following graph indicates the level of bat activity for the three bat species recorded on the static unit inside the structure with lesser horseshoe bats the most frequently recorded bat species. The level of lesser horseshoe bat activity in this structure (n=1,099 bat passes) is greater than Building 1 (n=11 bat passes)) which indicates that Building 3 is more important for this species of bat than Building 1.

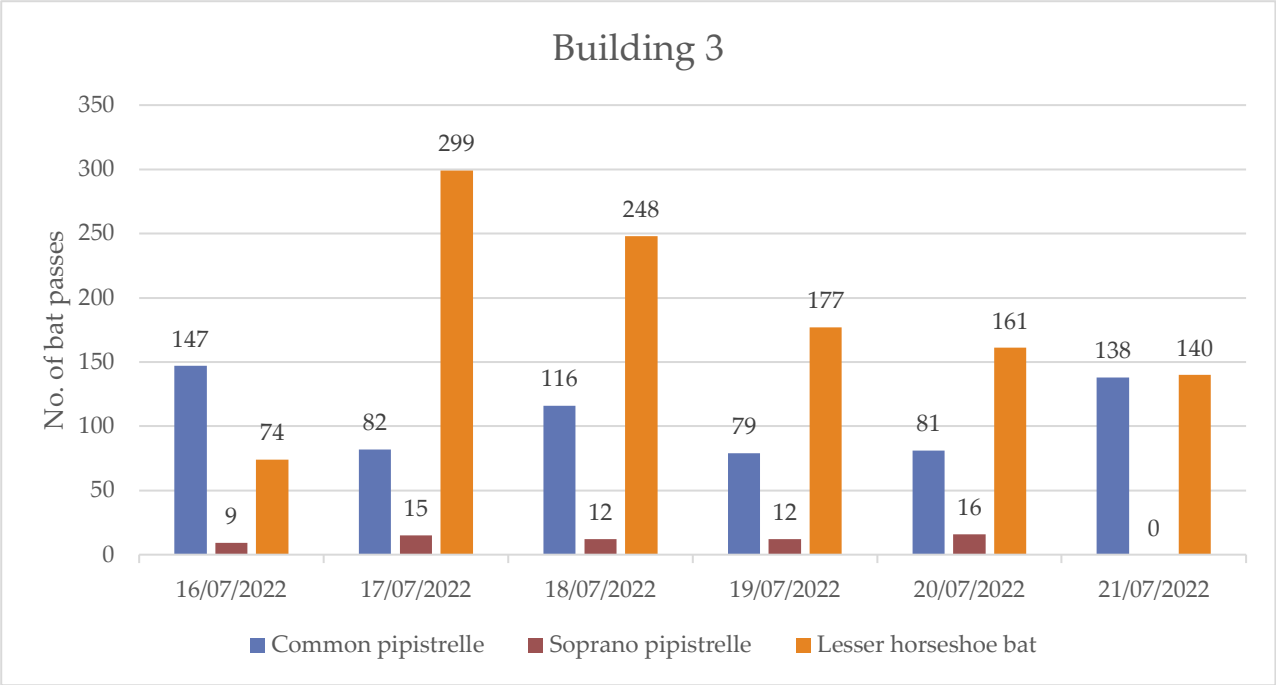


Figure 3a: Location of static units deployed during static surveillance.

The following graph depicts an example of the nightly activity of lesser horseshoe bats within the survey area (static unit (Static 2) located in Building 3 within the survey site). Sunset time on the 18/7/2022 was approximately at 21:45 hrs. This species of bat tends to emerge 20 minutes after sunset. As the first individual was detected at 23:10 hrs on this night, which was approximately 85 minutes after sunset, it provides evidence that this species is commuting to the survey area to forage and it is not roosting within the buildings during the daytime. This was the case for five and the six nights of surveillance. However, on this night, calls were recorded around sunrise indicating that at least one individual stayed in the structure during the daytime and emerged at sunset the following night.

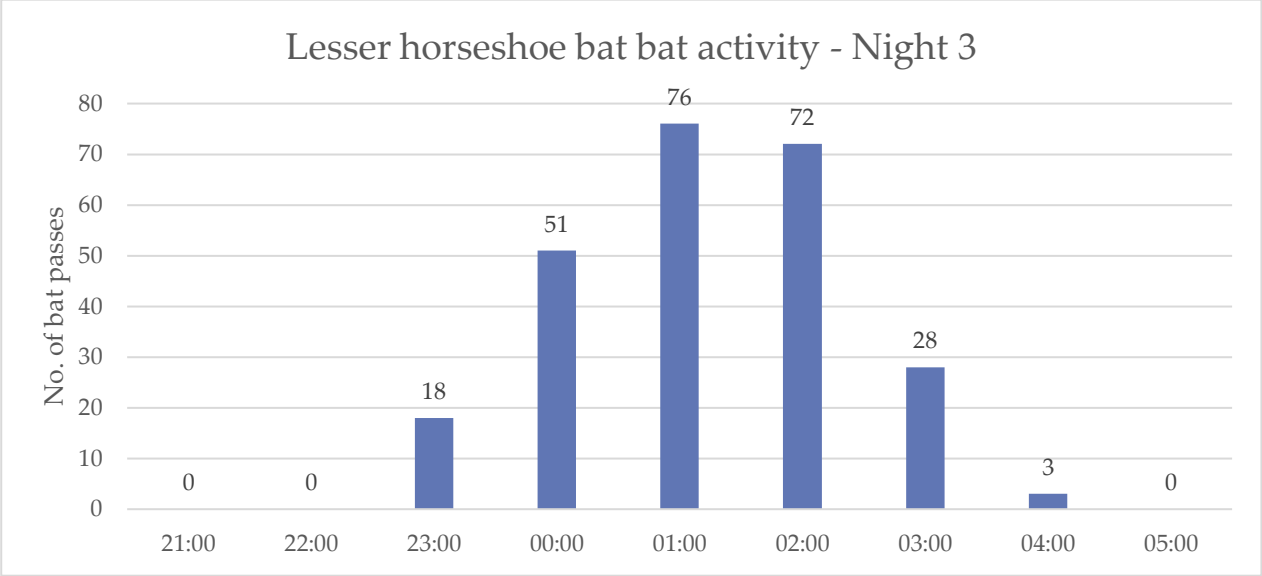


Figure 3b: Example of nightly activity of lesser horseshoe bats within Building 3 (Shed).

Static 4a was located in Building 4 (garage) for five nights and four bat species were recorded, but the type of calls indicated that only two of these species are likely to be roosting in the structure:

lesser horseshoe bat and Natterer's bat. The time stamps of lesser horseshoe bat calls recorded indicate that an individual bat entered the structure during the night, possibly to shelter. The calls recoded for Natterer's bats were at sunrise on two mornings (05:00 hrs on 19/7/2022 and 04:47 hrs and 04:48 hrs on 2/7/2022. Therefore it is likely that this individual roosted during the daytime in this structure.

The remaining static unit was located on a tree within the survey area to document the bat foraging and commuting activity. Six species of bat was recorded and the following two graphs depict the number of bat passes.

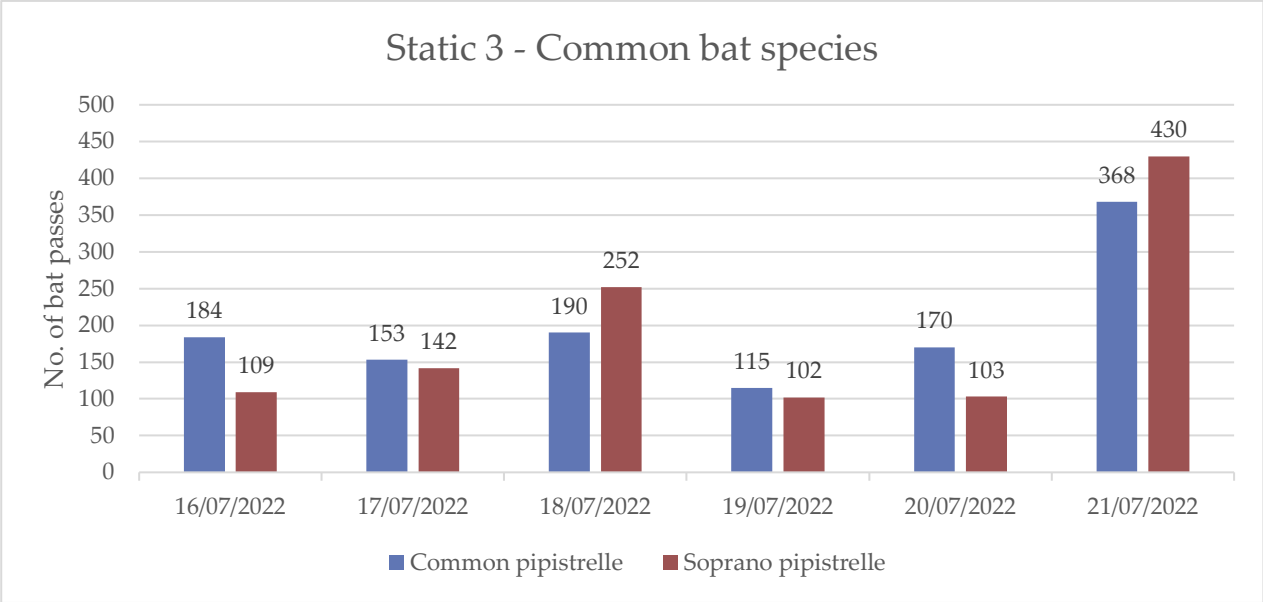


Figure 3c: Nightly bat activity of common pipistrelle and soprano pipistrelle on Static 3.

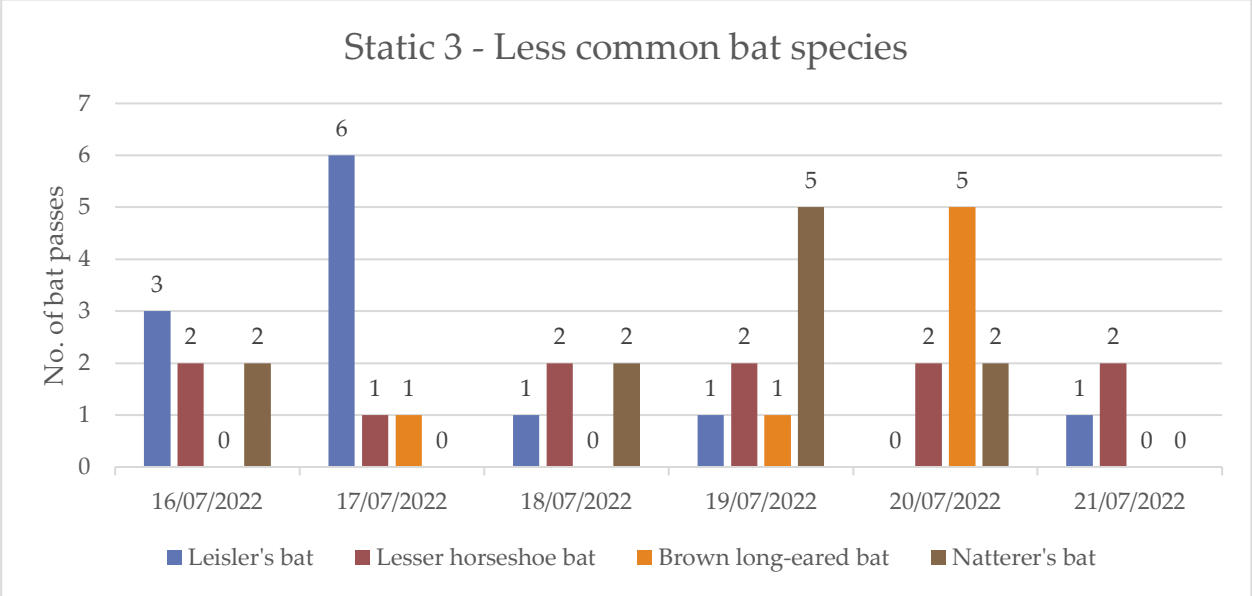


Figure 3d: Nightly bat activity of less common pipistrelle and soprano pipistrelle on Static 3.

4.2.3 Summary of Night Survey Results

The bat survey undertaken for this proposed development site yielded a large amount of results. A total of six bat species were recorded: Lesser horseshoe bat, common pipistrelle, soprano pipistrelle, Leisler's bat, brown long-eared bat and Natterer's bat. All four buildings located within the survey area were recorded as bat roosts:

- Building 1 (Farm house): Day roost for soprano and common pipistrelles (roof space) and night roost for lesser horseshoe bat (hot press), soprano pipistrelles (roof space) and common pipistrelles (roof space).
- Building 2 (Dormer bungalow): Maternity roost for common pipistrelles located in one dormer attic space (front dormer window).
- Building 3 (Shed): Day roost and night roost for lesser horseshoe bat located in the interior of structure, soprano pipistrelles and common pipistrelles located in the interior of structure and crevices of internal walls.
- Building 4 (Garage): Day roost for Natterer's bat in crevices of internal walls and night roost for lesser horseshoe bat in the interior of structure.

In addition, the survey site is a commuting and foraging area for the six bat species recorded during the surveys. This is a small development site with a rich bat biodiversity and therefore is an important place for local bat populations.

4.3 Survey Effort, Constraints & Survey Assessment

The following table details any Survey Constraints encountered and a summary of Scientific Assessment completed.

Table 11: Survey Effort, Constraints & Survey Assessment Results.

Category	Discussion
Timing of surveys	Undertaken in the appropriate survey season for bats: May to August.
Survey Type	Bat Survey Duties Completed (Indicated by red shading) Tree PBR Survey ■ Daytime Building Inspection ■ Static Detector Survey ■ Daytime Bridge Inspection ○ Dusk Bat Survey ■ Dawn Bat Survey ■ Walking Transect ○ Driving Transect ○ Trapping/Mist Netting ○ IR Camcorder filming ■ Endoscope Inspection ■ Other ■
Weather conditions	Suitable for bat surveys.
Survey Constraints	No survey constraints.
Survey effort **Total: 228 hrs**	Dusk & Dawn survey coupled with IR and thermal imagery filming (10 hrs) Static surveillance (4 units x 6 nights) (216 hrs) Daytime inspections (2 hrs)
Extent of survey area	Immediate area of proposed development.
Equipment	All in good working order.

The extent of the surveys undertaken has achieved to determine:

- Presence / absence of bat within the survey area;
- A bat species list for the survey area;
- Extent and pattern of usage by bats within the survey area.

Surveying was completed according Collins (2016) and the timing and survey level meets this guidance document.

It is therefore deemed that the Scientific Assessment completed is appropriate in order to completed the aims of the bat survey.

5. Bat Ecological Evaluation

5.1 Bat Species Recorded & Sensitivity

The bat survey undertaken for this proposed development site yielded a large amount of results. A total of six bat species were recorded: Lesser horseshoe bat, common pipistrelle, soprano pipistrelle, Leisler's bat, brown long-eared bat and Natterer's bat. All four buildings located within the survey area were recorded as bat roosts:

- Building 1 (Farm house): Day roost for soprano and common pipistrelles and night roost for lesser horseshoe bat, soprano pipistrelles and common pipistrelles.
- Building 2 (Dormer bungalow): Maternity roost for common pipistrelles.
- Building 3 (Shed): Day roost and night roost for lesser horseshoe bat, soprano pipistrelles and common pipistrelles.
- Building 4 (Garage): Day roost for Natterer's bat and night roost for lesser horseshoe bat.

In addition, the survey site is a commuting and foraging area for the six bat species recorded during the surveys. This is a small development site with a rich bat biodiversity and therefore it is an important area for local bat populations.

Table 12: Bat Ecological Evaluation Results for the survey site according to referenced criteria.

Bat Species	Survey Results	Evaluation Value	Roost Evaluation
Lesser horseshoe bat	Day & Night roosts Foraging habitat Commuting routes	Local Importance	Conservation Significance (Marnell *et al.*, 2022) – "Small numbers of rarer species. Not a maternity roost".
Common pipistrelle	Maternity roost Day & Night roosts Foraging habitat Commuting routes	Local importance	Conservation Significance (Marnell *et al.*, 2022) – "Maternity sites of common".
Soprano pipistrelle	Day & Night roosts Foraging habitat Commuting routes	Local importance	Conservation Significance (Marnell *et al.*, 2022) – "Small numbers of common species. Not a maternity roost".
Natterer's bat	Night and day roosts Foraging habitat Commuting routes	Local importance	Conservation Significance (Marnell *et al.*, 2022) – "Small numbers of rarer species. Not a maternity roost".
Brown long-eared bat	Foraging habitat Commuting routes	Not significant	Conservation Significance (Marnell *et al.*, 2022) – no significance
Leisler's bat	Tree Roosts Foraging habitat Commuting routes	Not significant	Conservation Significance (Marnell *et al.*, 2022) – no significance

Lesser horseshoe bat

- Lesser horseshoe bat is an Annex II bat species under the EU Habitats Directive. The status of this bat species is listed as Least Concern. The national lesser horseshoe bat population is considered to be significantly increasing trend (Aughney *et al.,* 2022).
- The modelled Core Area for Leisler's bats is a small area confined to the western seaboard counties of Mayo, Galway, Clare, Limerick, Kerry and Cork (5,993km^2). It is considered that this small core area represents the only suitable range for this species in the country. The Bat Conservation Ireland Irish Landscape Model indicated that the lesser horseshoe bat habitat preference for deciduous woodland and riparian vegetation within a few kilometres of roosts and relies on linear landscape features to commute from roosts to feeding areas (Roche *et al.,* 2014)..

Leisler's bat

- Leisler's bat is an Annex IV bat species under the EU Habitats Directive. The status of this bat species is listed as Least Concern. The national Leisler's bat population is considered to be significantly increasing trend (Aughney *et al.,* 2022).
- The modelled Core Area for Leisler's bats is a relatively large area that covers much of the island of Ireland (52,820km^2). The Bat Conservation Ireland Irish Landscape Model indicated that the Leisler's bat habitat preference has been difficult to define in Ireland. Habitat modelling for Ireland shows an association with riparian habitats and woodlands (Roche *et al.,* 2014). The landscape model emphasised that this is a species that cannot be defined by habitats preference at a local scale compared to other Irish bat species but that it is a landscape species and has a habitat preference at a scale of 20.5km.

Common pipistrelle

- Common pipistrelle is an Annex IV bat species under the EU Habitats Directive. The status of this bat species is listed as Least Concern. The national common pipistrelle population is considered to be significantly increasing trend (Aughney *et al.,* 2022).
- The modelled Core Area for common pipistrelle is a relatively large area that covers much of the island of Ireland (56,485km^2). The Bat Conservation Ireland Irish Landscape Model indicated that the Common pipistrelle selects areas with broadleaf woodland, riparian habitats and low density urbanization (<30%) (Roche *et al.,* 2014).

Soprano pipistrelle

- Soprano pipistrelle is an Annex IV bat species under the EU Habitats Directive. The status of this bat species is listed as Least Concern. The national soprano pipistrelle population is considered to be significantly increasing trend (Aughney *et al.,* 2022).
- The modelled Core Area for soprano pipistrelle is a relatively large area that covers much of the island of Ireland (62,020km^2). The Bat Conservation Ireland Irish Landscape Model indicated that the soprano pipistrelle selects areas with broadleaf woodland, riparian habitats and low density urbanisation (Roche *et al.,* 2014).

Brown long-eared bat

- Brown long-eared bat is an Annex IV bat species under the EU Habitats Directive. The status of this bat species is listed as Least Concern. The national brown long-eared bat population is considered to be stable (Aughney *et al.,* 2021).
- The modelled Core Area for brown long-eared bat is a relatively large area that covers much of the island of Ireland (49,929 km^2). The Bat Conservation Ireland Irish Landscape Model indicated that the brown long-eared bat habitat preference is for areas with broadleaf woodland and riparian habitats on a small scale of 0.5km emphasising the importance of local landscape features for this species (Roche *et al.,* 2014).

Natterer's bat

- Natterer's bat is an Annex IV bat species under the EU Habitats Directive. The status of this bat species is listed as Least Concern. The national Natterer's bat population is currently unknown.
- The modelled Core Area for Natterer's bat is a relatively large area that covers much of the island of Ireland (52,864km^2).The Bat Conservation Ireland Irish Landscape Model indicated that the Natterer's bat selects areas with broadleaf woodland, riparian habitats and areas with larger scale provision of mixed forest (Roche *et al.,* 2014). Therefore, it is likely that this species is more widespread within the survey area.

An Annex II bat species (i.e. lesser horseshoe bat) under the EU Habitats Directive was recorded within the survey. This species of bat was recorded during dusk surveys and static surveillance. Two SACs designated for this species of bat are located within 10km of the proposed development site. All other bat species recorded are Annex IV bat species.

5.1.1 International & National Site Designations

National Parks and Wildlife Service mapping provides the locations and details of environmental designations (Source: www.npws.ie). The proposed development site adjacent to the Kenmare River SAC (Site Code 002158) and lesser horseshoe bats is one of the qualifying interests for the designated site. This SAC overlaps with Iveragh Peninsula SPA (004154), Beara Peninsula SPA (004155) and Deenish Island and Scariff Island SPA (004175). It also adjoins Old Domestic Building, Dromore Wood SAC (000353), Cleanderry Wood SAC (001043), Cloonee and Inchiquin Loughs, Uragh Wood SAC (001342), Mucksna Wood SAC (001371), Glanmore Bog SAC (001879) and Drongawn Lough SAC (002187).

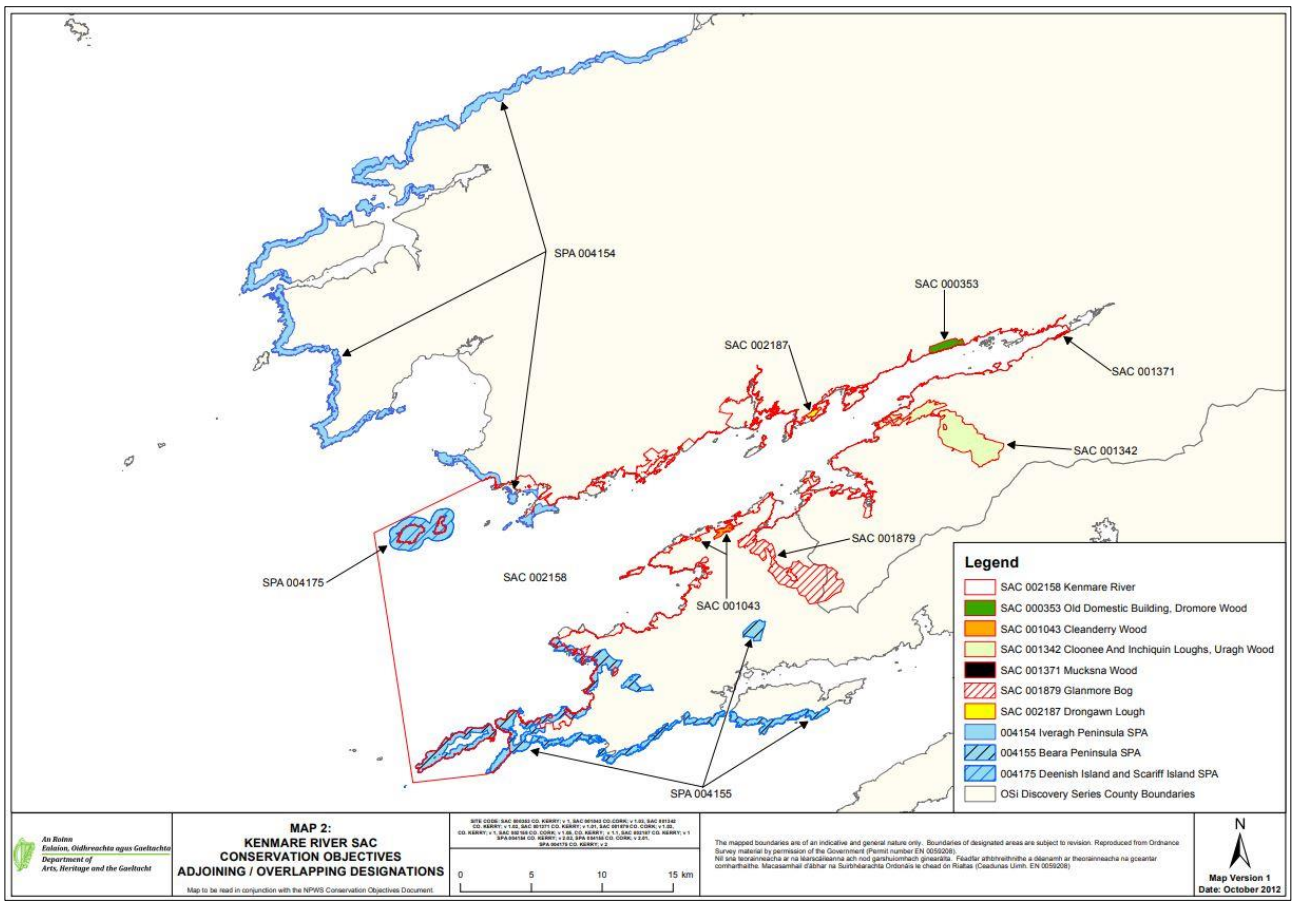


Figure 4a: Kenmare River SAC and overlapping designations (Taken from Map 2, NPWS (2013) Source: www.npws.ie).

Information on the Conservation Objectives for Kenmare River SAC are provided in the following document:

NPWS (2013) Conservation Objectives: Kenmare River SAC 002158. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.

This SAC has been selected for lesser horseshoe bats because of the presence of one internationally important winter roost: Dunkerron souterrain and because of the presence of one internationally important summer roost: Foley's cottage, Killaha. The conservation objectives relating to lesser horseshoe bats is a “Minimum number for the winter roost at Dunkerron souterrain is 138; Minimum of 100 for summer roost (Foley's cottage, Killaha)”.

This document also states that “Lesser horseshoe bat populations will use a variety of roosts besides the main summer maternity roost and winter hibernation roost. Such additional roosts within the SAC

may be important as night/satellite roosts. A database of all known lesser horseshoe roosts is available on the National Biodiversity Data Centre website. NB Further unrecorded roosts may also be present within this SAC".

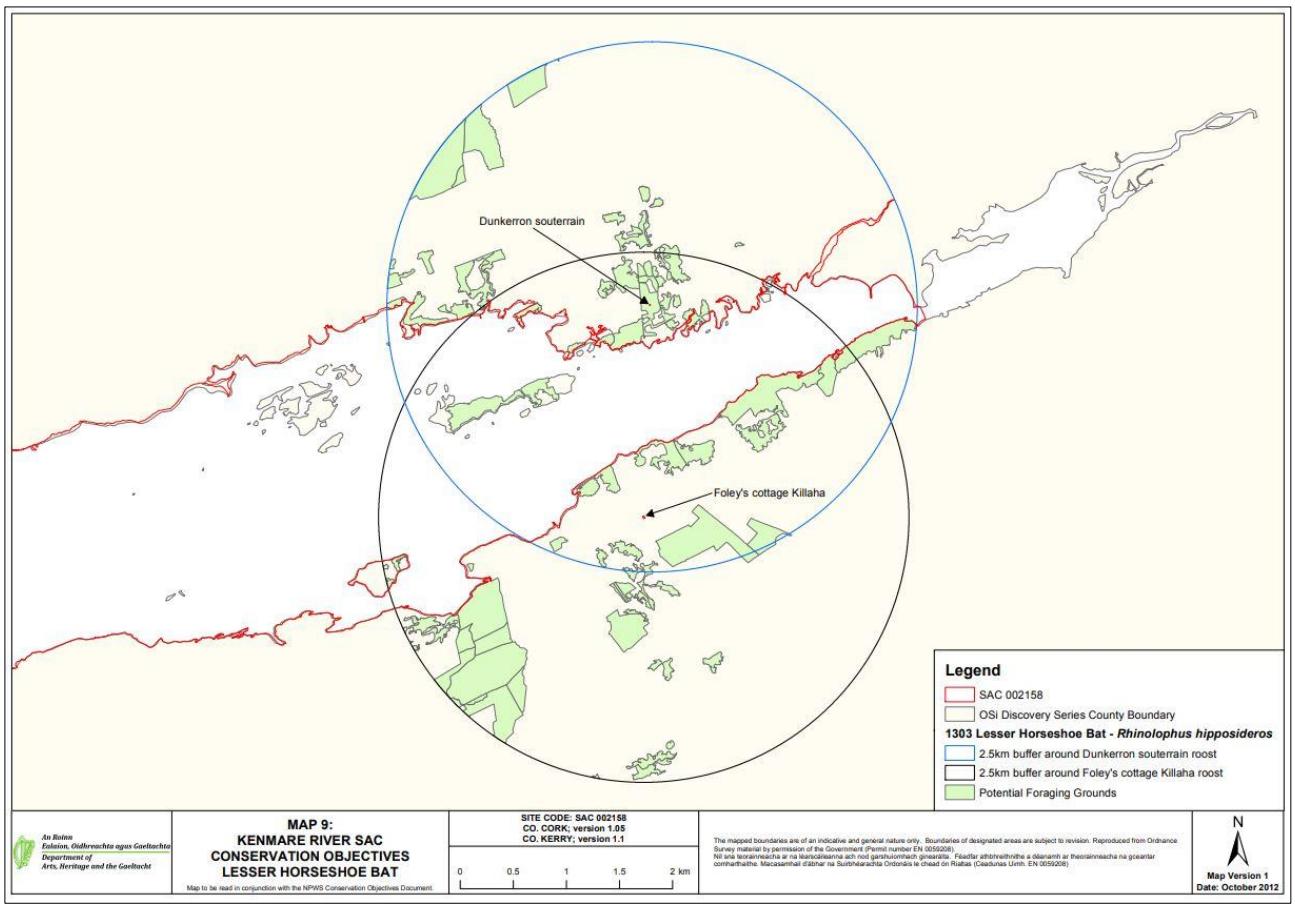


Figure 4b: Kenmare River SAC conservation objectives for lesser horseshoe bats (Taken from Map 9, NPWS (2013) Source: www.npws.ie).

Old Domestic Building, Dromore Wood SAC (000353) is also designated for lesser horseshoe bats. Information on the Conservation Objectives for this SAC are provided in the following document:

NPWS (2018) Conservation Objectives: Old Domestic Building, Dromore Wood SAC 000353. Version 1. National Parks and Wildlife Service, Department of Culture, Heritage and the Gaeltacht.

Old Domestic Building, Dromore Wood SAC has been selected for lesser horseshoe bat because of the presence of one internationally important winter roost (roost id. 454 in NPWS database) (Figure 4c).

Overall the conservation objectives for lesser horseshoe bat populations is:

- Ensuring no decline in winter roost and summer roost;
- No significant decline within 2.5km of qualifying roost in relation to extent of potential foraging habitat;
- No significant loss within 2.5km of qualifying roost in relation to linear features;
- No significant increase in artificial light intensity adjacent to named roost or along commuting routes within 2.5km of the roost.

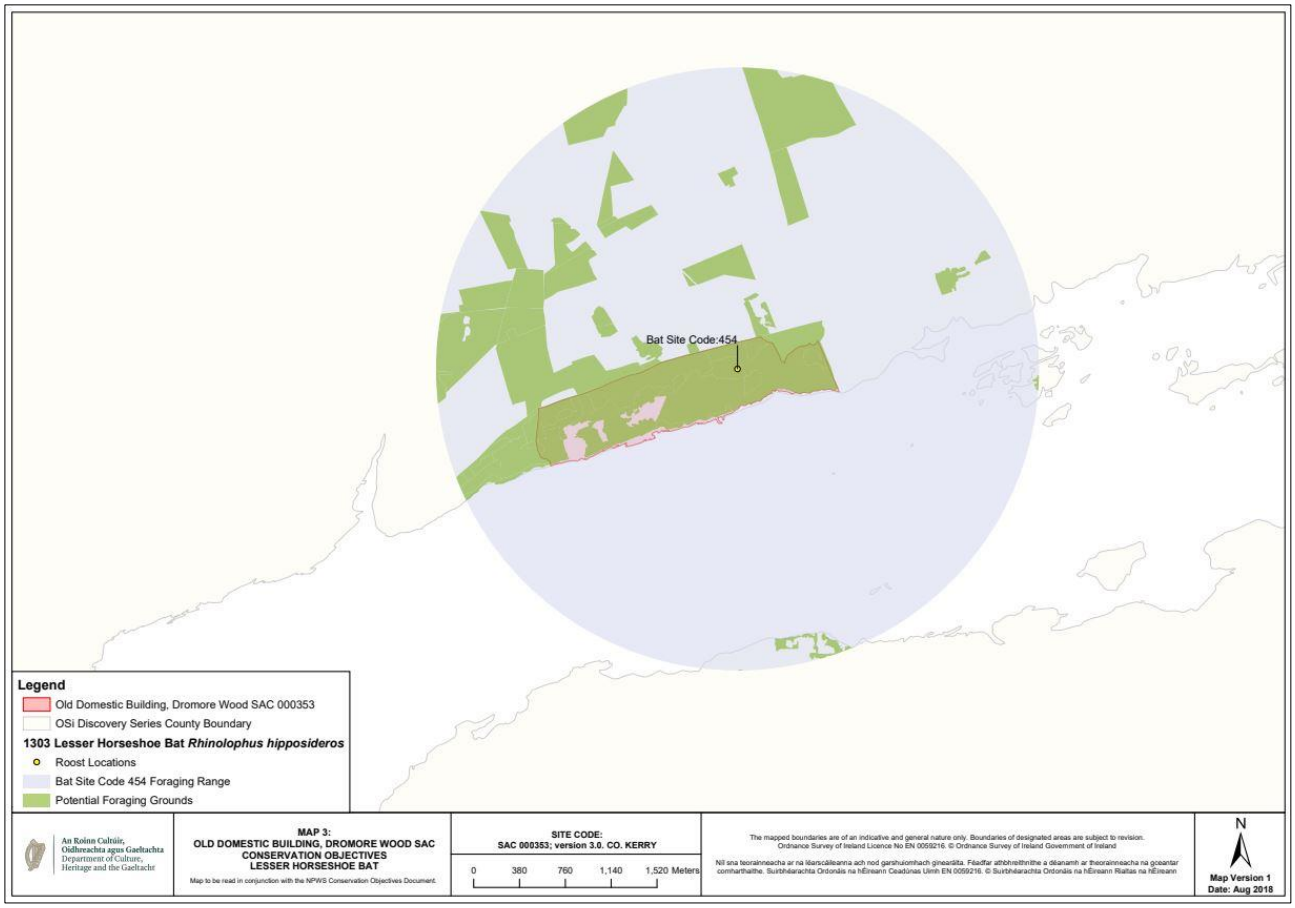


Figure 4c: Old Domestic Building, Dromore Wood SAC conservation objectives for lesser horseshoe bats (Taken from Map 2, NPWS (2018) Source: www.npws.ie).

The primary conservation objectives for lesser horseshoe SAC sites relevant to the proposed development is as follows:

Extent of potential foraging habitat	Hectares	No significant decline within 2.5km of qualifying roost	Lesser horseshoe bats normally forage in woodlands/scrub within 2.5km of their roosts (Schofield, 2008). See map 2 which shows a 2.5km zone around the above roost and identifies potential foraging grounds
Linear features	Kilometres	No significant loss within 2.5km of qualifying roost. See map 2	This species follows commuting routes from its roost to its foraging grounds. Lesser horseshoe bats will not cross open ground. Consequently, linear features such as hedgerows, treelines and stone walls provide vital connectivity for this species within 2.5km around each roost (Schofield, 2008)
Light pollution	Lux	No significant increase in artificial light intensity adjacent to named roost or along commuting routes within 2.5km of the roost. See map 2	Lesser horseshoe bats are very sensitive to light pollution and will avoid brightly lit areas. Inappropriate lighting around roosts may cause abandonment; lighting along commuting routes may cause preferred foraging areas to be abandoned, thus increasing energetic costs for bats (Schofield, 2008)

Figure 4d: Conservation Objectives relating to lesser horseshoe bats.

NPWS & VWT (2022) states that it is essential, that existing foraging habitat supporting colonies is retained, and that steps are taken to provide new habitat. The optimal foraging habitats for this species are deciduous woodlands, riparian vegetation and mature hedgerows within a few kilometres

of a roost. In the absence of woodland, areas of scrub close to roosts are also deemed important and should be retained.

NPWS & VWT (2022) also recommends that there is no significant increase in artificial lighting adjacent to roosts of importance, or along commuting routes within 2.5km of these roosts, and that a list of recommendations should be provided to each local authority on how to reduce or mitigate existing high levels of light intensity in the vicinity of roosts or foraging areas.

6. Assessment of Potential Impact

The bat survey undertaken for this proposed development site yielded a large amount of results. A total of six bat species were recorded: Lesser horseshoe bat, common pipistrelle, soprano pipistrelle, Leisler's bat, brown long-eared bat and Natterer's bat. All four buildings located within the survey area were recorded as bat roosts:

- Building 1 (Farm house): Day roost for soprano and common pipistrelles and night roost for lesser horseshoe bat, soprano pipistrelles and common pipistrelles.
- Building 2 (Dormer bungalow): Maternity roost for common pipistrelles.
- Building 3 (Shed): Day roost and night roost for lesser horseshoe bat, soprano pipistrelles and common pipistrelles.
- Building 4 (Garage): Day roost for Natterer's bat and night roost for lesser horseshoe bat.

The proposed development will be undertaken as two separate planning proposals. The current planning proposal relates to Building 1 (Farm house) and Building 4 (Garage). The renovation of these buildings will result in the loss of the following roosts:

- Day roost for soprano and common pipistrelles and night roost for lesser horseshoe bat, soprano pipistrelles and common pipistrelles.
- Day roost for Natterer's bat and night roost for lesser horseshoe bat.

The operation of the site will also increase human activity and therefore noise and lighting. This will also potentially impact on local bat populations.

Therefore the potential impact of the proposed development relating to Building 1 and Building 4, is, overall, considered to be Permanent Negative and to have a scale of impact of Slight impact on named bat species (according to criteria set out in Tables 2c and d, Section 1.2.2). This is primarily in relation to the fact that the roosts recorded are not important maternity sites (Building 2 and Building 3 are significantly more important for local bat populations) and to the lighting plan for the proposed development scheme and the presence of light-sensitive bat species.

The second planning application is proposed for Building 2. The plans for this building include to renovate the dormer windows to the rear of the house but there are no plans to undertaken renovation works on the dormer windows to the front of the house where the common pipistrelle maternity roost is located.

6.1 Bat Mitigation Measures

The bat mitigation measures described below take into consideration Marnell *et al.* (2022) as well as best practice guidelines from Collins (2016) and BCT (2018). The measures described are those considered to be practical and effective based on past experience of the principal bat specialist, for the proposed development site. Measures are also reflective to published scientific research, where available and applicable to Irish bat populations. As stated by Marnell *et. Al.* (2022) "Any mitigation intended to ensure that there is no impact or minimal impact on the bats must be clearly described in detail, giving examples of how it worked in other places". Please see Section 1.2.3 for more information.

6.1.1 NPWS Derogation Licence

A NPWS Derogation Licence is required for renovation works on the buildings proposed to be renovated (i.e. Building 1 and 4). As a derogation licence will be required for the loss of the bat roosts and a draft derogation licence application is appended to this report. This is appended for information purposes, so that all information relevant to this impact is provided. The derogation licence application will not be submitted until prior to when construction is due to commence.

The following two questions are taken from the draft derogation licence application in order to provide information requested to allow NPWS to undertake an assessment of the licence application (Please see draft application form appended to the end of this report).

10. Please tick which reason below explains How this Application Qualifies under Regulation 54(2)(A-E) of the European Communities (Birds and Natural Habitats) Regulations:

a.	In the interests of protecting wild flora and fauna 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 beneficial consequences of primary importance for the environment	☐
d.	For the purpose of research and education, of re-populating and re-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 certain specimens of the species to the extent specified therein, which are referred to in the First Schedule	☐

The following table requires detailed information, which this bat survey report provides. Some of this information is presented as part of the table below while other sections within the report (as directed) are required to be consulted.

11. Report Checklist: Please append a detailed report to support this application and ensure that it contains the following information:

11.1	Explanation as to why the derogation licence sought is the only available option for works and no suitable alternative exists as per Regulation 54 of the European Communities (Birds and Natural Habitats) Regulations.	☒
	Explanation: Building 1 – Farmhouse	

	- Day roost for soprano and common pipistrelles and night roost for lesser horseshoe bat, soprano pipistrelles and common pipistrelles. The proposed renovation works for this building will prevent future use of the building by lesser horseshoe bats and will temporarily exclude usage by soprano and common pipistrelles. Building 4 (Garage): - Day roost for Natterer's bat and night roost for lesser horseshoe bat. The proposed renovation works for this building will prevent future use of the building by lesser horseshoe bats and will temporarily exclude usage by Natterer's bats.	
11.2	Evidence that actions permitted by a derogation licence will not be detrimental to the maintenance of the populations of the species to which the Habitats Directive relates at a favourable conservation status in their natural range as is required under Section 54(2) of the European Communities (Birds and Natural Habitats) Regulations.	☒
	The following information provides evidence on the status of the national populations of the bat species listed, the conservation status of the roosts recorded and additional information relating to their conservation status. a) Lesser horseshoe bat This species was recorded night roosting in the hot press of Building 1 (bat droppings and level of bat passes indicated 1-2 individuals) and night roosting in the interior of Building 4 (level of bat passes indicated 1-2 individuals). A higher level of bat passes for this species was recorded in Building 3, which will not be impacted on by the proposed development works. Lesser horseshoe bat is an Annex II bat species under the EU Habitats Directive. The status of this bat species is listed as Least Concern. The national common pipistrelle population is considered to be significantly increasing (Aughney *et al.,* 2021). The modelled Core Area for lesser horseshoe bat is a relatively small area that is confined to 6 western seaboard counties of Ireland (5,993km^2). The Bat Conservation Ireland Irish Landscape Model indicated that lesser horseshoe bats select areas with broadleaf woodland and riparian habitats within a few kilometres of roosts and relies on linear habitats to commute along (Roche *et al.,* 2014). Conservation Significance (Marnell *et. al.* (2022) of these roosts are "Small numbers of rarer species. Not a maternity roost". The Conservation Significance according to Marnell *et. al.* (2022) results determines the bat mitigation measures required. In relation to this species of bat, the mitigation recommended is "Provision of new roosting facilities where possible. Need not be exactly like-for-like, but should be suitable, based on species requirements. Minimum timing constraints or monitoring requirements". It is considered that the of night roosts in Buildings 1 and 4 will not impact on the favourable conservation status in their natural range and will not have a detrimental effect on the local bat population due to the fact that Building 3 had a higher level of lesser horseshoe bat activity and therefore is a more important structure for this bat species. b) Soprano pipistrelle	

This species was recorded day and night roosting in Building 1 & 4 (1-2 individuals). Soprano pipistrelle was the second most frequently encountered bat species.

Soprano pipistrelle is an Annex IV bat species under the EU Habitats Directive. The status of this bat species is listed as Least Concern. The national soprano pipistrelle population is considered to be significantly increasing (Aughney *et al.,* 2021).

The modelled Core Area for soprano pipistrelle is a relatively large area that covers much of the island of Ireland (62,020km^2). The Bat Conservation Ireland Irish Landscape Model indicated that the common pipistrelle selects areas with broadleaf woodland, riparian habitats and low density urbanization (Roche *et al.,* 2014).

Conservation Significance (Marnell *et. al.* (2022) of the Building 1 & 4 roosts is "Small numbers of common species. Not a maternity roost". The Conservation Significance according to Marnell *et. al.* (2022) results determines the bat mitigation measures required. In relation to the roosts recorded for soprano pipistrelles, the mitigation requirement is "Flexibility over provision of bat boxes, access to new buildings etc. No conditions about timing or monitoring".

Therefore it is considered that the temporary loss of a day and night roost will not impact on the favourable conservation status in their natural range and will not have a detrimental effect on the local bat population of soprano pipistrelles.

c) Natterer's bat

This species was recorded roosting in the crevices of Building No. 4.

Natterer's bat is an Annex IV bat species under the EU Habitats Directive. The status of this bat species is listed as Least Concern. The national Natterer's bat population is currently unknown (Aughney *et al.,* 2021).

The modelled Core Area for Natterer's bat is a relatively large area that covers much of the island of Ireland (52,864km^2). The Bat Conservation Ireland Irish Landscape Model indicated that the Natterer's bat selects areas with broadleaf woodland, riparian habitats and mixed woodland (Roche *et al.,* 2014).

Conservation Significance (Marnell *et. al.* (2022) of these roosts are "Small numbers of rarer species. Not a maternity roost". The Conservation Significance according to Marnell *et. al.* (2022) results determines the bat mitigation measures required. In relation to this species of bat, the mitigation recommended is "Provision of new roosting facilities where possible. Need not be exactly like-for-like, but should be suitable, based on species requirements. Minimum timing constraints or monitoring requirements".

Therefore it is considered that the loss of a day night roost will not impact on the favourable conservation status in their natural range and will not have a detrimental effect on the local bat population of Natterer's bat.

d) Common pipistrelle

Common pipistrelle was the most frequently encountered bat species. This species was recorded in small numbers in Buildings 1 & 4 but a maternity roost was recorded in Building 2 which will not be impacted on by the proposed development.

Common pipistrelle is an Annex IV bat species under the EU Habitats Directive. The status of this bat species is listed as Least Concern. The national common pipistrelle population is considered to be significantly increasing (Aughney *et al.,* 2021).

	The modelled Core Area for common pipistrelle is a relatively large area that covers much of the island of Ireland (56,485km^2). The Bat Conservation Ireland Irish Landscape Model indicated that the common pipistrelle selects areas with broadleaf woodland, riparian habitats and low density urbanization (<30%) (Roche *et al.,* 2014). Conservation Significance (Marnell *et. al.* (2022) of the Building 1 & 4 roosts is "Small numbers of common species. Not a maternity roost". The Conservation Significance according to Marnell *et. al.* (2022) results determines the bat mitigation measures required. In relation to the satellite roost recorded for common pipistrelles, the mitigation requirement is "Flexibility over provision of bat boxes, access to new buildings etc. No conditions about timing or monitoring". Therefore it is considered that the temporary loss of a day and night roost will not impact on the favourable conservation status in their natural range and will not have a detrimental effect on the local bat population of common pipistrelles.	
11.3	Details of any mitigation measures planned for the species affected by the derogation at the location, along with evidence that such mitigation has been successful elsewhere.	☒
	A summary of the proposed bat mitigation measures are provided as part of this table but these are described in greater detail as part of Section 6. a) Provision of alternative bat roosting site in Building 3. This structure was recorded as a roosting site for lesser horseshoe bats, common pipistrelle and soprano pipistrelle while crevices in the internal walls are suitable for Natterer's bat. Recommendations have been described to increase the long-term suitability of this building for roosting bats. b) Renovation procedures In order to ensure that renovation works are undertaken in a manner to ensure the no bats are harmed, procedures are described in detail. Additional measures are also described in relation to: c) Lighting recommendations (particularly important for lesser horseshoe bats) d) Landscape recommendations	
11.4	As much information as possible to allow a decision to be made on this application.	☒
	Please consult Section 1.2.3 for information on effective bat mitigation measures. Details bat mitigation measures are presented below. Particularly please consult Section 6.1.2 in relation to alternative bat roosts.	

6.1.2 Alternative Bat Roosts

In preparation for planning application, it is proposed to focus on Building 3 as an alternative bat roost. This building provided roosting space for three bat species (lesser horseshoe bat, common pipistrelle and soprano pipistrelle) and has crevices suitable for Natterer's bats. Therefore this building has the capacity to provided alternative roosting for the four species of bat likely to be impacted on the renovation works for Building 1 and Building 4.

6.1.2.1 Building 3 Renovation Works

The following works are recommended to turn Building 3 into a Bat House:

- Stabilise the external walls of the shed (i.e. re-pointing by hand ensuring that they are bat free prior to re-pointing. This can be undertaken by checking the crevices using a high power torch searching for potentially roosting bats).
- Insert a new doorframe and solid door entrance to shed (ensure that there are no bats roosting in the stonework around the existing door frame prior to works).
- Remove oil tank at gable end of shed.
- Install predator protection around the gable window (North Elevation) to protect roosting bats. This entails attaching a sheet of smooth steel (Orange Rectangle, Figure 5) to the existing stone work which will prevent predators from using stonework to climb into the interior of the structure). Fix a second sheet of steel along the lower part of the window in a manner to prevent predators jumping from the ground onto the base of the opening (i.e. the steel sheet is attached with an upward angle to deflect predators such as cats).
- Internally, install a plywood (3/4 inch marine ply, painted black using a mammal friendly paint product) partition (Blue Lines, Figure 5) around the gable window to reduce wind and sunlight directly entering the interior of the building.
- Install 4 bat boxes along the East Elevation internal wall at the highest point possible (Red Squares on Figure 5).
- Ensure that there is no outdoor lighting attached to this building (plus not interior lighting installed) and that any lighting within the proposed development site does not shine on this building, particularly around the gable window. In order to reduce any potential spillage of lighting from the operation of the proposed development site, it is recommended that a solid timber fence is constructed from the gable wall (northern elevation – shown as large graded blue square on Western Elevation, Figure 5) for at least 5m from the structure.
- Close off the door of the building shown on the East Elevation to ensure the there is no gaps to allow lighting or wind to enter the building.

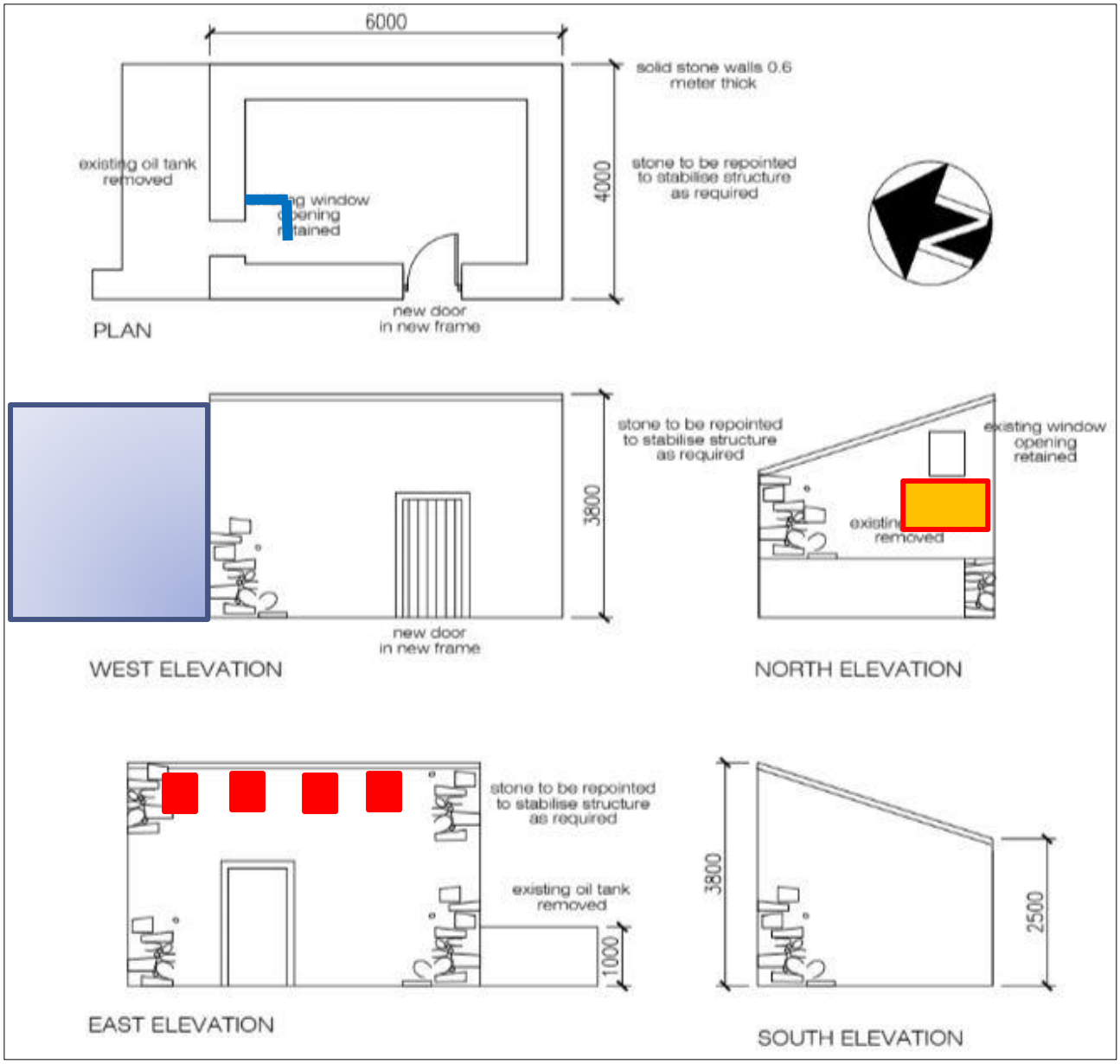


Figure 5: Drawings of Building 3 and proposed bat mitigation works.

Plate 6: Example of predator proofing on external wall around entrance point of bat house.

6.1.3 Renovation Procedures

Renovation works cannot be undertaken on Building 1 and Building 4 until the “Bat House” is finished. It is recommended to undertaken these works in the following months: September, October, November, February, March and April.

6.1.3.1 Building 1

In order to ensure that there are no lesser horseshoe bats present in the building prior to renovation works, a static bat detector unit is required to place in the hot press for one week. Once there are no bats present, close the window to the rear of the building to prevent access. Please note that this cannot be undertaken until an NPWS Derogation licence is received for this project.

The proposed renovation works for Building 1 include the replacement of the existing roost with a natural slate roof. As soprano and common pipistrelles were recorded emerging from this area, the following bat mitigation measures are required:

- Undertaken a dawn survey prior to roof removal.
- Remove ridge tiles, a section of the slates and associate facia/soffit by hand and under supervision of a bat specialist.
- Any bats encountered should be safely removed by the bat specialist to the “Bat House”.

6.1.3.2 Building 4

Any crevices proposed to be pointed within the stonework of this structure should be inspected prior to infilling using a high powered torch and endoscope to ensure that it is bat free.

6.1.4 Lighting Plan

This element of the proposed planning application is important aspect in relation to local bat populations, particularly in relation to lesser horseshoe bats. All European bat species, including Irish bat species, are nocturnal. They usually hide in roosts during the daytime, while fly to feeding areas or drinking sites using commuting routes during the night. Annually bats will hibernate in the winter, swarm in the autumn and give birth in the summer months. In all aspects of the bat lifestyle, Artificial Light at Night (ALAN) may significantly change their natural behaviour in relation to roosting, commuting and feeding. While bats are naturally exposed only to very low lighting levels produced by moonlight, starlight and low intensity twilight, light levels greater than natural light levels can impact on the lifestyle of bats.

Bats are light sensitive species, hence their nocturnal activities. Three bat species recorded commuting and foraging within the survey area are Light Tolerant or Semi-tolerant bat species (Leisler’s bat, common pipistrelle and soprano pipistrelle). However, the remaining bat species are all light sensitive and therefore the outdoor lighting plan should be designed for these bat species. it is important that strict lighting guidelines are required to reduce the potential impact of the proposed development on local bat populations as standard best practice. In relation to lesser horseshoe bats, it is a conservation objective to ensure that there is no increase of outdoor lighting win the foraging area. As the bat house is the location of the lesser horseshoe bat alternative roosting, it is important that there is no lighting on, in or adjacent to this structure. It is recommended that there is no lighting of the garden area of the proposed development site and to limit the amount of lighting spilling from the interior of the buildings when in operation.

Luminaire design is extremely important to achieve an appropriate lighting regime. Luminaires come in a myriad of different styles, applications and specifications which a lighting professional can help to select. The following should be considered when choosing luminaires. This is taken from the most

recent BCT Lighting Guidelines (BCT, 2018). Consultation was undertaken with the lighting specialists to reduce the potential impact on local bat populations.

- All luminaires used will lack UV/IR elements to reduce impact.
- LED luminaires will be used due to the fact that they are highly directional, lower intensity, good colour rendition and dimming capability.
- A warm white spectrum (2200 Kelvins will be used to reduce the blue light component of the LED spectrum).
- Luminaires will feature peak wavelengths higher than 550nm to avoid the component of light most disturbing to bats.
- Column heights should be carefully considered to minimise light spill. The shortest column height allowed should be used where possible.
- Only luminaires with an upward light ratio of 0% and with good optical control will be used.
- Luminaires will be mounted on the horizontal, i.e. no upward tilt.
- Any external security lighting will be set on motion-sensors and short (1min) timers.
- As a last resort, accessories such as baffles, hoods or louvres will be used to reduce light spill and direct it only to where it is needed.

Any external lighting for the proposed development should strictly follow the above guidelines and these should be strictly implemented during construction and operation phase of the proposed development.

It is highly recommended that the conservation objectives for lesser horseshoe bats (i.e. no outdoor lighting that may impact on bat foraging and commuting habitat) are incorporated into the Lighting Pan.

6.1.5 Landscaping

It is recommended that native tree, shrub and plant species are included in the landscaping plan. It is recommended that night-scented planting is also undertaken to encourage foraging areas for local bat populations. Planting is particularly recommended in vicinity of Building 3 to increase tall vegetation cover to allow lesser horseshoe bats to safely exit Building 3 under the cover of darkness (ensure that planting is at least 3m from the gable window entrance point to reduce predators potential using such vegetation to gain access to the structure.

It is highly recommended that the conservation objectives for lesser horseshoe bats (i.e. no reduction in bat foraging and commuting habitat) are incorporated into the Landscape Pan. These additional measures will add to the compensatory requirement to ensure that there is no accumulative loss of linear habitats.

6.1.6 Monitoring

Monitoring is recommended post-construction works. This monitoring should involve the following aspects:

- In relation to the bat house, monitoring is required for a total of 2 years. A temperature data logger will be installed and maintained for a total of 2 years. Monitoring will involve a summer survey to determine the level of bat usage of the Bat House.

7. Survey Conclusions

The bat survey undertaken for this proposed development site yielded a large amount of results. A total of six bat species were recorded: Lesser horseshoe bat, common pipistrelle, soprano pipistrelle, Leisler's bat, brown long-eared bat and Natterer's bat. All four buildings located within the survey area were recorded as bat roosts:

- Building 1 (Farm house): Day roost for soprano and common pipistrelles and night roost for lesser horseshoe bat, soprano pipistrelles and common pipistrelles.
- Building 2 (Dormer bungalow): Maternity roost for common pipistrelles.
- Building 3 (Shed): Day roost and night roost for lesser horseshoe bat, soprano pipistrelles and common pipistrelles.
- Building 4 (Garage): Day roost for Natterer's bat and night roost for lesser horseshoe bat.

The proposed development planning proposal relates to Building 1 (Farm house) and Building 4 (Garage). The renovation of these buildings will result in the loss of the following roosts:

- Day roost for soprano and common pipistrelles and night roost for lesser horseshoe bat, soprano pipistrelles and common pipistrelles.
- Day roost for Natterer's bat and night roost for lesser horseshoe bat.

The operation of the site will also increase human activity and therefore noise and lighting. This will also potentially impact on local bat populations.

Therefore the potential impact of the proposed development relating to Building 1 and Building 4, is, overall, considered to be Permanent Negative and to have a scale of impact of Slight impact on named bat species (according to criteria set out in Tables 2c and d, Section 1.2.2). This is primarily in relation to the fact that the roosts recorded are not important maternity sites (Building 2 and Building 3 are significantly more important for local bat populations) and to the lighting plan for the proposed development scheme and the presence of light-sensitive bat species.

The provision of Building 3 as a bat house will likely increase the roosting opportunities for lesser horseshoe bats, Natterer's bat and soprano pipistrelles while supporting the existing maternity roost for common pipistrelles in Building 2.

Additional mitigation measures, if implemented fully, will reduce the potential impact on local bat populations to Non-significant Permanent Negative.

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9. Appendices

Appendix 1 Bat Habitat & Commuting Route Classifications

Table 1.A: Hedgerow Category (Bat Conservation Ireland, 2015)

Type of Hedgerow / Treeline	Code	Description / Bat Potential
Small Hedgerow	**SH**	Hedgerow is less than approximately 1.5 m high, there are no, or very few, protruding bushes or trees. This type of hedgerow would provide little shelter to bats. 
Medium Hedgerow	**MH**	Hedgerow is approximately 1.5 to 3 m high. This type of hedgerow will provide foraging and commuting potential for bats. 
Sparse Treeline Hedgerow	**ST**	Hedgerow, low or medium in height, with individuals trees (where tree canopies, for the most part, do not touch).

		
Dense Treeline Hedgerow	**DT**	Large uncut hedgerows or treelines, dominated by mainly large tree or very tall scrub species (e.g. tall hawthorn, blackthorn or hazel), where the canopies are mostly touching. 

Table 1.B: Habitat Classification (Bat Conservation Ireland, 2015, based on Fossit, 2000)

Cultivated land		Salt marshes		Exposed rock		Fens/flushes	
Built land		Brackish waters		Caves		Grasslands	
Coastal structures		Springs		Freshwater marsh		Scrub	
Shingle/gravel		Swamps		Lakes/ponds		Hedges/treelines	
Sea cliffs/islets		Disturbed ground		Heath		Conifer plantation	
Sand dunes		Watercourse		Bog		Woodland	

9.1 Appendix 4 – Alternative Bat Roosts

Bat Boxes

Woodstone Beaumaris design (Potential supplier - www.birdfood.ie)

Appendix 3 Bat Assessment Tables

Table 4.1 Guidelines for assessing the potential suitability of proposed development sites for bats, based on the presence of habitat features within the landscape, to be applied using professional judgement.

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

[a] For example, in terms of temperature, humidity, height above ground level, light levels or levels of disturbance.
[b] Evidence from the Netherlands shows mass swarming events of common pipistrelle bats in the autumn followed by mass hibernation in a diverse range of building types in urban environments (Korsten *et al.*, 2015). This phenomenon requires some research in the UK but ecologists should be aware of the potential for larger numbers of this species to be present during the autumn and winter in large buildings in highly urbanised environments.
[c] This system of categorisation aligns with BS 8596:2015 Surveying for bats in trees and woodland (BSI, 2015).

Figure A: Table 4.1 (p 35) Reproduced from Collins (2016).

(1) Conversion, modification, demolition or removal of buildings (including hotels, schools, hospitals, churches, commercial premises and derelict buildings) which are:

- agricultural buildings (e.g. farmhouses, barns and outbuildings) of traditional brick or stone construction and/or with exposed wooden beams;
- buildings with weather boarding and/or hanging tiles that are within 200m of woodland and/or water;
- pre-1960 detached buildings and structures within 200m of woodland and/or water;
- pre-1914 buildings within 400m of woodland and/or water;
- pre-1914 buildings with gable ends or slate roofs, regardless of location;
- located within, or immediately adjacent to woodland and/or immediately adjacent to water;
- Dutch barns or livestock buildings with a single skin roof and board-and-gap or Yorkshire boarding if, following a preliminary roost assessment, the site appears to be particularly suited to bats.

(2) Development affecting built structures:

- tunnels, mines, kilns, ice-houses, adits, military fortifications, air-raid shelters, cellars and similar underground ducts and structures; unused industrial chimneys that are unlined and brick/stone construction;
- bridge structures, aqueducts and viaducts (especially over water and wet ground).

(3) Floodlighting of:

- churches and listed buildings, green space (e.g. sports pitches) within 50m of woodland, water, field hedgerows or lines of trees with connectivity to woodland or water;
- any building meeting the criteria listed in (1) above.

(4) Felling, removal or lopping of:

- woodland;
- field hedgerows and/or lines of trees with connectivity to woodland or water bodies;
- old and veteran trees that are more than 100 years old;
- mature trees with obvious holes, cracks or cavities, or that are covered with mature ivy (including large dead trees).

(5) Proposals affecting water bodies:

- in or within 200m of rivers, streams, canals, lakes, reed beds or other aquatic habitats.

(6) Proposals located in or immediately adjacent to:

- quarries or gravel pits;
- natural cliff faces and rock outcrops with crevices or caves and swallets.

(7) Proposals for wind farm developments of multiple wind turbines and single wind turbines (depending on the size and location) (NE TIN 051 – undergoing updates at the time of writing).

(8) All proposals in sites where bats are known to be present[1]

This may include proposed development affecting any type of buildings, structures, feature or location.

Notes:

1. Where sites are of international importance to bats, they may be designated as SACs. Developers of large sites 5–10km away from such SACs may be required to undertake a HRA.

Figure B: Reproduced from Collins (2016) – page 13.

Table 2 Factors affecting the probability of bats being present.

Factors affecting the probability of a building being used by bats in summer	
Increased probability	Disused or little used; largely undisturbed
	Large roof void with unobstructed flying spaces
	Large dimension roof timbers with cracks, joints and holes
	Uneven roof covering with gaps, though not too draughty
	Entrances that bats can fly in through
	Hanging tiles or wood cladding, especially on south-facing walls
	Rural setting
	Close to woodland and/or water
	Pre-20th century or early 20th century construction
	Roof warmed by the sun
	Within the distribution area of horseshoe bats
Decreased probability	Highly urbanised area with few feeding places
	Small or cluttered roof void (esp. for brown long-eared bat)
	Heavily disturbed
	Modern construction with few gaps around soffits or eaves (but be aware these may be used by pipistrelles in particular)
	Prefabricated with steel and sheet materials
	Active industrial premises
	Roof shaded from the sun
Factors affecting the probability of trees being used by roosting bats	
Increased probability	In ancient woodland or parkland
	Large trees with complex growth form
	Species that typically form cavities, such as beech, willow, oak or ash
	Visible damage caused by rot, wind, lightning strike *etc.*
	Loose bark providing cavities
Decreased probability	Coniferous plantation with no specimen trees
	Young trees with simple growth form and little damage
Factors affecting the probability of underground sites being used by roosting bats	
Increased probability	Large enough to develop stable temperature in winter
	High humidity
	Undisturbed
	Close to woodland or water (but note that bats will also use upland sites)
	Many cracks and crevices suitable for bats
Decreased probability	Small and draughty
	Heavily disturbed
	In urbanised areas
	Smooth surfaces with few roosting opportunities

Figure C: Table 2 Reproduced from Marnell *et al.* (2022).

10. Bat Species Profile

10.1 Leisler's bat

Ireland's population is deemed of international importance and the paucity of knowledge of roosting sites, makes this species vulnerable. However, it is considered to be widespread across the island. The modelled Core Area for Leisler's bats is a relatively large area that covers much of the island of Ireland (52,820km^2). The Bat Conservation Ireland Irish Landscape Model indicated that the Leisler's bat habitat preference has been difficult to define in Ireland. Habitat modelling for Ireland shows an association with riparian habitats and woodlands (Roche *et al.,* 2014). The landscape model emphasised that this is a species that cannot be defined by habitats preference at a local scale compared to other Irish bat species but that it is a landscape species and has a habitat preference at a scale of 20.5km. In addition, of all Irish bat species, Leisler's bats have the most specific roosting requirements. It tends to select roosting habitat with areas of woodland and freshwater.

Irish Status	Near Threatened
European Status	Least Concern
Global Status	Least Concern
Irish Population Trend	2003-2013 ↑
Estimated Irish Population Size	73,000 to 130,000 (2007-2013) Ireland is considered the world stronghold for this species
Estimate Core Area (Lundy *et al. 2011*)	52,820 km^2

Taken from Roche *et al.,* 2014, Lysaght & Marnell, 2016 & Marnell *et al.*, 2019

The principal concerns for Leisler's bats are poorly known in Ireland but those that are relevant for this survey area are as follows:

- Selection of maternity sites is limited to specific habitats;
- Relative to the population estimates, the number of roost sites is poorly recorded;
- Tree felling, especially during autumn and winter months; and
- Increasing urbanisation.

10.2 Common pipistrelle

This species is generally considered to be the most common bat species in Ireland. The species is widespread and is found in all provinces. The modelled Core Area for common pipistrelles is a large area that covers much of the island of Ireland (56,485km^2) which covers primarily the east and south east of the area (Roche *et al.,* 2014). The Bat Conservation Ireland Irish Landscape Model indicated that the Common pipistrelle selects areas with broadleaf woodland, riparian habitats and low density urbanization (<30%) (Roche *et al.,* 2014).

Irish Status	Least Concern
European Status	Least Concern
Global Status	Least Concern
Irish Population Trend	2003-2013 ↑
Estimated Irish Population Size	1.2 to 2.8 million (2007-2012)
Estimate Core Area (km^2) (Lundy *et al. 2011*)	56,485

Taken from Roche *et al.,* 2014, Lysaght & Marnell, 2016 & Marnell *et al.*, 2019

Principal concerns for Common pipistrelles in Ireland that are relevant for this survey area are as follows:

- Lack of knowledge of roosting requirements
- This species has complex habitat requirements in the immediate vicinity of roosts. Therefore, careful site specific planning for this species is required in order to ensure all elements are maintained.
- Renovation or demolition of derelict buildings.
- Tree felling
- Increasing urbanisation (e.g. increase in lighting)

10.3 Soprano pipistrelle

This species is generally considered to be the second most common bat species in Ireland. The species is widespread and is found in all provinces, with particular concentration along the western seaboard. The modelled Core Area for soprano pipistrelle is a large area that covers much of the island of Ireland (62,020km^2). The Bat Conservation Ireland Irish Landscape Model indicated that the soprano pipistrelle selects areas with broadleaf woodland, riparian habitats and low density urbanisation (Roche *et al.,* 2014).

Irish Status	Least Concern
European Status	Least Concern
Global Status	Least Concern
Irish Population Trend	2003-2013 ↑
Estimated Irish Population Size	0.54 to 1.2 million (2007-2012)
Estimate Core Area (km^2) (Lundy *et al. 2011)*	62,020

Taken from Roche *et al.,* 2014, Lysaght & Marnell, 2016 & Marnell *et al.*, 2019

Principal concerns for Soprano pipistrelles in Ireland that are relevant for this survey area are as follows:

- Lack of knowledge of roosts;
- Renovation or demolition of structures;
- Tree felling; and
- Increasing urbanisation (e.g. increase in lighting).

10.4 Brown long-eared Bat

This species is generally considered to be widespread across the island. The modelled Core Area for Brown long-eared bats is a relatively large area that covers much of the island of Ireland (52,820km^2) with preference suitable areas in the southern half of the island. The Bat Conservation Ireland Irish Landscape Model indicated that the Brown long-eared bat habitat preference is for areas with broadleaf woodland and riparian habitats on a small scale of 0.5km emphasising the importance of local landscape features for this species (Roche *et al.,* 2014).

Irish Status	Least Concern
European Status	Least Concern
Global Status	Least Concern
Irish Population Trend	2008-2013 Stable
Biographical Range	km^2
Estimate Core Area (Lundy *et al. 2011)*	49,929 km^2

Taken from Roche *et al.,* 2014, Lysaght & Marnell, 2016 & Marnell *et al.*, 2019

Principal concerns for brown long-eared bats are poorly known in Ireland, but those that are relevant for this survey area are as follows:

- Selection of maternity sites is limited to specific habitats;
- Lack of knowledge of winter roosts;
- Loss of woodland, scrub and hedgerows;
- Tree surgery and felling;
- Increasing urbanisation; and
- Light pollution.

10.5 Natterer's bat

There are three species included in the *Myotis* species family and their echolocation calls are very similar across these three species. The modelled Core Area for Natterer's bats is a relatively large area that covers much of the island of Ireland (52,864km^2). The Bat Conservation Ireland Irish Landscape Model indicated that the Natterer's bat selects areas with broadleaf woodland, riparian habitats and areas with larger scale provision of mixed forest (Roche *et al.,* 2014). Therefore, it is likely that this species is more widespread within the survey area.

Irish Status	Least Concern
European Status	Least Concern
Global Status	Least Concern
Irish Population Trend	Unknown
Estimated Irish Population Size	Unknown
Estimate Core Area (Lundy *et al. 2011)*	52,864

Taken from Roche *et al.,* 2014, Lysaght & Marnell, 2016 & Marnell *et al.*, 2019

Principal concerns for Natterer's bats in Ireland that are relevant for this survey area are as follows:

- Lack of knowledge of roosting requirements;
- This species has complex habitat requirements in the immediate vicinity of roosts. Therefore careful site specific planning for this species is required in order to ensure all elements are maintained;
- Tree felling; and
- Increasing urbanisation (e.g. increase in lighting).

10.6 Daubenton's bat

The modelled Core Area for Daubenton's bats is a relatively large area that covers much of the island of Ireland (41,285km^2) reflecting the distribution of sizeable river catchments. The Irish Landscape Model indicated that the Daubenton's bat habitat preference is for areas with broadleaf woodland, riparian habitats and low density urbanisation (Roche *et al.,* 2014).

Irish Status	Least Concern
European Status	Least Concern
Global Status	Least Concern
Irish Population Trend	2008-2013 Stable
Estimated Irish Population Size	81,000 to 103,000 (2007-2012)
Estimate Core Area (km^2) (Lundy *et al. 2011)*	41,285

Taken from Roche *et al.,* 2014, Lysaght & Marnell, 2016 & Marnell *et al.*, 2019

Principal concerns for Daubenton's bats are poorly known in Ireland but those that are relevant for this survey area are as follows:

- Potential roost loss due to bridge maintenance;
- Loss of woodland and forest clearance;
- Loss of woodland, scrub and hedgerows;
- Tree surgery and felling;
- Increasing urbanisation; and
- Light pollution.

10.7 Whiskered bat

The modelled Core Area for whiskered bats is a relatively small area (29,222 km2) compared to the other two resident *Myotis* bat species. The range is restricted to southern and eastern areas of Ireland. The Irish Landscape Model indicated that the whiskered bat habitat preference is for areas of woodland cover, small areas of pasture, urban and scrub habitat (Roche *et al.,* 2014).

Irish Status	Least Concern
European Status	Least Concern
Global Status	Least Concern
Irish Population Trend	Unknown
Estimated Irish Population Size	Unknown
Estimate Core Area (km^2) (Lundy *et al. 2011)*	29,222

Taken from Roche *et al.,* 2014, Lysaght & Marnell, 2016 & Marnell *et al.*, 2019

Principal concerns for whiskered bats are poorly known in Ireland but those that are relevant for this survey area are as follows:

- Lack of knowledge of roosting requirements, swarming sites
- Riparian habitat loss
- Loss of woodland and forest clearance
- Loss of woodland, scrub and hedgerows
- Tree surgery and felling
- Increasing urbanisation
- Light pollution

10.8 Nathusius' pipistrelle

The modelled Core Area for Nathusius' pipistrelle is a relatively restricted area (13,543km^2) and these areas are primarily associated with large water bodies such as Lough Neagh and the Lough Erne complex. The Bat Conservation Ireland Irish Landscape Model indicated that the Nathusius' pipistrelle habitat preference is large waterbodies (Roche *et al.,* 2014). But due to the paucity of information on this species, the knowledge of this species preference in Ireland is limited, any records recorded for this species is important.

Irish Status	Least Concern
European Status	Least Concern
Global Status	Least Concern
Irish Population Trend	2003-2013 (limited data, probably stable
Estimated Irish Population Size	10,000 to 18,000 (2007-2013)
Estimate Core Area (km^2) (Lundy *et al. 2011)*	13,543

Taken from Roche *et al.,* 2014, Lysaght & Marnell, 2016 & Marnell *et al.*, 2019

The principal concerns for Nathusius' pipistrelle is the fact that roosting sites are poorly known in the Republic of Ireland:

- Lack of knowledge of winter sites and whether migration occurs;
- Renovation or demolition of derelict buildings and structures may cause undocumented roost losses; and
- Water pollution may be a threat to this species because it is particularly associated with lakes.