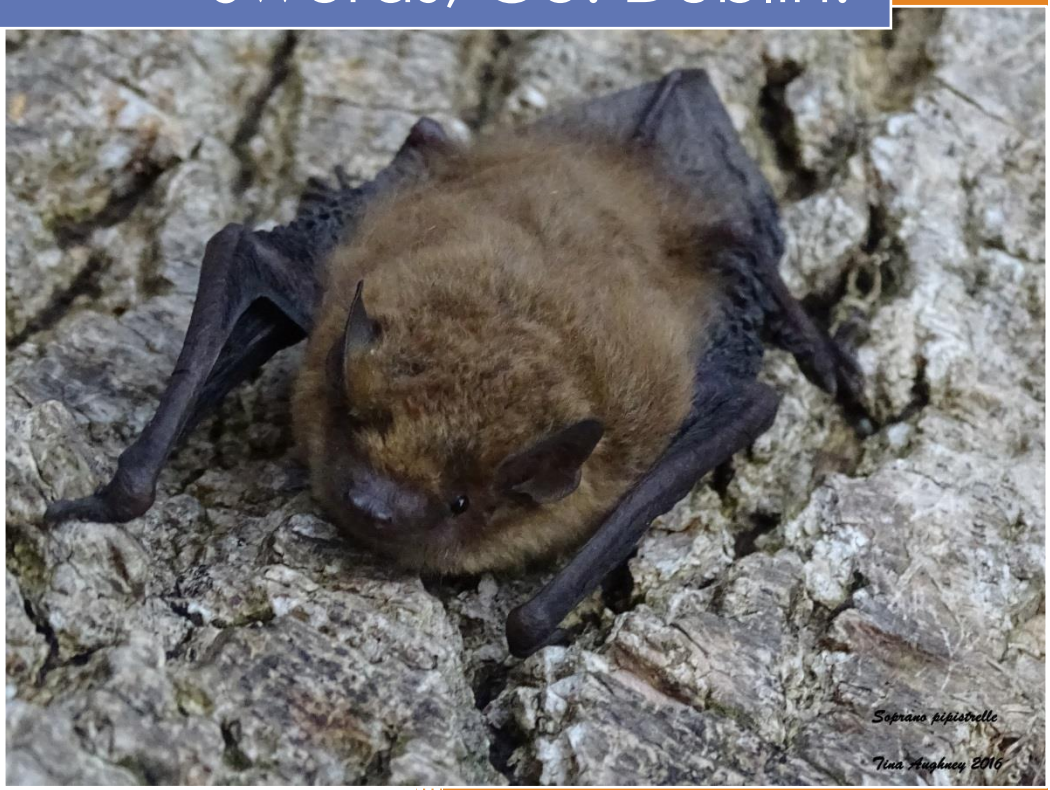
2022

Bat Assessment: SHD, Holybanks, Swords, Co. Dublin.



Dr Tina Aughney

Bat Eco Services

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Licenced Bat Specialist: Dr Tina Aughney (tina@batecoservices.com, 086 4049468)
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 2019-138 (Survey licence, expires 29th March 2022).

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 2021-19 (Survey licence, expires 15th March 2022).

Client: Cairn Homes Properties Ltd.
Project Name & Location: SHD, Holybanks, Swords, Co. Dublin.

Report Revision History

Date of Issue	Draft Number	Issued To (process of issuing)
24th August 2020	Draft 1	Email to Cairn Homes
27th September 2020	Draft 2	Email to Cairn Homes
13th November 2020	Draft 3	Email to KPMG
8th October 2021	Draft 4	Email to KPMG
11th November 2021	Draft 5	Email to KPMG
16th December 2021	Draft 6	Email to KPMG
25th January 2022	Draft 7	Email to KPMG
23rd March 2022	Final	Uploaded to Sharepoint

Purpose

This document has been prepared as a Report for Cairn Homes Properties Ltd. 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: SHD, Holybanks, Swords, Co. Dublin.

Proposed work: Residential development.

Executive Summary

The following is a brief summary of the survey results and the bat survey duties completed. Five species of bat was recorded commuting and foraging along habitats within the proposed development area. No bats were recorded roosting within the proposed development area but there are a number of trees deemed as Potential Bat Roosts (PBRs).

Bat Survey Results – Brief Summary of Results (within the proposed development area)

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*			

This data was collated through a combination of the bat survey duties undertaken below:

Bat Survey Duties Completed (indicated by red)

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	○

Citation: Bat Eco Services (2022) Bat assessment of proposed development at SHD, Holybanks, Swords, Co. Dublin. Unpublished report prepared for Cairns Homes Properties Ltd.

Contents

1. Introduction

Bat Eco Services was commissioned by Cairn Homes Properties Ltd. to complete a bat assessment of the proposed planning application on a site located at Holybanks, Swords, Co. Dublin.

1.1 Relevant Legislation & Bat Species Status in Ireland

1.1.1 Irish Statutory Provisions

A small number of these 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. In this document, the following is stated:

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.

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. 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:

- 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.

Kelleher & Marnell (2006) was referred to for guidance in relation to survey guidance (timing and survey design), derogation licences and mitigation measures. Version 2 of this guidance document was released in March 2022 and is referred as part of updating the report content.

1.2.1 Bat Survey Requirements & Timing

With reference to Collins (2016) and Kelleher & Marnell (2006) (NOTE: Version 2 released March 2022 - 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 3 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 21 from Kelleher & Marnell (2006). 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.

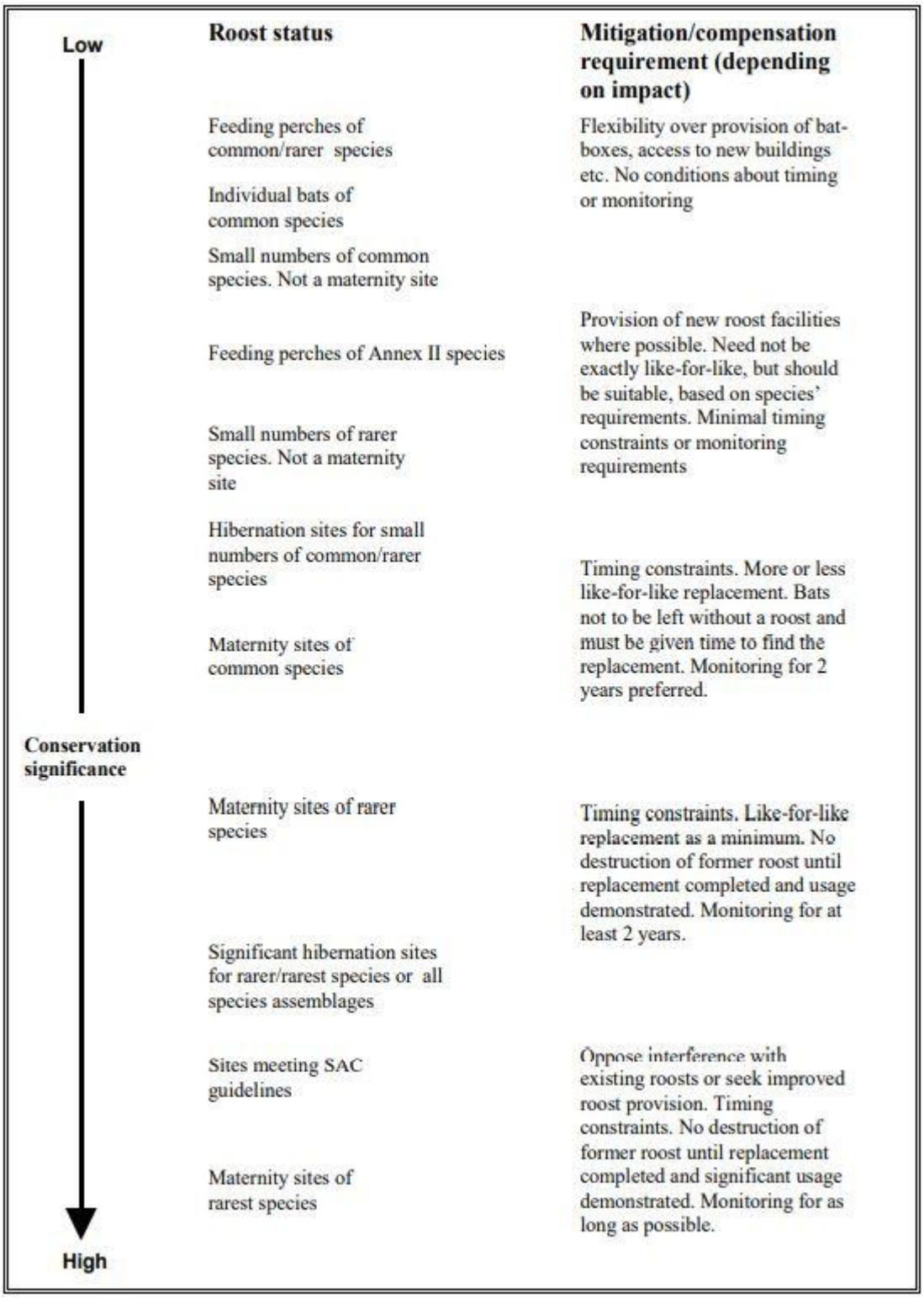


Figure 20 Guidelines for proportionate mitigation. The definition of common, rare and rarest species requires regional interpretation.

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 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, 2017)

Table 2c: Criteria for assessing impact quality based on EPA, 2017,

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, 2017).

Table 2d: Criteria for assessing significance of effects based on EPA, 2017,

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 duration of the potential effects (selected from EPA, 2017):

- Temporary – effects lasting less than a year
- Short-term – effects lasting 1 to 7 years
- Medium term – effects lasting 7 to 15 years
- Long term – effects lasting 15 to 60 years
- Permanent – effects lasting over 60 years
- Reversible – effects that can be undone, for example through remediation or restoration

1.2.3 Bat Mitigation Measures

1.2.3.1 Bats & Lighting

One area of importance that is required to be assessed is the potential impact of outdoor lighting on local bat populations. 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 affect 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

In the context of terrestrial ecosystems, the impact of street lights may appear to be positive for some bats but over the long term impacts may be negative even for those species that seem to gain from exploiting insect swarms. As Rydell (2006) points out, there has been no research into whether or how bat predation at lights affects the size of moth populations. Moths that normally exhibit evasive responses to bats have been shown to be unable to avoid capture by bats under bright street lights (Svensson and Rydell 1998) and some bats that feed at street lights increase their consumption of moths compared with their normal catch in other habitats (Rydell 1992). By disorientating insects that would normally be feeding or engaging in reproductive behaviours, as well as increasing predation by bats, overall reproductive rates may well decrease for insects that are within range of light pollution sources. Therefore resulting in long-term overall decreased availability or diversity of prey species.

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 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.

There are a number of guidelines documents that this bat survey report takes into consideration and these guidelines are based on scientific research.

EUROBATS (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, providing best practice mitigation measures. These recommendations are the basis of mitigation measures pertaining to bats listed in this report and are provided in detail in the Mitigation Section of the report.

1.2.3.2 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. Marnell *et al.* (2022) states that "Bat boxes are generally inappropriate substitutes for significant roosts in buildings and do not constitute 'like for like' replacement". However, the guidance document does consider 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 but does recommend that the type of bat box provided should be appropriate to the species (Figure 1f).

McAney & Hanniffy (2015) reviewed the use of bat boxes in Ireland. 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), but the review identified significant differences in usage and also identified some inter-species differences in bat box choice. This report review the bat usage of the following bat box schemes: 62 Schwegler boxes of three models erected in Portumna Forest Park, 30 1FF, 30 2FN and 2 1FW; 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 main summary points are as follows (directly quoted from publication):

- 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.
- 31% chance of encountering a bat at Portumna Forest Park compared to 11.5% and 10% at Coole-Garryland and Knockma respectively.
- Pipistrellus spp. preferred 1FF boxes that offer crevice-like roosting conditions, showed a seasonal preference with more bats present later in the season (visual observations confirmed the bats were using the boxes as mating roosts), their numbers increased with time but appear to be stabilising, and they preferred boxes located close to the shores of Lough Derg in Portumna.
- Long-eared bats preferred 2FN boxes that mimic holes in trees, the natural roosting sites for this species, they showed no seasonal pattern to their occurrence in the boxes – possibly as males of this species do not set up mating roosts to attract females.
- Leisler's bat showed no preference for box model but 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 2013.
- Aspect was not a significant factor for occupancy but most boxes received dappled sunshine for part of the day.

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 (directly quoted from paper):

- Bat boxes were the most frequently deployed roosting provision, being installed at 64% (n = 71) of sites 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 (n = 270). Bats, or evidence of bats, were recorded in 20% of these.
- Bat boxes mounted externally on buildings showed the highest occupation rate regardless of species. 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 (all Schwegler). Bat presence was highest in the 1FF (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.

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).

The following is an example of one of the bat box schemes set up by the author: a bat box scheme erected in Kileshandra, Co. Cavan which consisted 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 were erected in 2012 as part of mitigation for the demolishment of a large derelict building where small satellite roosts were recorded. Two site visits have been made 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) recommends a design life, including essential maintenance, of about 10 years is be appropriate, as this would be comparable with the lifespan of the tree roosts that bat boxes 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). It is the authors preference to recommend Schwegeler woodcrete bat boxes as part of bat mitigation measures. However, due to a shortage in this bat box type in recent years, woodstone bat boxes have become available. Bat Conservation Ireland is currently trialling a number of woodstone designs to determine bat usage of such. However, due to lack of durability in Irish weather conditions, timber bat boxes are not considered suitable for bat mitigation by the author.

1.3 Project Description

1.3.1 Site Location

The proposed planning application is for a site located on Holybank, Glen Ellan Road, Swords, Co. Dublin. These fields and river valley were the principal survey area for this bat survey report.

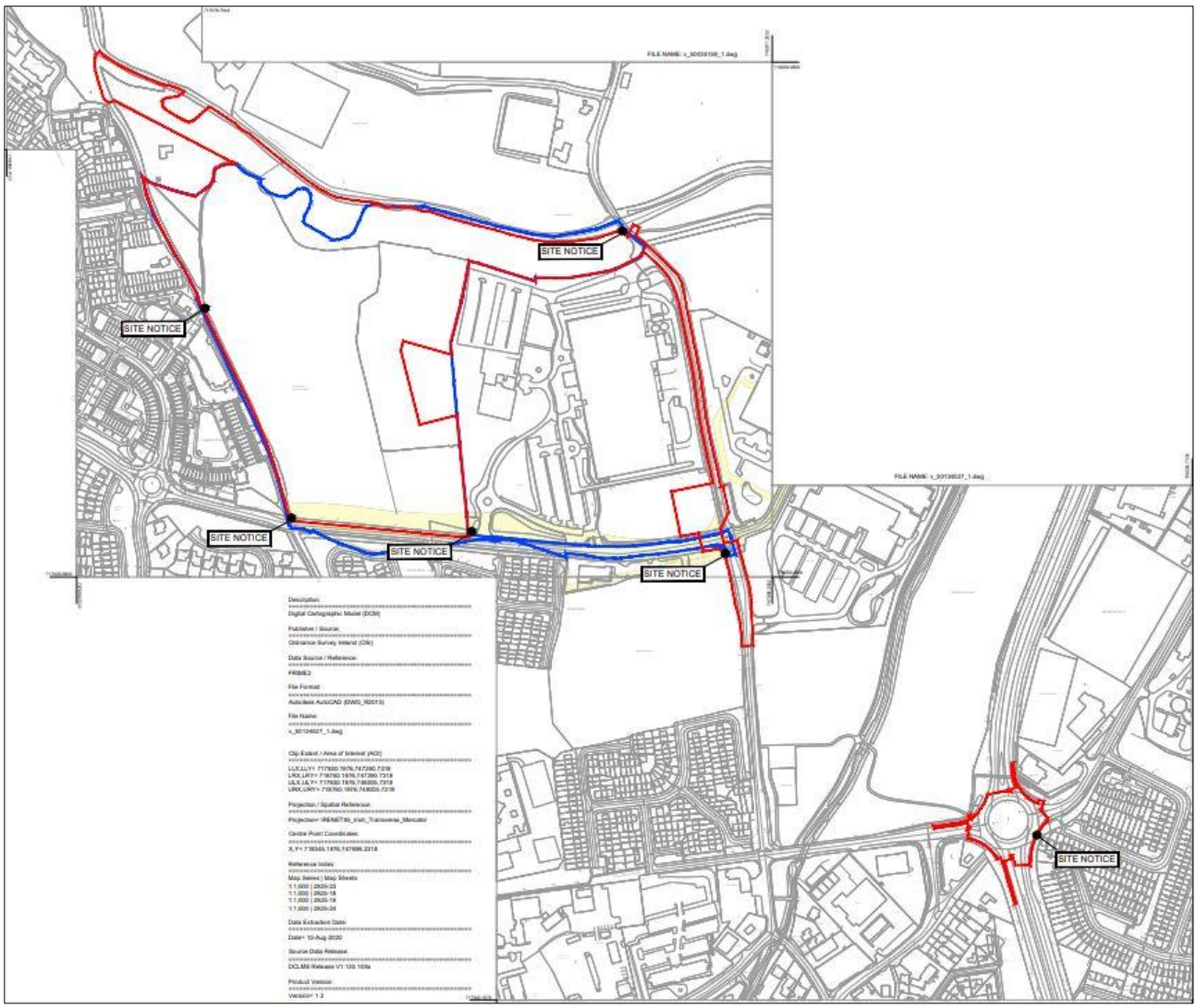


Figure 2a: Location of the proposed development site (red line is an approximate outline of the proposed development site).

Lands marked for proposed residential development at Holybanks, Glen Ellen Road, Swords, Co. Dublin consists of unused greenfields located between Jugback Lane/Terrace to the west and the former Motorolla factory, on the northern edge of Swords Co Dublin. The site is located beside existing residential housing estates to the west. St Colmcille GAA club is located to the north of the proposed development site. The former (now vacant) Motorolla factory and Swords Business Park adjoin the site to the east. The proposed development site is located adjacent to the Broadmeadow River which flows along the northern boundary. There is extensive woodland along the boundary of the Broadmeadow River and scrub adjacent to car parks on the eastern boundary of the proposed development site.

1.3.2 Proposed Project

The proposed development will consist of a residential scheme of 621 no. units (145 no. 1-bed units, 278 no. 2-bed units, 187 no. 3-bed units and 11 no. 4-bed units) comprising 349 no. apartments, 118 no. houses and 154 no. duplex units. Building heights range from 1 no. to 7 no. storeys (over basement level). The scheme provides for public open space, communal open space areas, a crèche, residential amenities (including concierge, multi-purpose room, meeting room and gym), a new public park to the north of the site as an extension to Broadmeadow Riverside Park and services / bin store areas. The development provides for a total of 705 no. car park spaces (including houses), 856 no. secure bike parking spaces and 21 no. motorbike spaces at basement, under-croft, and surface level. As part of the proposed development, temporary permission (3 no. years) is sought for a single-storey Marketing Suite and associated signage (including hoarding) during the development construction stage. Principal vehicular access to the site is from Glen Ellan Road, with an additional new secondary site entrance provided from Jugback Lane/Terrace. Pedestrian connections are provided to the site from Jugback Lane/Terrace, Glen Ellan Road and the proposed Broadmeadow Riverside Park extension. The development also includes infrastructure upgrade works to local roads junctions, and existing Irish Water infrastructure including the construction of a stormwater storage tank and outfall pipeline, all associated ancillary and site development works above and below ground including hard and soft landscaping, boundary treatments, lighting, SuDs, pumping station, ESB substations and services to facilitate the development. A full and detailed description of development is set out on the statutory notices.

Figure 2b: Proposed layout of the proposed development site.

2. Bat Survey Methodology

The following information provides some general non-specific information on the different components of a bat survey as well as specific information on what was completed as part of the bat survey methodology for this proposed development. This is background information to provide context to survey results presented in Section 3.

2.1 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 types 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, will be based on the following:

Table 4: Bat Roost Types (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

2.1.1 Building & Structure Inspection

There are no buildings located within the proposed development area. Newtown Bridge is located along the eastern boundary of the proposed development site over the Broad Meadow River (Balheary Road) and this was inspected on 14/5/2021.

The bridge was 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).

Bridge structure was also assessed using a 4-point classification system designed for bridges by Billington & Norman (1997) as follows:

Table 5a: Bridge and Stone Structure Bat Roost Classification System (Adapted from Billington & Norman, 1997).

Bridge Category	Description
0	No potential (i.e. no suitable crevices for roosting bats).
1	Low potential (i.e. crevices present that may be of use to bats).
2	High potential (i.e. crevices ideal for roosting bats but no evidence of usage during inspections).
3	Roost (evidence of bats roosting either because bats are present or other evidence is recorded during inspection (e.g. bat droppings).

2.1.2 Tree Potential Bat Roost (PBRs) Inspection

Trees that may provide a roosting space for bats were examined using the Bat Tree Habitat Key (BTHK, 2018) and the classification system reported in Collins (2016). The Potential Roost Features (PRFs) listed in the BTHK were used to determine the PBR value of trees. Trees identified as Potential Bat Roosts (PBRs) were inspected during the daytime, where possible, for evidence of bat usage. Evidence of bat usage was in the form of actual bats (visible or audible), bat droppings, urine staining, grease marks (oily secretions from glands present on stonework), bat pupae and claw marks.

A Phase 1 inspection was undertaken on the 11/8/2017 and 29/8/2019 in order to make a list of trees within the proposed development site that may be suitable as roosting sites for bats. An additional daytime inspection was undertaken on 14/5/2021. Inspections were undertaken visually with the aid of a strong torch beam (LED Lenser P14.2) during the daytime.

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

Tree Category	Description
1	Trees with multiple, highly suitable features (Potential Roosting Features = PRFs) capable of supporting larger roosts
2	Trees with definite bat potential but supporting features (PRFs) suitable for use by individual bats;
3	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	Trees have no potential.

2.1.3 Bat Habitat & Commuting Routes Mapping

The survey site was assessed during daytime on 11/8/2017, 29/8/2019 and 14/5/2021 where a walkabout survey was completed to document potential bat foraging habitat and potential bat commuting routes. Aerial photographs were also examined to assist this step. Bat habitats and commuting routes were also identified in the wider landscape to determine landscape connectivity for local bat populations through the examination of aerial photographs.

2.2 Night-time Bat Detector Surveys

The following bat surveys were completed and methodology for these are described below.

2.2.1 Dusk & Dawn Bat Surveys, Walking Transects

Due to the fact that there are no buildings / structures located in the proposed development site, the preferred survey type for this site was a walking transect to allow bat encounters to be mapped.

Dusk emergence surveys were completed from 10 minutes before sunset to 90 minutes post sunset. Dawn surveys were completed 90 minutes before sunrise to 10 minutes after sunrise. Walking transects were completed 20 minutes after sunset or as part of the dusk surveys. These involved the survey team walking a predetermined route, noting the time, location and bat species encountered. The geo-referenced calls were mapped (from 2018 onwards) using Google Earth with a KLM file produced for mapping purposes. In 2017, bat encounters were noted as Irish grid reference co-ordinate points. Validation of bat records was completed by the principal bat surveyor prior to mapping.

Surveys were completed during mild and dry weather conditions with air temperature of 8^{o}C or greater. All bat encounters were noted during surveys.

The following equipment was used:

Surveyor 1: (Principal surveyor): Anabat Walkabout Full Spectrum Detector (or Wildlife Acoustics Echo Meter Touch (Generation 1, Apple IOS) connected to iPad 2 (32 GB storage) prior to 2020) and Petersson D200 Heterodyne Bat Detector.

Surveyor 2 (from 2018 onwards): Wildlife Acoustics Echo Meter Touch2 Pro (Android) connected to Samsung Galaxy Tab S3 and Petersson D200 Heterodyne Bat Detector.

2.2.2 Passive Static Bat Detector Survey

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. This 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 Full Spectrum 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) and downloaded for analysis. These results are depicted on a graph showing the number of bat passes per species per night. Each bat pass does not correlate to an individual bat 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 is one individual bat. On the other hand, Leisler's bats tend to travel through an area quickly and therefore an individual sequence or bat pass is more likely to be indicative of individual bats not unless the individual is foraging above a tree canopy.

The recordings were analysed using Wildlife Acoustics Kaleidoscope Pro. Each sound file was 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.

The following static units were deployed during this static bat detector survey. The static surveillance was completed for 3-6 nights in 2017, 2018, 2019 and 2020.

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

Static Unit Code	Bat Detector Type	Recording Function	Microphone
SM Mini Units 1-3	Wildlife Acoustics SongMeter mini Bat FS	Passive Full Spectrum	SMM-U2
SM3 Unit 1	Wildlife Acoustics SongMeter 3	Passive Full Spectrum	SMM-U1, 5m cable
SM2 Units 1, 2, 4 & 5	Wildlife Acoustics SongMeter 2 Bat+	Passive Full Spectrum	SMX-US (connected directly to unit) SMX-U1 (connected directly to unit)

2.3 Desktop Review

2.3.1 Bat Conservation Ireland Database

A 1km radius of the Irish grid Reference O178481 was requested.

3. Bat Survey Results

3.1 Daytime Inspections

3.1.1 Building & Structure Inspection

Newtown Bridge (Balheary Road) was inspected on 14/5/2021 and it was noted as a 3-arch bridge and all of the arches were sealed. Therefore this bridge does not have any potential as a roosting site for bats (i.e. Bridge Category = 0).

3.1.2 Tree Potential Bat Roost (PBRs) Inspection

There are a large number of trees within the proposed development area deemed to be suitable as bat roosts. There is also a high degree of connectivity between the wooded areas, treelines and hedgerows along the northern boundary (Broadmeadow River valley) of this proposed development site.

A total of forty-five individual trees, thirteen tree groups and two hedgerows were recorded as part of the survey. Most of the existing trees on site are located along the land along the boundary of the river and within former field boundary hedgerows.

Twenty-one of these trees were deemed to be Potential Bat Roosts (PBR) with a Category 2 classification (Table 7). The eastern boundary (Hedgerow 1) provides a commuting route for common pipistrelles while Tree Group 2 and 3 are an important for foraging and commuting bats.

Table 7: Tree Potential Bat Roost (PBR) inspection results (PBR value Classification according to Collins, 2016).

Tree No.	Tree Species	Potential Roost Features (PRFs)	Bat Usage	PBR Value
T548-552	*Pinus* spp.	4 live specimens, 1 dead monolith: tree holes, dead wood (Treeline adjacent to Newtown Bridge, eastern boundary)	Foraging bats	Cat. 2
T535	Ash	Heavy ivy growth	Foraging and commuting bats	Cat. 2
T536	Ash	Heavy ivy growth	Foraging and commuting bats	Cat. 2
T537	Ash	Heavy ivy growth	Foraging bats	Cat. 2
T539	Ash	Heavy ivy growth	Foraging bats	Cat. 2
T540	Ash	Heavy ivy growth	Foraging bats	Cat. 2
T541	Ash	Heavy ivy growth	Foraging bats	Cat. 2
T542	Ash	Heavy ivy growth	Foraging bats	Cat. 2
T543	Ash	Heavy ivy growth	Foraging bats	Cat. 2
T546	Ash	Heavy ivy growth	Foraging bats	Cat. 2
T547	Ash	Heavy ivy growth	Foraging bats	Cat. 2
T545	Sycamore	Ivy growth, dead wood and tree holes	Foraging bats	Cat. 2
T553	Ash	Heavy ivy growth	Foraging bats	Cat. 2
T556	Ash	Heavy ivy growth	Foraging bats	Cat. 2
T557	Ash	Heavy ivy growth	Foraging bats	Cat. 2
T673	Ash	Heavy ivy growth	Foraging bats	Cat. 2
T667	Ash	Heavy ivy growth	Foraging bats	Cat. 2

The Arboriculture Impact Assessment (please consult original documents for more information) indicates 10 trees with a PBR value are to be removed and these area listed in Table 8 – highlighted in Orange. However the majority of the tall vegetation along the Broad Meadow River will be retained and this is the primary area for commuting and foraging bat populations.

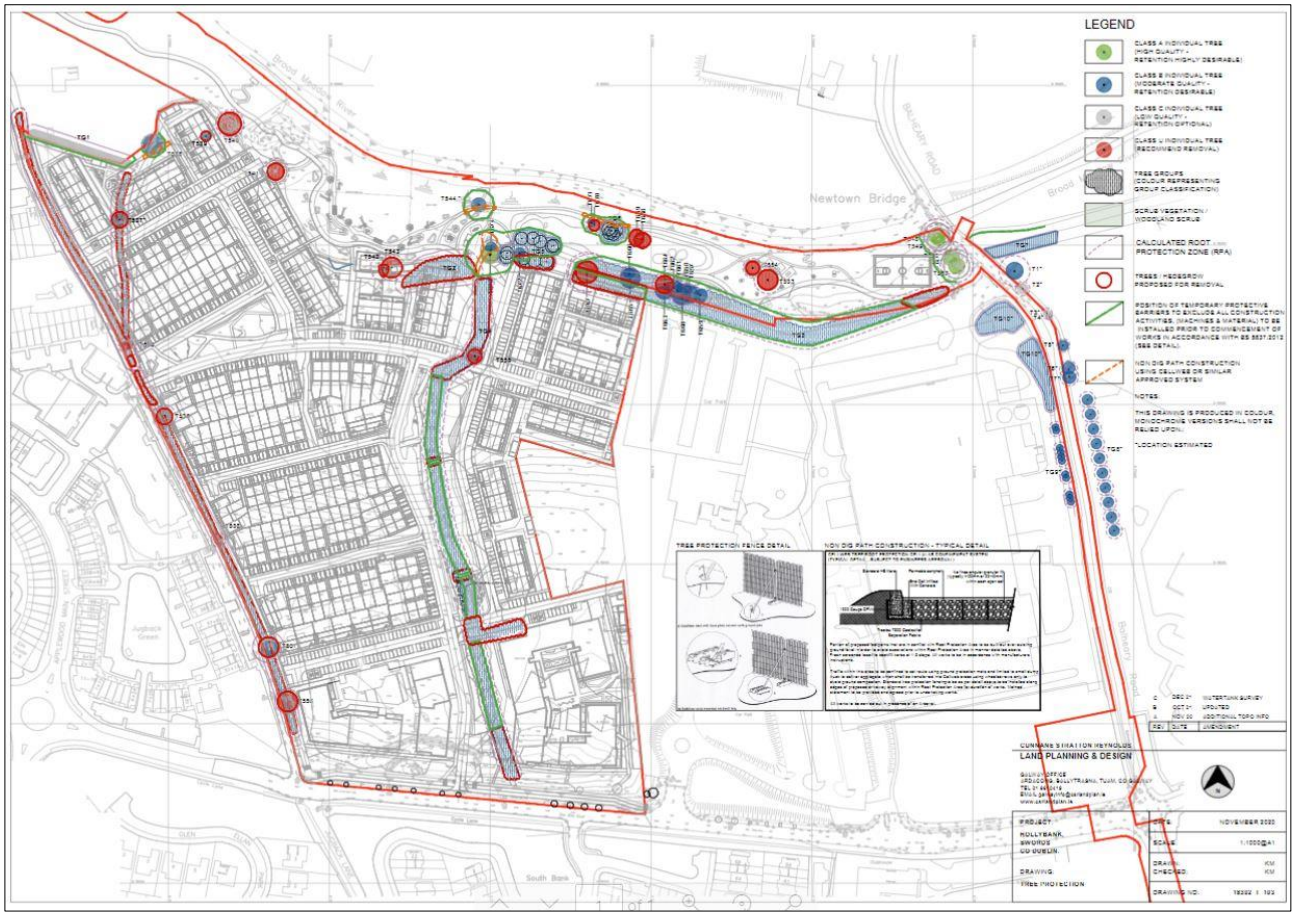


Figure 3: Tree Protection Drawing (Source: Cunnane Stratton Reynolds – Arboriculture Impact Assessment).

Trees adjacent to Newtown Bridge (Balheary Road) and along the Balheray Road were inspected, during the daytime, on 14/5/2021. There is a group of Scot's Pine trees adjacent to the bridge and the trees were deemed as Category 2 PBRs (Tree Tags 548-552). There are no PBR trees along road side of the immediate 100m section of Balheary Road from the bridge and moving towards the direction of Swords. However the treeline is considered to be a suitable foraging habitat for local bat populations.

3.1.3 Bat Habitat & Commuting Routes Mapping

The proposed development site is located in an urban setting. However the presence of the Broadmeadow River valley along the northern boundary provides an essential bat commuting route to the wider landscape. This also connects with the Ward River Valley to the east and the agricultural fields to the north of the proposed development site.

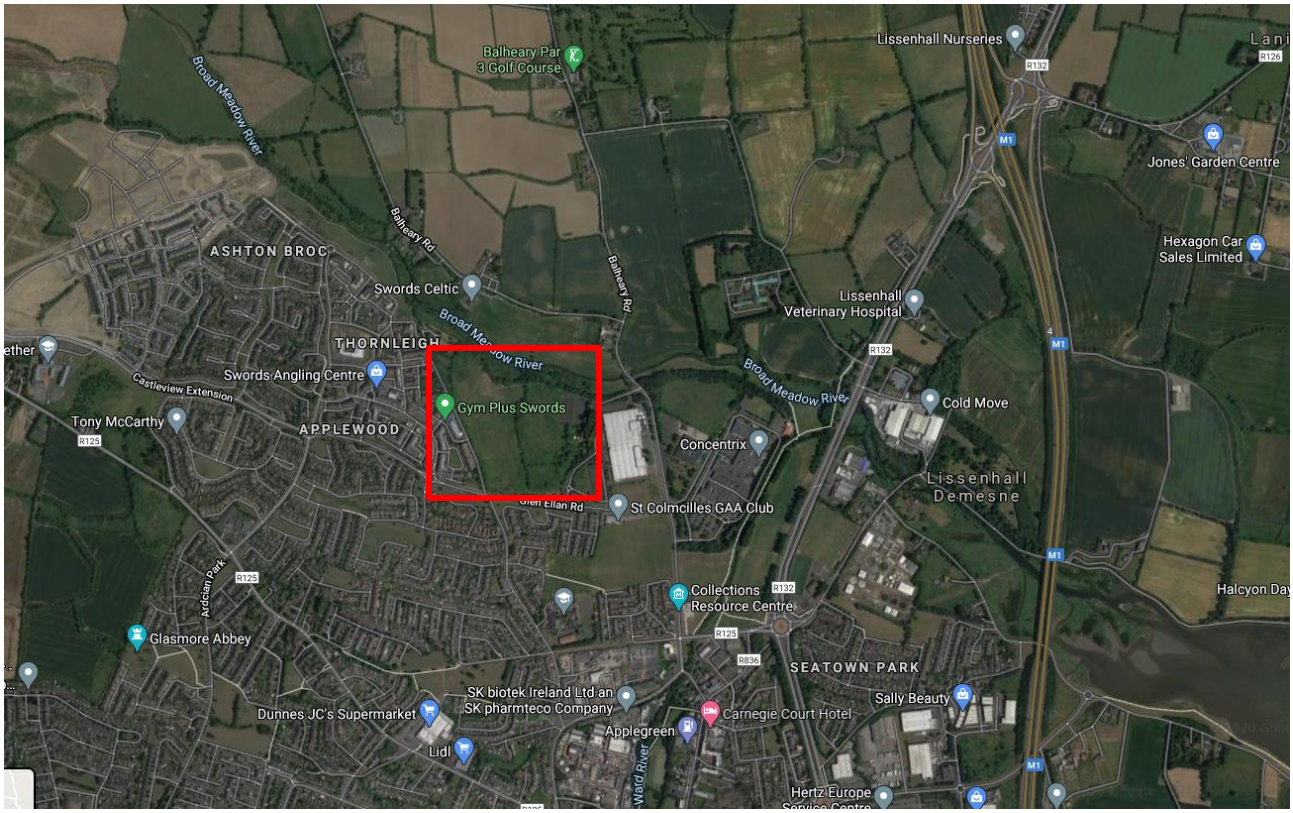


Figure 4: Aerial map of the proposed development site within the wider landscape (approximate area within red line) (source: Google Maps).

A summary map of the principal commuting routes is presented at the end of Section 3 (Figure 9b).

3.2 Night-time Bat Detector Surveys

One dusk survey, one dawn survey and four walking transects were completed. The results of these are presented below. Walking transects were deemed as the most suitable means of surveying this site due to the fact that there are no buildings/structures within the proposed development site. During surveys, a particular effort was made in relation to trees identified to have a PBR value in order to determine if bats were roosting within them at the time of the survey. Bat roosts in trees is often difficult to determine due to the transient roosting behaviour of bats.

3.2.1 Dusk Bat Survey 2017

The dusk survey completed in 2017 (11/8/2017) was principally a walking transect of the proposed development site but the surveyor completed stopping points along accessible sections to observe bats and their foraging/commuting behaviour.

The Dusk Survey was confined to the fields within the survey site and the accessible areas to the east of the survey site. Surveying started in the fields located to the NW of the site starting from the road, walking through fields, long tracks through the woods adjacent to the river, accessing the river bank where possible and proceeding towards the business park to the east of the survey area. The recorded bat encounters were mapped on the figure below.

Figure 5: Bat encounters during Dusk Survey. Circles indicate the location of bat encounters and these are colour coded for each of the bat species recorded. Green = common pipistrelles; Red = soprano pipistrelles; Blue = Leisler's bats; Orange = brown long-eared bats; Purple = *Myotis* bats

- The first bat was recorded at 21:05 hrs. This was a Leisler's bat commuting through the proposed development site from E to W direction.
- The first common pipistrelle was recorded at 21:15 hours and this bat was commuting along the treelines leading to the static unit located at the river bank (Static Unit 3, Green Circle, Table 10a).
- The first soprano pipistrelle was recorded at 21:20 hours and this individual was foraging along treelines adjacent to the static unit at the river bank (Green Circle).
- Brown long-eared bat activity was confined to wooded and scrub habitats.
- *Myotis* bat activity was confined to the river and these were identified as Daubenton's bats.
- The bat encounters are presented on Figure 4. Bat activity was highest along the northern boundary of the survey area.
- No tree roosts were recorded.

3.2.2 Walking Transects 2018

A walking transect was completed for this bat survey assessment on 27/9/2018. The walking route was of the boundaries of the proposed development site, a section of the river and accessible sections of the derelict business park. The degree of dense vegetation had increased since 2017 which meant that there was less safe accessible points for walking during the hours of darkness.

Only two species of bat (common pipistrelle and soprano pipistrelle) was recorded during this survey and the level of bat activity was considered to be low. The bat encounters was also confined to the northern section of the proposed development site walked.

Figure 6a: Common pipistrelle bat encounters recorded during Walking Transect completed on 27/9/2018 (Walking route – pink line, Map source: Google Earth).

Figure 6b: Soprano pipistrelle bat encounters recorded during Walking Transect completed on 27/9/2018 (Walking route – pink line, Map source: Google Earth).

3.2.3 Walking Transects 2019

A walking transect was also completed on 31/8/2019. The walking route was along accessible boundaries of the proposed development site, internal treelines/hedgerows and a section of the river was walked during this transect.

Figure 7a: Common pipistrelle bat encounters recorded during Walking Transect completed on 31/8/2019 (Walking route – yellow line, Map source: Google Earth).

Figure 7b: Soprano pipistrelle bat encounters recorded during Walking Transect completed on 31/8/2019 (Walking route – yellow line, Map source: Google Earth).

Figure 7c: Daubenton's bat encounters recorded during Walking Transect completed on 31/8/2019 (Walking route – yellow line, Map source: Google Earth).

A total of three bat species were recorded: common pipistrelle, soprano pipistrelle and Daubenton's bat. Bat encounters were low but a little more spread out across the walked area compared to 2018. Daubenton's bats were only recorded along the section of the river walked.

3.2.4 Walking Transect 2020

A walking transect was also completed on 6/6/2020. The walking route was along accessible boundaries of the proposed development site, internal treelines/hedgerows and a section of the river was walked during this transect. The surveyor then continued to walk a larger area incorporating a longer length of the Broadmeadow River (from the opposite bank of the proposed development site from the bridge to the GAA club fields) and additional local roads through housing estates and the Ward River boundary within the new business park.

During this survey, four species of bat was recorded: common pipistrelle, soprano pipistrelle, Leisler's bat and Daubenton's bat. Again the level of bat activity would be considered low and dispersed throughout the walked area. The only concentration of bat activity was for common pipistrelles along the local road adjacent to the proposed development site and housing estate (Figure 8a) and for soprano pipistrelle activity, which was concentrated along the Ward River valley further east of the proposed development site (Figure 8b). No tree roosts were recorded during the survey.

Leisler's bats and Daubenton's bat were recorded along the river.

Figure 8a: Common pipistrelle bat encounters recorded during Walking Transect completed on 6/6/2020 (Walking route – pink line, Map source: Google Earth).

Figure 8b: Soprano pipistrelle bat encounters recorded during Walking Transect completed on 6/6/2020 (Walking route – pink line, Map source: Google Earth).

Figure 8c: Leisler's bat encounters recorded during Walking Transect completed on 6/6/2020 (Walking route – pink line, Map source: Google Earth).

Figure 8d: Daubenton's bat encounters recorded during Walking Transect completed on 6/6/2020 (Walking route – pink line, Map source: Google Earth).

3.2.5 Dawn Survey 2020

Due to the higher level of common pipistrelle activity recorded on the 6/6/2020 along to local road on the eastern boundary of the proposed development site, a dawn survey was completed (7/6/20200) here to recorded any potential roosting sites located adjacent to the proposed development site. In addition, trees were also surveyed for swarming bats to determine if roosts were present.

Three species of bat was recorded: common pipistrelle (40 passes), Leisler's bat (7 passes) and soprano pipistrelle (1 pass). A common pipistrelle roost was recorded in a private residence located along this road and therefore adjacent to the proposed development site. This is likely to be the roost for common pipistrelle individuals recorded commuting and foraging within the proposed development site. No tree roosts were recorded.

Figure 9a: All bat encounters recorded during the dawn survey completed on 7/6/2020 (Walking route – blue line, Map source: Google Earth).

3.2.6 Dusk Survey 2021

The dusk survey was undertaken on 14/5/2021 and concentrated along the Broad Meadow River and Belheary Road with particular emphasis on mature trees (Tree Tags 548-552). No bats were recorded emerging from the pine trees adjacent to Newtown Bridge. Common pipistrelles and soprano pipistrelles were recorded foraging along the hedgerow connected to the location of the pine trees and along the mature treeline of Balheary Road. Daubenton's bats were recorded foraging on the river and commuted from a easterly direction towards the bridge.

During all of the bat surveys, it was noted that the principal commuting routes for bats recorded within the proposed development site are as follows:

- Common pipistrelle: entered the site along the western boundary.
- Soprano pipistrelle commuted from a NW direction.
- Leisler's bat commuted towards the river valley from the south and east.
- Daubenton;s bats commuted along the Broadmeadow River from a easterly direction.
- Brown long-eared bats were noted only as foraging individuals.

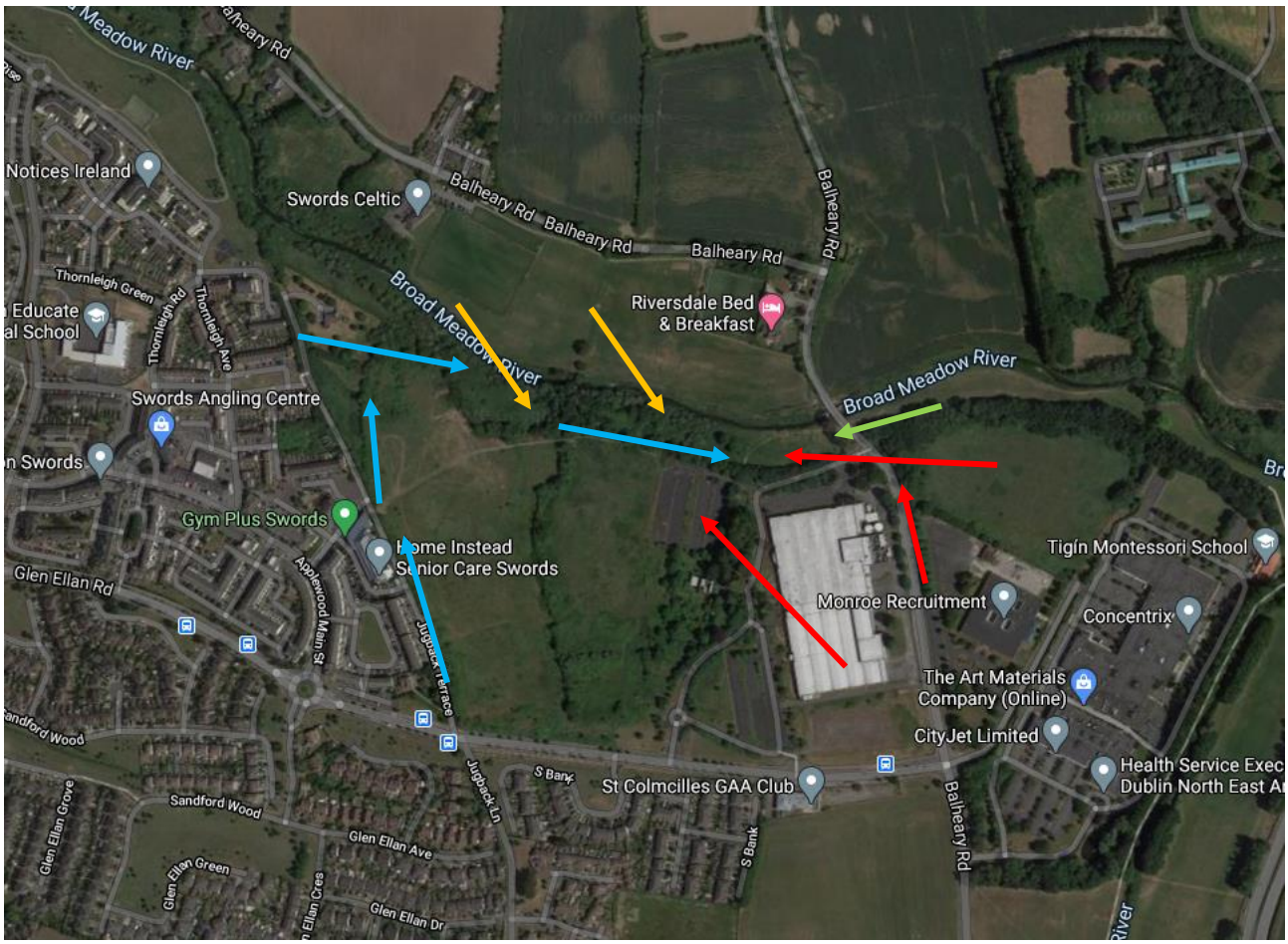


Figure 9b: Summary of principal commuting routes recorded (Map source: Google Earth). Red = Leisler's bats, Blue – common pipistrelle, Orange = soprano pipistrelle and Green = Daubenton's bats.

3.3 Passive Static Bat Detector Survey

Static recording units were deployed in 2017 (3 units, Static 1-3), 2018 (3 units, Statics 4-6), 2019 (3 units, Static 7-9) and 2020 (3 units, Static 10-12). The location of the static units are presented on the aerial photograph below.

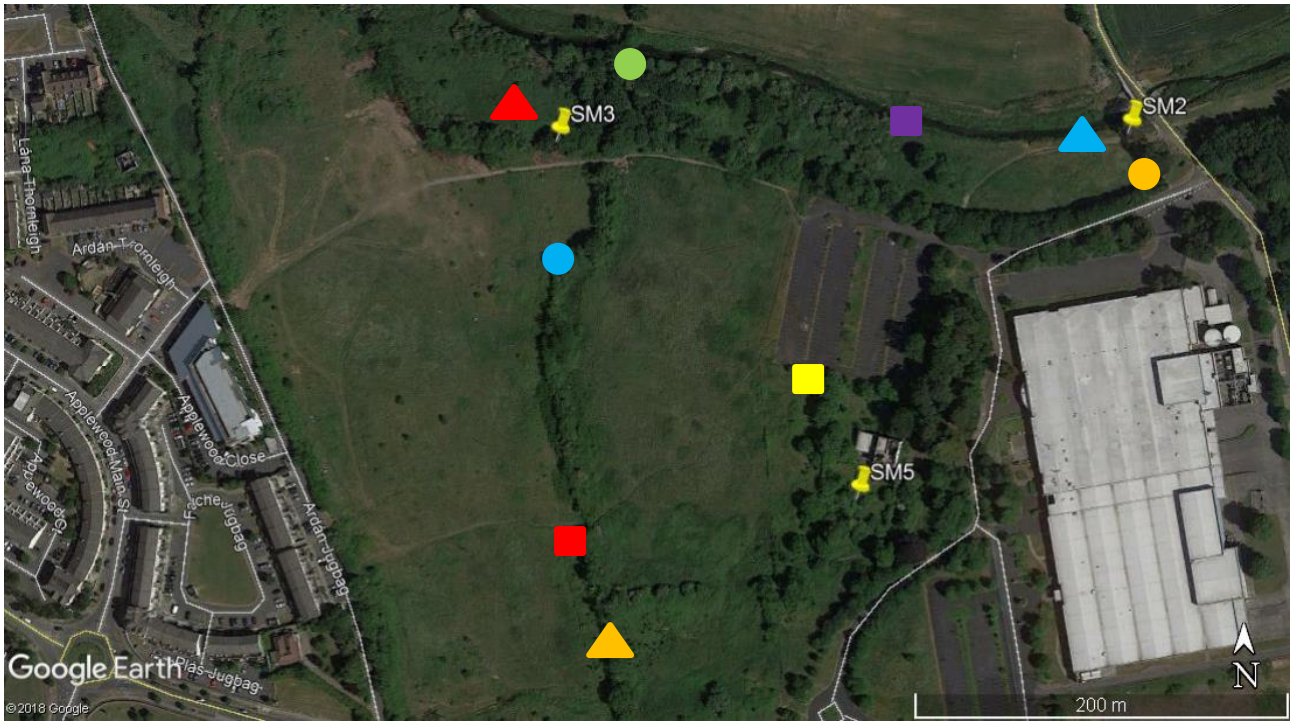


Figure 10: Location of statics units during the four surveillance periods completed. 2017: Circles, 2018: Squares; 2019: Pins, 2020: Triangles.

Static units located along the Broadmeadow River tended to recorded a Medium level of bat activity for common pipistrelles, soprano pipistrelles and Leisler's bats. Also, the recording of additional bat species (i.e. Daubenton's bats and brown long-eared bats) was more likely on statics units located along the river valley or within the dense treeline connected to the river valley.

The highest number of bat passes for any species recorded on an individual static unit was for soprano pipistrelles (Green Circle, Figure 10). But overall, common pipistrelles was the most frequently encountered bat species during all static deployments.

Myotis spp., (Daubenton's bats) were recorded on four static locations, the highest number of passes per night was recorded in 2020 (Blue Triangle, Figure 10).

Brown long-eared bats were recorded on six static locations, but consistently in low levels. The highest number of bat passes for this species was in 2018 along the river valley (Purple Square, Figure 10).

A lower level of bat activity was recorded on static units located away from the river valley.

The internal treeline (where Blue Circle and Red Square were located, Figure 10) was only occasionally used as a foraging and commuting route for local bat populations and this was confined to the more common bat species (common pipistrelle, soprano pipistrelle and Leisler's bat).

The scrub habitats along the eastern boundary of the proposed development site (where Red Square and Yellow Pin SM5 were located, Figure 10) also recorded a low level of bat activity for the more common bat species (common pipistrelle, soprano pipistrelle and Leisler's bat).

Table 8: Results of Static Bat Detectors deployed during Static Bat Detector Surveys.

Static Code	Location Description	Survey Period	Bat Species – no. of bat passes per surveillance period	Activity Value
Static 1 SM2 Unit 1	Along internal hedgerow Blue Circle	11/8/2017 to 15/8/2017 (4 nights)	CP – 186 passes (47 passes/night) SP – 100 passes (25 passes/night) Leis – 18 passes (5 passes/night)	Low Low Low
Static 2 SM2 Unit 4	Along scrub Orange Circle	11/8/2017 to 15/8/2017 (4 nights)	CP – 72 passes (18 passes/night) SP – 39 passes (10 passes/night) Leis – 29 passes (7 passes/night) *Myotis* – 6 passes BLE – 8 passes	Low Low Low Low Low
Static 3 SM2 Unit 5	Along river bank Green Circle	11/8/2017 to 15/8/2017 (4 nights)	CP – 643 passes (161 passes/night) SP – 989 passes (247 passes/night) Leis – 39 passes (4 passes/night) *Myotis* – 42 passes (5 passes/night) BLE – 7 passes	Medium Medium Low Low Low
Static 4 SM3	Along internal hedgerow Red Square	27/9/2018 to 30/9/2018 (3 nights)	CP – 29 passes (10 passes/night) SP – 4 passes (1 pass/night) Leis – 8 passes (3 passes/night)	Low Low Low
Static 5 SM2 Unit 5	Along scrub Yellow Square	27/9/2018 to 30/9/2018 (3 nights)	CP – 28 passes (9 passes/night) SP – 17 passes (6 passes/night) Leis – 13 passes (4 passes/night)	Low Low Low
Static 6 SM2 Unit 2	Along river bank Purple Square	27/9/2018 to 30/9/2018 (3 nights)	CP – 704 passes (235 passes/night) SP – 179 passes (60 passes/night) Leis – 145 passes (48 passes/night) *Myotis* – 27 passes (9 passes/night) BLE – 15 passes	Medium Medium Medium Low Low
Static 7 SM2 Unit 2	Along the river Yellow Pin	29/8/2019 to 1/9/2019 (3 nights)	CP – 21 passes (7 passes/night) SP – 5 passes (2 passes/night) Leis – 5 passes (2 passes/night)	Low Low Low
Static 8 SM3	Treeline Yellow Pin	29/8/2019 to 1/9/2019 (3 nights)	CP – 7 passes (2 passes/night) SP – 18 passes (3 passes/night) Leis – 4 passes (1 passes/night)	Low Low Low

			BLE – 10 passes (3 passes/night)	Low
Static 9 SM2 Unit 5	Along hedgerow at disused car park Yellow Pin	29/8/2019 to 1/9/2019 (3 nights)	CP – 28 passes (10 passes/night) SP – 4 passes (1 passes/night) Leis – 9 passes (3 passes/night)	Low Low Low
Static 10 Mini 1	Adjacent to treeline Red Triangle	2/6/2020 to 7/6/2020 (6 nights)	CP – 1115 passes (186 passes/night) SP – 217 passes (36 passes/night) Leis – 116 passes (19 passes/night)	Medium Medium Low
Static 11 Mini 2	Adjacent to the river Blue Triangle	2/6/2020 to 7/6/2020 (6 nights)	CP – 907 passes (151 passes/night) SP – 318 passes (53 passes/night) Leis – 107 passes (19 passes/night) Myotis – 44 passes (7 passes/night) Daub – 254 passes (42 passes/night) BLE – 1 pass	Medium Medium Low Low Low
Static 12 Mini 3	Along treeline Orange Triagle	2/6/2020 to 7/6/2020 (6 nights)	CP – 399 passes (186 passes/night) SP – 27 passes (36 passes/night) Leis – 249 passes (19 passes/night) BLE – 3 passes	Medium Medium Low Low

Note: SP = Soprano pipistrelle, CP = Common pipistrelle, Leis = Leisler's bat.

As a general guide, activity level is determined as follows: Low = <10 bat passes/hr; Medium = >10 - <50 bat passes/hr; High = >50 bat passes/hr). The static units recorded for approximately 8 hours per night. Therefore the activity levels for each bat species, for each surveillance period, is presented above.

NOTE: The behaviour of bats during commuting and foraging greatly influences the level of bat passes recorded on static units. The number of bat passes do not equate to the number of bats flying past the static unit. Pipistrellus species tended to foraging as they commute and therefore are regularly observed flying up and down a treeline or hedgerow before moving on in the landscape. Leisler's bats fly high in the sky and therefore can be observed flying fast through the landscape, occasionally foraging over treetops as they commute. As a consequence, Pipistrellus species bat activity tends to result in a higher number of bat passes recorded on static units compared to Leisler's bats. In relation to other bat species recorded, as they tend to be less common in the landscape compared to common pipistrelles, soprano pipistrelles and Leisler's bats, their recorded presence is notable. Exceptions to this would include Daubenton's bats on a waterway or a static located adjacent to a known bat roost.

3.4 Survey Constraints & Survey Summary

The following is a summary of the surveying completed for this project:

Table 9: Survey Summary.

Category	Discussion
Timing of surveys	The majority of the surveys were completed during the maternity season (May to August). Surveying completed in September was undertaken during good weather conditions in order to collate suitable bat activity results. Therefore there is no constraints in relation to timing.
Weather conditions	Good weather conditions were noted during all surveys completed. Therefore there are no constraints in relation to weather conditions.
Survey effort **Total Hours of surveys:** TOTAL = 11 hours 40 mins **Total hours of static surveillance** TOTAL = 375 hours The survey effort is compliant with Collins (2016).	**2017 Bat Survey** Dusk Survey & Walking Transect 11/8/2017 Static Surveillance 11/8/2017 to 15/8/2017 (4 nights) **2018 Bat Survey** Walking Transect 27/9/2018 Static Surveillance 27/9/2018 to 30/9/2018 (3 nights) **2019 Bat Survey** Dusk Survey & Walking Transect 29/8/2019 Static Surveillance 29/8/2019 to 1/9/2019 (3 nights) **2020 Bat Survey** Walking Transect 6/6/2020 Dawn Survey 7/6/2020 Static Surveillance – 6/6/2020 to (6 nights) **2021 Bat Survey** Dusk Survey 14/5/2021
Equipment	All in good working order.
Access	Anti-social behaviour was encountered during a number of site visits which limited areas that could be surveyed. Therefore there were some survey constraints, but due to the annual surveys, the surveys completed are deemed to represent the proposed development area.

Surveying was completed according to Collins, 2016. A large volume of surveying was completed for the proposed development site and this was undertaken in the appropriate season to record bat activity, during good weather conditions and at a survey level that meets Collins (2016). It is therefore deemed that the survey work completed is adequate in order to complete the aims of the bat survey.

3.5 Summary of Results

The following is the principal results recorded:

Surveys over five years were completed for this proposed development site. During these seven dusk, dawn and walking transect surveys, five species of bat was recorded: common pipistrelle, soprano pipistrelle, Leisler's bat, Daubenton's bat and brown long-eared bat.

Twelve static locations also recorded the same suite of bat species: common pipistrelle, soprano pipistrelle, Leisler's bat, Daubenton's bat and brown long-eared bat with additional bat encounters identified only to family level (i.e. *Myotis* spp.)

The primary bat areas within the proposed development site is the Broadmeadow River valley and associated treeline. In the wider landscape, the Broadmeadow River valley and associated treeline are connected to the Ward River valley. These river valleys are well connected with treelines and hedgerows. As a consequence the northern boundary of the proposed development site is important for local bat populations.

While a number of trees were recorded as Potential Bat Roosts (PBRs) through the daytime assessment process, no tree roosts were confirmed during the array of dusk and dawn surveys and walking transects.

3.6 Desktop Review

3.6.1 Bat Conservation Ireland Database

Data for a 1km radius of the Irish grid Reference O178481 was received from Bat Conservation Ireland.

The results are as follows:

There is one Ad Hoc bat detector record~

- BATLAS 2010 recorded common pipistrelles, soprano pipistrelles and Daubenton's bats.

4. Bat Ecological Evaluation

4.1 Bat Species Recorded

Five bat species were recorded in total by the array of bat surveys completed for this proposed development site.

Three of the bat species recorded were common pipistrelle, Leisler's bat and soprano pipistrelle and these are the three most common bat species in Ireland.

Common pipistrelle was the most frequently encountered bat species. This species was principally recorded commuting from a westerly direction and a roost was recorded outside the proposed development site. Commuting was frequently recorded along the western boundary of the site and foraging was recorded throughout the proposed development site. A medium level of bat activity was recorded for this species of bat.

Leisler's bats were recorded commuting into the survey area from an easterly and southern direction and foraging was recorded over the mature trees adjacent to the Broadmeadow River. A medium level of bat activity was recorded for this species of bat.

Soprano pipistrelles were principally recorded foraging and commuting along the Broadmeadow River and associated treelines. A medium level of bat activity was recorded for this species.

The remaining two bat species are considered to be less common in Ireland. Daubenton's bats were recorded on the Broadmeadow River and the associated treelines. A low level of bat activity was recorded for this species of bat. Brown long-eared bats were recorded within the dense treelines along the northern boundary of the site and with some encounters in the scrub located adjacent to the derelict car parks. A low level of bat activity was recorded for this species of bat.

Overall, the level of bat activity could be considered as Medium level for the proposed development site. The Broad Meadow River valley is considered to be an locally important area for bats.

4.2 Bat Foraging Habitat & Commuting Routes

The proposed development site is comprised of linear woodland, treelines and hedgerows and the northern boundary flanks the Broadmeadow River valley. This connects to the Ward River Valley to the east of the prosed development site. The proposed development site is within an urban setting with agricultural fields located to the north.

The proposed development site is principally used a commuting route and foraging area for bats. All of the treelines and wood areas adjacent to the Broadmeadow River are used as foraging areas for bats. This linear habitat was also the principal area where brown long-eared bats and *Myotis* species were recorded.

4.3 Zone of Influence – Bat Landscape Connectivity

The linear woodland, treelines and hedgerows and the northern boundary flanks the Broadmeadow River valley connects to the Ward River Valley to the east of the prosed development site and to the agricultural fields to the north.

5. Impact Assessment & Mitigation

The following bat species were recorded during this bat survey: common pipistrelle, soprano pipistrelle, Leisler's bat, Daubenton's bat and brown long-eared bat. This represents five of the nine resident bat species known to Ireland.

5.1 Impact Assessment - Loss of bat roosts

There are no buildings / structures within the proposed development area and therefore there will be no loss of building roosts.

Twenty-one trees were classified as Category 2 Potential Bat Roosts (PBRs), ten of which are marked for felling. Therefore there is a potential loss of trees recorded as PBRs. However, the majority of the trees and associated vegetation will be retained, especially in vicinity of the river valley, which will reduce the overall impact of tree felling on local bat populations.

5.2 Impact Assessment – Foraging & Commuting Habitats

The Arboriculture Impact Assessment indicates that 10 trees which are considered to have a PBR value are to be removed. In addition, Tree groups 2 and 4, section of Tree group 5, Hedgerow 1 and sections of Hedgerow 2 is proposed to be removed. However the majority of the tall vegetation along the Broad Meadow River will remain and this is the primary area for commuting and foraging bat populations. The Landscape Master Plan proposes to retain this area with some removal of scrub to provide amenity areas along the river and is included in the Open Space Layout as a Riverside Park (Broadmeadow Linear Park) (Figure 10a).

5.3 Impact Assessment – Construction of residential development

The construction of the proposed residential development will potentially increase the degree of light (both street and residential lighting) spilling onto the treeline and woodland habitats within the survey area. This will potentially impact on bats species considered to be light sensitive such as brown long-eared bats and Daubenton's bat. However the lighting plan has been designed to minimise potential impact on bats and no lighting is proposed along the Boradmeadow River and adjacent linear woodland. Therefore the main commuting and bat foraging habitat will remain a dark zone post development.

5.4 Landscape Plan

The Landscape Master Plan indicates individual trees, sections of Tree groups 2 and 4, section of Tree group 5, Hedgerow 1 and sections of Hedgerow 2 that are to be removed to facilitate the construction of the proposed development.

The Landscape & Green Infrastructure Strategy aims "to retain the primary green features of field hedgerows and woodland along the Broadmeadow River". This will lead to the development of a Broadmeadow Linear Park which is a positive step towards retaining important commuting and foraging areas for local bat populations. In addition, the central green area (Green Spine) through the park will also provide landscaping links to the Broadmeadow Linear park.

The proposed planting is a mixture of native and non-native tree and shrub species

Figure 11: Open Space Layout (Source: PL55 Open Space Approach.pdf).

5.5 Lighting Plan

It is important that any proposed lighting for the proposed residential development is wildlife friendly and that there is a provision for continued dark zones to facilitate movement of light sensitive bat species such as brown long-eared bats and Daubenton's bats. This is particularly important along the northern boundary of the proposed development site (i.e. adjacent to the Broadmeadow River).

Nocturnal mammals are impacted by lighting. Therefore it is important that lighting installed within the proposed development site is completed with sensitivity for local wildlife while still providing the necessary lighting for human usage. It is also important that developments reduce their impact on the night sky and reduce sky glow. The "Dark Sky" principal should be followed – i.e. no upward lighting to reduce light pollution. The following principles should be followed:

- Luminaire design for any street lighting or lighting on buildings 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 (BCT, 2018).

The Lighting Report has taken into consideration the "Bats and artificial lighting in the UK: bats and the built environment series. Guidance Note 09/2018". The lighting plan was assessed using the table below and the lighting plan meets the guidelines listed.

Table 10a: Assessment of proposed lighting plan in relation to Bats and artificial lighting in the UK: bats and the built environment series. Guidance Note 08/2019" (BCT, 2018).

BCT (2018) Recommendations	Applied to Proposed Lighting Plan
All luminaires used will lack UV/IR elements to reduce impact.	LED – therefore UV/IR elements will be nil.
LED luminaires will be used due to the fact that they are highly directional, lower intensity, good colour rendition and dimming capability.	LED
A warm white spectrum (<2700 Kelvins will be used to reduce the blue light component of the LED spectrum).	2700 Kelvins (apart from Luminaire F where lamps are located along the main road south of the proposed development. These luminaires will be 4000 Kelvins. However as these are located away from the main bat foraging areas, it will not impact on local bat populations).
Luminaires will feature peak wavelengths higher than 550nm to avoid the component of light most disturbing to bats.	Yes
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 and greenway areas, if deemed necessary.	6m No lighting proposed for cycle path along Broadmwadow River.
Only luminaires with an upward light ratio of 0% and with good optical control will be used.	Yes
Luminaires will be mounted on the horizontal, i.e. no upward tilt.	Yes
Any external security lighting will be set on motion-sensors and short (1min) timers. The intensity of external lighting should be limited to ensure that skyglow does not occur in order to reduce light pollution.	Yes

In addition, there is no lighting proposed along the Broadmeadow River and adjoining woodland area which will ensure the principal foraging and commuting area for local bat populations recorded. Below is the illuminance map of the area along the Broadmeadow River (please consult Outdoor Lighting Report for more details) and there is no lighting spill indicated into this area.

Figure 12: Illuminance map of proposed lighting plan in Grid 1 (Source: Outdoor Lighting Report).

5.6 Impact Assessment – Overall

A medium level of bat activity was recorded within the proposed development area with the majority of bat activity associated with the Broadmeadow River and linear woodland along the river valley. The overall potential impact of the proposed development is considered to be Permanent Slight-Moderate Negative Impact.

Table 10b: Potential impact of the proposed development on the different bat species recorded during survey work.

Works	SP	CP	Leis	BLE	Daub
Lighting of development area	Slight	Slight	Slight	Slight	Slight
Removal of sections of linear habitats	Slight-Moderate	Slight-Moderate	Slight	Slight	Slight
Removal of individual trees (potential tree roosts)	Slight-Moderate	Slight-Moderate	Slight-Moderate	Slight-Moderate	Slight-Moderate
Operation of the development site	Slight-Moderate	Slight-Moderate	Slight	Slight	Slight
Infrastructure	Slight-Moderate	Slight-Moderate	Slight	Slight	Slight
Landscape Plan – Planting	Positive	Positive	Positive	Positive	Positive

SP = soprano pipistrelle, CP = common pipistrelle, Leis = Leisler's bat, BLE = brown long-eared bat, Daub = Daubenton's bat

5.7 Mitigation Measures

The following mitigation measures are recommended to reduce the potential impact of the proposed development on local bat populations, to protect local bat populations during proposed works and to conserve local bat populations post residential development.

The bat mitigation measures described below take into consideration Marnell *et al.* (2022) as well as best practice guidelines from Collins (2016), EUROBATS (2018) and BCT (2018). The measures described are those considered to be practical and effective based on past experience of the principal bat specialist and for the proposed development site. Measures are reflective of 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 in relation to lighting and bat box schemes.

5.7.1 Tree Felling

A Phase One survey of trees was undertaken and trees considered to have a bat roosting value were identified as PBRs. Night-time surveys were undertaken in the vicinity of such trees to determine if there were roosting bats and none were recorded. However, due to the transient nature of bats, it is recommended that a Phase Two PBR survey is required for all PBR trees proposed to be felled. This is a precautionary step and if a bat roost is recorded, then an NPWS Derogation Licence is required to be applied where the existence of any tree roost is confirmed. This Phase Two survey should be undertaken at least one month prior to tree felling in order to propose a tree felling plan in conjunction with tree contractors.

i) Erection of an alternative roosting sites are required to be erected to removal of trees. These will be erected prior 6 months to tree felling to allow local bat populations to become aware of it prior to removal of the structure.

a. Rocket Bat Box (x2) – free-standing chamber on free standing pole (See appendices – Habibat Box). Location of rocket box will be in dark zones along the Broadmeadow River.
b. Summer Bat Boxes (1FF Schwegler woodcrete or similar design (no timber bat boxes)) – 10 bat boxes should also be erected on mature trees within the proposed development site (e.g. pine trees located beside Newtown Bridge).

Bat boxes will be erected prior to tree felling and will be erected under supervision by the bat specialist. Some general points that will be followed include:

- Straight limb trees (or telegraph pole) with no crowding branches or other obstructions for at least 3 metres above and below position of bat box.
- Diameter of tree should be wide and strong enough to hold the required number of boxes.
- Locate bat boxes in areas where bats are known to forage or adjacent to suitable foraging areas. Locations should be sheltered from prevailing winds.
- Bat boxes should be erected at a height of 4-5 metres to reduce the potential of vandalism and predation of resident bats.
- It is recommended to erect a number of bat boxes on one tree at an array of aspects. South facing boxes will receive the warmth of the sun, which is necessary for maternity colonies. In large bat box scheme it is generally recommended to have three bat boxes arranged at the same height facing North, South-East and South-West. This ensures a range of temperatures are available all day. If the South facing boxes become warm, bats can safely remove to the cooler North facing box.
- Locations for bat boxes will be selected to ensure that the lighting plan for the proposed site does not impact on the bat boxes.

Trees proposed to be removed, will be felled on mild days during the autumn months of September, October or November or Spring month of February (felling during the spring or autumn months avoids the periods when the bats are most active or most vulnerable during hibernation).

An assessment of trees according to their PBR value determines the methodology of felling. The trees identified within the survey area are PBR Category 2. The procedure to fell these is as follows:

- Category 2: Trees with roosting features (dead wood, tree holes etc.) should be checked prior to felling. It is recommended that they are physically checked (using an endoscope and high power torch) or a dusk/dawn surveys are completed to determine if bats are roosting within. A tree felling plan will be required in consultation with the tree surgeons. A bat box scheme will need to be erected prior to felling and in consultation with the bat specialist. Any trees showing crevices, hollows, *etc*., should be removed while a bat specialist is present to deal with any bats found. Such animals should be retained in a box until dusk and released on-site. Large mature trees will be felled carefully, essentially by gradual dismantling by tree surgeons, under supervision of a bat specialist. Care will be taken when removing branches as removal of loads may cause cracks or crevices to close, crushing any animals within.
- Category 2: Any ivy covered trees which require felling will be left to lie for 24 hours after cutting to allow any bats beneath the cover to escape.

5.7.2 Lighting Plan

Lighting Plan has taken into consideration recommendations and will therefore comply with BCT (2018) guidelines. A particular emphasis was made to ensure that there is no lighting planned along the Broadmeadow River and the adjoining linear woodland. This will ensure that there is a dark corridor along these habitats which will allow local bat populations to commute and avail of foraging habitats.

In addition to above, there is no lighting proposed for the cycle path and therefore lighting is avoiding the principal bat habitats along the Broadmeadow River.

All lighting within the proposed development site will meet BCT (2018) guidelines thereby minimising potential impact on local bat populations.

5.7.3 Landscape Master Plan

In addition to the proposals within the Landscape Master Plan, it is recommended that an additional native hedgerow is planted along the eastern boundary of the site. The proposed species mix is as follows:

- Hedgerow species: Crataegus monogyna, Corylus avellane, Prunus spinosa. Rosa canina, Ilex aquifolium, Sambucus nigra.
- Tree species: Alnus glutinosa (alder), Sorbus aucuparia (rowan), Quercus robur (pedunculate oak), Quercus petraea (sessile oak), Pinus sylvestris (Scots pine), Betula pendula (silver birch), Betula pubescens (downy birch).

It is also recommended to plant at least 2 trees for each tree proposed to be felled, using the tree species mix provided above. These should be located along the northern boundary of the proposed development site (e.g. Broadmeadow Riverside park).

5.7.4 During Construction Period

During the construction phase of the proposed development, it is proposed that lighting within the construction zone is turned off outside daytime working hours.

All habitats, trees and hedgerows (particularly within the river valley) are protected during the construction phase from damage.

5.7.5 Monitoring

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

- Inspection of bat boxes within one year of erection of bat box scheme/rocket box. Register bat box scheme, rocket bat boxes and supplementary roosts with Bat Conservation Ireland. This should be undertaken for a minimum of 2 years.
- Monitoring of any bat mitigation measures. All mitigation measures should be checked to determine that they were successful. A full summer bat survey is recommended post-works.

If the mitigation measures recommended in this report are strictly followed the potential impact of the proposed development on local bat populations will be reduced to Permanent Slight-Moderate Negative impact.

6. Bat Assessment Conclusions

This report provides information on the bat usage of the proposed development site. A total of five bat species were recorded: common pipistrelle, Leisler's bat, soprano pipistrelle, Daubenton's bat and brown long-eared bat.

- Common pipistrelle was the most frequently encountered bat species. A medium level of bat activity was recorded for this species within the proposed development site.
- Leisler's bats were principally recorded commuting into the proposed development site from an easterly and southerly direction. A medium level of bat activity was recorded for this species of bat within the proposed development site.
- Soprano pipistrelles were recorded foraging and commuting principally along northern boundary of the proposed development site. A medium level of bat activity was recorded for this species of bat within the proposed development site.
- The remaining bat species recorded are considered to be less common in Ireland (Daubenton's bat and brown long-eared bat) and a low level of bat activity was recorded for these species of bat. The presence of these two species was primarily associated with the Broadmeadow River and adjacent linear woodland.

The proposed development site is a small area and is principally used a commuting route and foraging area for five species of bat. While no bat roosts were recorded within the proposed development site, 21 trees were deemed to have bat roosting potential, 10 of which are marked for tree felling. However additional surveying and felling proposals will ensure that the trees are felled in a sensitive manner while alternative roosting sites (e.g. bat boxes) and additional planting will mitigate for the loss of these trees.

Overall, the level of bat activity recorded within the proposed development site could be considered as Medium level. Without bat mitigation measures the proposed development will likely have a Permanent Slight-Moderate Negative impact on local bat populations.

The lighting plan does not plan for lighting along the cycle path and within the Broadmeadow River Valley (i.e. Broadmeadow Riverside Park) and therefore reducing the potential impact of the lighting plan on local bat populations. The lighting plan within the proposed development site is design to meet bat lighting guidelines.

The landscape plan aims to retain as much of the trees, treelines and woodland area within and adjacent to the proposed development site. It will also undertake additional planting to provide foraging and commuting habitat for local bat populations.

Therefore the proposed development, if all mitigation measures including the Lighting Plan and Landscape Plan are strictly adhered to, will likely have a Permanent Slight Negative impact on local bat populations.

7. Bibliography

Abbott, I. M., Butler, F. And Harrison, S. (2012) When flyways meet highways – the relative permeability of different motorway corssing sites to functionality diverse bat species. Landscape and Urban Planning 106 (4): 293-302.

Abbott, I. M., Berthinessen, A., Stone, E., Booman, M., Melber, M. and Altringham, J. (2015) Bats and Roads, Chapter 5, pp/ 290-299. In: Handbook of Road Ecology. Editors: R. Van der Ree., D. J. Smidt and C. Grilo. Wiley Blackwell.

Altringham, J. D. (2013) Biritah Bats. Collins New Naturalist Library, Volume 93. Haper Collins, London.

Altringham, J. And Kerth, G. (2016) Bats and Roads, Chapter 3. In: Bats in the Anthropocence: Conservation of Bats in a Changing World. Editors: C. C. Voigt and T. Kingston. Springer Open.

Aughney, T., Roche, N., & Langton, S (2018) The Irish Bat Monitoring Programme 2015-2017. *Irish Wildlife Manuals*, No. 103. National Parks and Wildlife Service, Department of Cultural heritage and the Gaeltacht, Ireland.

Barratt, E. M., Deauville, R., Burland, T. M., Bruford, M. W., Jones, G., Racey, P. A., & Wayne, R. K. (1997). DNA answers the call of pipistrelle bat species. *Nature* 387: 138 - 139.

Bat Conservation Ireland (2015) BATLAS 2020 Pilot Project 2015: Volunteer Survey Manual. Version 01. www.batconservationireland.org.

Bat Conservation Trust (2018) Bats and artificial lighting in the UK: bats and the built environment series. Guidance Note 08/2019. BCT, London.

Bharddwaj, M., Soaner, K., Straka, T., Lahoz-Monfort, J., Lumsden, L. F. and van der Ree, R. (2017) Differential use of highway underpasses by bats. Biological Conservation 212: 22-28.

Billington, G. E. & Norman, G. M. (1997). A report on the survey and conservation of bat roosts in bridges in Cumbria, Kendal. English Nature.

BTHK (2018) Bat Roosts in Trees – A Guide to Identification and Assessment for Tree-Care and Ecology Professionals. Exeter: Pelagic Publishing.

CIEEM (2016) Guidelines for Ecological impact Assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal (2nd Edition). CIEEM, Winchester.

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

Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention) 1982.

Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention) 1979.

Dietz, C., Helversen, O. and Dietmar, N. (2011) Bats of Britain, Europe & Northweat Africa. A&C Black, London.

EC Directive on The Conservation of Natural habitats and of Wild Fauna and Flora (Habitats Directive) 1992.

Gunnell, K., Grant, G. and Williams, C (2012) Landscape and urban design for bats and biodiversity. The Bat Conservation Trust, London.

Hundt, L. (2012) Bat Surveys: Good Practice Guidelines (2nd Edition). The Bat Conservation Trust, London.

Kelleher, C. & Marnell, F. (2006) Bat Mitigation Guidelines for Ireland. Irish Wildlife Manuals, No. 25. National Parks and Wildlife Service, Department of Environment, Heritage and Local Government, Dublin, Ireland.

Lundy, M.G., Montgomery, I.W., Roche, N. & Aughney, T. (2011). *Landscape Conservation for Irish Bats & Species Specific Roosting Characteristics* (Unpublished). Bat Conservation Ireland, Cavan, Ireland.

Lysaght, L. and Marnell, F. (eds) (2016) Atlas of Mammals in Ireland 2010-2015, National Biodiversity Data Centre, Waterford.

Marnell, F., Kingston, N. & Looney, D. (2009) *Ireland Red List No. 3: Terrestrial Mammals*, National Parks and Wildlife Service, Department of the Environment, Heritage and Local Government, Dublin, Ireland.

Mathews, F., Roche, N., Aughney, T., Jones, N,M Day, J., Baker, J. and Langton, S. (2015) Barriers and benefits: implications of artificial night-lighting for the distribution of common bats in Britain and Ireland. *Philosphical Transactions of the Royal Society of London B* 370 (1667), doi: 10.1098/rstb.2014.0124.

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. McAney, K. (2014). An overview of Rhinolophus hipposideros in Ireland (1994-2014). *Vespertilio* **17**, 115–125.

McAney, K., O'Mahony, C., Kelleher, C., Taylor, A. & Biggane, S. (2013). *The Lesser Horseshoe Bat in Ireland: Surveys by The Vincent Wildlife Trust*. Belfast, Northern Ireland: Irish Naturalists' Journal.

Mullen, E. (2007). Brandt's Bat *Myotis brandtii* in Co. Wicklow. Irish Naturalists' Journal 28: 343.

O'Sullivan, P. (1994). *Bats in Ireland.* Special supplement to the Irish Naturalists' Journal.

Richardson, P. (2000). *Distribution atlas of bats in Britain and Ireland 1980 - 1999*. The Bat Conservation Trust, London, UK.

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

Roche, N., Langton, S. & Aughney, T. (2012). *Lesser Horseshoe Bat: Population, Trends and Threats 1986 to 2012* (Unpublished). Bat Conservation Ireland, Cavan, Ireland.

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

Russ, J. (2012) British Bat Calls: A guide to species identification. Pelagic Publishing, Exeter.

Schofield, H. (2008). *The Lesser Horseshoe Bat Conservation Handbook*. Herefordshire, England: The Vincent Wildlife Trust.

Stebbings, R. E. & Walsh, S. T. (1991) *Bat Boxes: A guide to the history, function, construction and use in the conservation of bats.* The Bat Conservation Trust, 1991.

Whilde, A. (1993). *Threatened mammals, birds, amphibians and fish in Ireland. Irish Red Data Book 2: Vertebrates.* Belfast: HMSO.

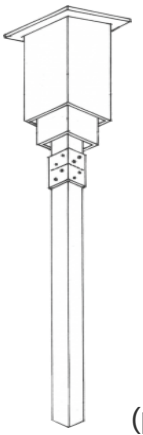
Wildlife Act 1976 and Wildlife [Amendment] Act 2000. Government of Ireland.

8. Appendices

8.1 Appendix 1

A) Alternative Bat Roosting (Tree Mitigation)

Habibat Double Chambered Rocket Box
Pole-mountable bat box to provide extensive roosting space



(please view on www.nhbs.com)

Recommended - An Irish supplier of this type of bat box is:

Shop - Eire Ecology – Rocket Bat Box (please order at least 3 months in advance as these boxes are made to order)

Examples of bat box design (self-cleaning boxes i.e. opened at the bottom to allow bat droppings to fall out).

a) Woodcrete 1FF (Potential supplier - www.nhbs.com)

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

Please order 3 months in advance as delivery delays have been noted.

8.2 Appendix 2 Static Surveillance Results

2017 Static Surveillance Results

Table 1: Songmeter SM2 Bat+ Unit 2

Time (hrs)	Leis	SP	CP	BLE	Myotis
11th to 12th August 2017					
21:00-22:00	2 passes	1 pass	3 passes	0 passes	0 passes
22:00-23:00	2 passes	0 passes	1 pass	0 passes	0 passes
23:00-00:00	0 passes	3 passes	0 passes	0 passes	0 passes
00:00-01:00	1 pass	1 pass	2 passes	0 passes	0 passes
01:00-02:00	1 pass	3 passes	2 passes	0 passes	0 passes
02:00-03:00	0 passes	2 passes	1 pass	0 passes	0 passes
03:00-04:00	0 passes	0 passes	0 pass	0 passes	0 passes
04:00-05:00	0 passes	2 passes	3 passes	0 passes	0 passes
12th to 13th August 2017					
21:00-22:00	2 passes	0 passes	3 passes	0 passes	0 passes
22:00-23:00	0 passes	1 pass	3 passes	0 passes	0 passes
23:00-00:00	1 pass	0 passes	8 passes	0 passes	0 passes
00:00-01:00	1 pass	0 passes	8 passes	0 passes	0 passes
01:00-02:00	0 passes	2 passes	2 passes	0 passes	0 passes
02:00-03:00	0 passes	0 passes	3 passes	0 passes	0 passes
03:00-04:00	2 passes	0 passes	4 passes	0 passes	0 passes
04:00-05:00	0 passes	0 passes	1 pass	0 passes	0 passes
13th to 14th August 2017					
21:00-22:00	0 passes	9 passes	4 passes	0 passes	0 passes
22:00-23:00	0 passes	1 pass	3 passes	0 passes	0 passes
23:00-00:00	1 pass	0 passes	8 passes	0 passes	0 passes
00:00-01:00	1 pass	0 passes	7 passes	0 passes	0 passes
01:00-02:00	0 passes	2 passes	2 passes	0 passes	0 passes
02:00-03:00	0 passes	0 passes	3 passes	0 passes	0 passes
03:00-04:00	2 passes	0 passes	4 passes	0 passes	0 passes
04:00-05:00	0 passes	0 passes	1 pass	0 passes	0 passes
14th to 15th August 2017					
21:00-22:00	0 passes	7 passes	12 passes	0 passes	0 passes
22:00-23:00	2 passes	43 passes	93 passes	0 passes	2 passes
23:00-00:00	0 passes	19 passes	5 passes	0 passes	1 pass
00:00-01:00	0 passes	1 pass	0 passes	0 passes	0 passes
01:00-02:00	0 passes	2 passes	0 passes	0 passes	0 passes
02:00-03:00	0 passes	0 passes	0 passes	0 passes	0 passes
03:00-04:00	0 passes	1 pass	0 passes	0 passes	0 passes
04:00-05:00	0 passes	1 pass	0 passes	0 passes	0 passes

Table 2: Songmeter SM2 BAT+ Unit 4

Time (hrs)	Leis	SP	CP	BLE	Myotis
11th to 12th August 2017					
21:00-22:00	0 passes	6 passes	0 passes	0 passes	0 passes
22:00-23:00	0 passes	0 passes	0 passes	0 passes	0 passes
23:00-00:00	2 passes	0 passes	0 passes	0 passes	0 passes
00:00-01:00	6 passes	4 passes	4 passes	0 passes	0 passes
01:00-02:00	2 passes	7 passes	6 passes	1 pass	0 passes

02:00-03:00	0 passes	5 passes	17 passes	1 pass	0 passes
03:00-04:00	2 passes	1 pass	4 passes	0 passes	0 passes
04:00-05:00	1 pass	0 passes	2 passes	0 passes	0 passes
12th to 13th August 2017					
21:00-22:00	0 passes	0 passes	1 pass	0 passes	0 passes
22:00-23:00	3 passes	0 passes	0 passes	0 passes	0 passes
23:00-00:00	0 passes	1 pass	1 pass	0 passes	0 passes
00:00-01:00	1 pass	1 pass	0 passes	0 passes	0 passes
01:00-02:00	0 passes	0 passes	0 passes	0 passes	0 passes
02:00-03:00	0 passes	0 passes	0 passes	0 passes	0 passes
03:00-04:00	0 passes	0 passes	0 passes	0 passes	0 passes
04:00-05:00	0 passes	0 passes	2 passes	0 passes	0 passes
13th to 14th August 2017					
21:00-22:00	2 passes	5 passes	7 passes	3 passes	3 passes
22:00-23:00	3 passes	1 pass	3 passes	1 pass	0 passes
23:00-00:00	0 passes	1 pass	3 passes	2 passes	2 passes
00:00-01:00	1 pass	1 pass	5 passes	0 passes	0 passes
01:00-02:00	0 passes	0 passes	2 passes	0 passes	0 passes
02:00-03:00	0 passes	0 passes	4 passes	0 passes	0 passes
03:00-04:00	0 passes	0 passes	0 passes	0 passes	1 pass
04:00-05:00	0 passes	2 passes	5 passes	0 passes	0 passes
14th to 15th August 2017					
21:00-22:00	2 passes	0 passes	0 passes	0 passes	0 passes
22:00-23:00	3 passes	2 passes	2 passes	0 passes	0 passes
23:00-00:00	0 passes	0 passes	3 passes	0 passes	0 passes
00:00-01:00	0 passes	0 passes	0 passes	0 passes	0 passes
01:00-02:00	1 pass	1 pass	0 passes	0 passes	0 passes
02:00-03:00	0 passes	0 passes	1 pass	0 passes	0 passes
03:00-04:00	0 passes	1 pass	0 passes	0 passes	0 passes
04:00-05:00	0 passes	0 passes	0 passes	0 passes	0 passes

Table 3: Songmeter SM2 Bat+ Unit 5

Time (hrs)	Leis	SP	CP	BLE	Myotis
11th to 12th August 2017					
21:00-22:00	1 pass	26 passes	5 passes	0 passes	0 passes
22:00-23:00	1 pass	42 passes	95 passes	0 passes	1 pass
23:00-00:00	0 passes	20 passes	47 passes	1 pass	0 passes
00:00-01:00	0 passes	44 passes	43 passes	0 passes	1 pass
01:00-02:00	2 passes	117 passes	28 passes	0 passes	2 passes
02:00-03:00	2 passes	119 passes	39 passes	0 passes	1 pass
03:00-04:00	0 passes	25 passes	58 pass	0 passes	2 passes
04:00-05:00	0 passes	17 passes	28 passes	0 passes	1 pass
12th to 13th August 2017					
21:00-22:00	2 passes	4 passes	13 passes	0 passes	0 passes
22:00-23:00	3 passes	32 passes	17 passes	0 passes	7 passes
23:00-00:00	2 passes	19 passes	10 passes	0 passes	2 passes
00:00-01:00	2 passes	23 passes	33 passes	0 passes	1 pass
01:00-02:00	0 passes	164 passes	27 passes	0 passes	2 passes
02:00-03:00	2 passes	174 passes	27 passes	0 passes	1 pass
03:00-04:00	0 passes	61 passes	21 passes	0 passes	7 passes
04:00-05:00	0 passes	18 passes	11 passes	0 passes	5 passes

13th to 14th August 2017					
21:00-22:00	16 passes	5 passes	7 passes	3 passes	3 passes
22:00-23:00	3 passes	1 pass	3 passes	1 pass	0 passes
23:00-00:00	0 passes	1 pass	3 passes	2 passes	2 passes
00:00-01:00	1 pass	1 pass	5 passes	0 passes	0 passes
01:00-02:00	0 passes	0 passes	2 passes	0 passes	0 passes
02:00-03:00	0 passes	0 passes	4 passes	0 passes	0 passes
03:00-04:00	0 passes	0 passes	0 passes	0 passes	1 pass
04:00-05:00	0 passes	2 passes	5 passes	0 passes	0 passes
14th to 15th August 2017					
21:00-22:00	0 passes	7 passes	12 passes	0 passes	0 passes
22:00-23:00	2 passes	43 passes	93 passes	0 passes	2 passes
23:00-00:00	0 passes	19 passes	5 passes	0 passes	1 pass
00:00-01:00	0 passes	1 pass	0 passes	0 passes	0 passes
01:00-02:00	0 passes	2 passes	0 passes	0 passes	0 passes
02:00-03:00	0 passes	0 passes	0 passes	0 passes	0 passes
03:00-04:00	0 passes	1 pass	0 passes	0 passes	0 passes
04:00-05:00	0 passes	1 pass	0 passes	0 passes	0 passes

2018 Static Surveillance Results

Date	SP	CP	Leis	BLE	Myotis
27/09/2018	0	11	3	0	0
28/09/2018	2	6	1	0	0
29/09/2018	2	12	4	0	0
SM3	**4**	**29**	**8**	**0**	**0**

Date	SP	CP	Leis	BLE	Myotis
27/09/2018	2	11	4	0	0
28/09/2018	10	14	2	0	0
29/09/2018	5	3	7	0	0
SM5	**17**	**28**	**13**	**0**	**0**

Date	SP	CP	Leis	BLE	Myotis
27/09/2018	77	113	22	2	5
28/09/2018	56	279	56	5	14
29/09/2018	46	312	67	8	8
SM2	**179**	**704**	**145**	**15**	**27**

2019 Static Surveillance Results

Date	SP	CP	Leis	BLE
29/08/2019	1	9	4	0
30/08/2019	0	1	0	0
31/08/2019	4	11	1	0
SM3	**5**	**21**	**5**	**0**

Date	SP	CP	Leis	BLE
29/08/2019	2	11	4	0

30/08/2019	1	14	2	0
31/08/2019	1	3	3	0
SM5	**4**	**28**	**9**	**0**

Date	SP	CP	Leis	BLE
29/08/2019	7	3	2	1
30/08/2019	4	1	2	1
31/08/2019	7	3	0	8
SM2	**18**	**7**	**4**	**10**

2020 Static Surveillance Results

Date	SP	CP	Leis	Myotis	Daub	BLE
02/06/2020	29	196	16	0	0	0
03/06/2020	26	312	3	0	0	0
04/06/2020	30	334	7	0	0	0
05/06/2020	4	31	0	0	0	0
06/06/2020	117	125	19	0	0	0
07/06/2020	11	117	71	0	0	0
Mini 1	**217**	**1115**	**116**	**0**	**0**	**0**

Date	SP	CP	Leis	Myotis	Daub	BLE
02/06/2020	95	227	74	1	93	0
03/06/2020	51	171	13	9	78	0
04/06/2020	38	159	31	12	63	0
05/06/2020	0	4	0	4	18	0
06/06/2020	32	86	30	9	61	1
07/06/2020	102	260	22	9	41	0
Mini 2	**318**	**907**	**170**	**44**	**354**	**1**

Date	SP	CP	Leis	Myotis	Daub	BLE
02/06/2020	3	85	31	0	0	1
03/06/2020	1	78	14	0	0	0
04/06/2020	10	95	29	0	0	0
05/06/2020	0	11	0	0	0	0
06/06/2020	5	62	133	0	0	0
07/06/2020	8	68	42	0	0	1
Mini 3	**27**	**399**	**249**	**0**	**0**	**2**

8.3 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).

9. Species Profiles

Leisler's bat

This bat species was recorded commuting through the proposed development site. 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
Biographical Range	km^2
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 & NPWS, 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.

Common pipistrelle

This species was the most recorded species along the proposed development site and it 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
Biographical Range	km^2
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 & NPWS, 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)

Soprano pipistrelle

This species was the second most recorded species along the proposed development site and it 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
Biographical Range	km^2
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 & NPWS, 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).

Brown long-eared Bat

This species is generally considered to be widespread across the island, but only a few records are known for County Limerick. 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
Biographical Range	km²
Irish Population Trend	2008-2013 Stable
Biographical Range	km²
Estimate Core Area (Lundy *et al. 2011)*	49,929 km²

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

Daubenton's bat

The modelled Core Area for Daubenton's bats is a relatively large area that covers much of the island of Ireland (41,285km²) 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
Biographical Range	km²
Irish Population Trend	2008-2013 Stable
Estimated Irish Population Size	81,000 to 103,000 (2007-2012)
Estimate Core Area (km²) (Lundy *et al. 2011)*	41,285

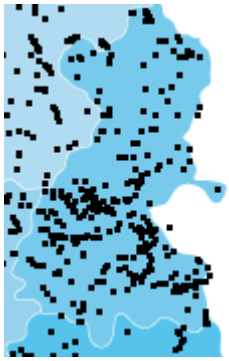
Taken from Roche *et al.,* 2014, Lysaght & Marnell, 2016 & NPWS, 2019

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

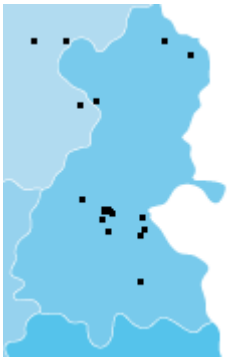
- Potential roost loss due to bridge maintenance;
- Loss of woodland and forest clearance;
- Loss of woodland, scrub and hedgerows;
- Tree surgery and felling;
- Increasing urbanisation; and
- Light pollution.

9.1 Bat Conservation Ireland Bat Species Maps

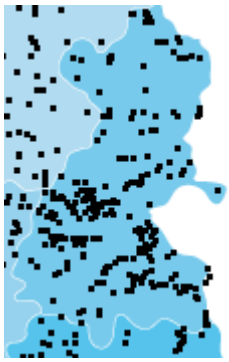
Bat records for County Dublin (Source: www.batconservationireland.org)



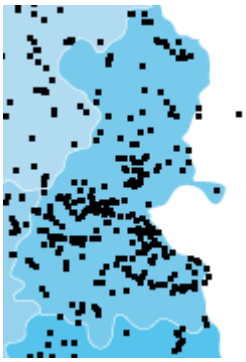
Common pipistrelle



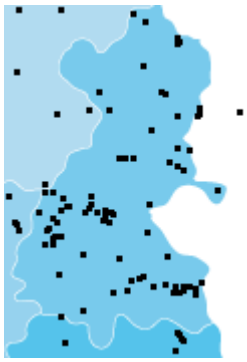
Nathusius' pipistrelle



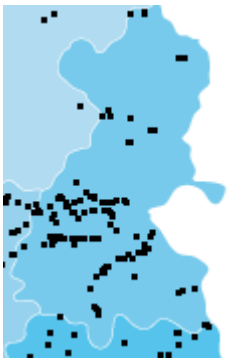
Soprano pipistrelle



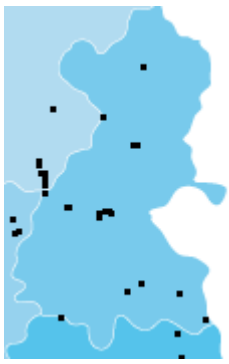
Leisler's bat



Brown long-eared bat



Daubenton's bat



Natterer's bat

Whiskered bat

Lesser horseshoe bat