

2020

Bat Assessment – Ballyhale Flood Relief Scheme



Soprano pipistrelle

Tina Aughney 2016

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Report Revision History

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Purpose

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

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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: Ballyhale Flood Relief Scheme, Ballyhale, Co. Kilkenny

Proposed work: Flood Relief Works

Bat Survey Results - Summary

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

Bat Survey Duties Completed (Indicated by red shading)

Tree PBR Survey	<input checked="" type="checkbox"/>	Daytime Building Inspection	<input checked="" type="checkbox"/>
Static Detector Survey	<input checked="" type="checkbox"/>	Daytime Bridge Inspection	<input checked="" type="checkbox"/>
Dusk Bat Survey	<input checked="" type="checkbox"/>	Dawn Bat Survey	<input checked="" type="checkbox"/>
Walking Transect	<input checked="" type="checkbox"/>	Driving Transect	<input type="checkbox"/>
Trapping / Mist Netting	<input type="checkbox"/>	IR Camcorder filming	<input type="checkbox"/>
Endoscope Inspection	<input checked="" type="checkbox"/>	Other	<input type="checkbox"/>

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1. Introduction

Bat Eco Services was commissioned by DBFL Consulting Engineers to undertake a bat survey of proposed flood relief options for Ballyhale, Co. Kilkenny. The purpose of this bat survey is to determine the local bat populations and potential constraints which may influence the assessment and design of the project's route options and the final selection of a preferred flood relief route.

1.1 Relevant Legislation & Bat Species Status in Ireland

A small number of these animal and plant species are protected under Irish legislation (Nelson, *et al.*, 2019). The principal Irish legislation is the Wildlife Act 1976. Amendments to the Wildlife Act and its Statutory Instruments have enacted and amended protection of individual species, notably in order to comply with EU legislation or other international agreements. The Birds and Habitats Directives are the primary EU legislation resulting in the legal protection of species in Ireland. The Acts and Statutory Instruments which list species within the broad taxonomic groupings are referred to in the relevant sections.

1.1.1 Irish Legislation

The Wildlife Act 1976 (Number 39 of 1976) was amended on four occasions up to 2019, the principal being the Wildlife (Amendment) Act 2000 (Number 38 of 2000). The Flora (Protection) Order lists the plant species protected by Section 21 of the Wildlife Acts. The regulations that give rise to the protection of animal species under the Wildlife Acts are detailed in the relevant sections. 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 primary legislation transposing the Nature Directives (Birds and Habitats Directives) into Irish law is the European Communities (Birds and Natural Habitats) Regulations 2011 (S.I. No. 477 of 2011), as amended.

The codes used for the EU Nature Directives and Habitats Directives (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.

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 mammal 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 a notifiable action and a derogation licence has to be obtained from the *National Parks and Wildlife Service* before works can commence. Any works interfering with bats and especially their roosts, may only be carried out under a licence to derogate from Regulation 23 of the Habitats Regulations 1997 and Regulation 54 of the European Communities (Birds and Natural Habitats) Regulations 2011 (which transposed the EU Habitats Directive into Irish law). The details with regards to appropriate assessments, the strict parameters within which derogation licences may be issued and the procedures by which and the order in relation to the planning and development regulations such licences should be obtained, are set out in Circular Letter NPWS 2/07 "*Guidance on Compliance with Regulation 23 of the Habitats Regulations 1997 - strict protection of certain species/applications for derogation licences*" issued on behalf of the Minister of the Environment, Heritage and Local Government on the 16th of May 2007.

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 (please see main body of text for more information in individual bat species) is presented in Table 1. The current status of the known bat species occurring in Ireland is given in the Table 1 below.

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 <i>Myotis daubentonii</i>	Least Concern	Least Concern	Least Concern
Whiskered bat <i>Myotis mystacinus</i>	Least Concern	Least Concern	Least Concern
Natterer's bat <i>Myotis nattereri</i>	Least Concern	Least Concern	Least Concern
Leisler's bat <i>Nyctalus leisleri</i>	Least Concern	Least Concern	Least Concern
Nathusius' pipistrelle <i>Pipistrellus nathusii</i>	Least Concern	Least Concern	Least Concern
Common pipistrelle <i>Pipistrellus pipistrellus</i>	Least Concern	Least Concern	Least Concern
Soprano pipistrelle <i>Pipistrellus pygmaeus</i>	Least Concern	Least Concern	Least Concern
Brown long-eared bat <i>Plecotus auritus</i>	Least Concern	Least Concern	Least Concern
Lesser horseshoe bat <i>Rhinolophus hipposideros</i>	Least Concern	Least Concern	Least Concern
Possible Vagrants ^			
Brandt's bat <i>Myotis brandtii</i>	Data deficient	Least Concern	Least Concern
Greater horseshoe bat <i>Rhinolophus ferrumequinum</i>	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.
- 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.
- 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.

Based on the information collected during the desktop studies and bat surveys, the bat ecologist assigns, where possible, an ecological value to each bat species recorded based on its conservation status at different geographical scales (Table 2). 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 2: 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: Kilkenny
Local	Proposed development and immediate surroundings
Negligible	None, the feature is common and widespread

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.

1.3 Project Description

1.3.1 Site Location

The Little Arrigle River, a tributary of the River Nore, flows west of Ballyhale, Co. Kilkenny. A tributary of the Little Arrigle River, known as the Ballyhale River, runs through the village of Ballyhale, Co. Kilkenny. It enters the village near the catholic church and splits into two channels either side of the church. As a consequence, there are numerous culverts and bridges along it's route through the village.

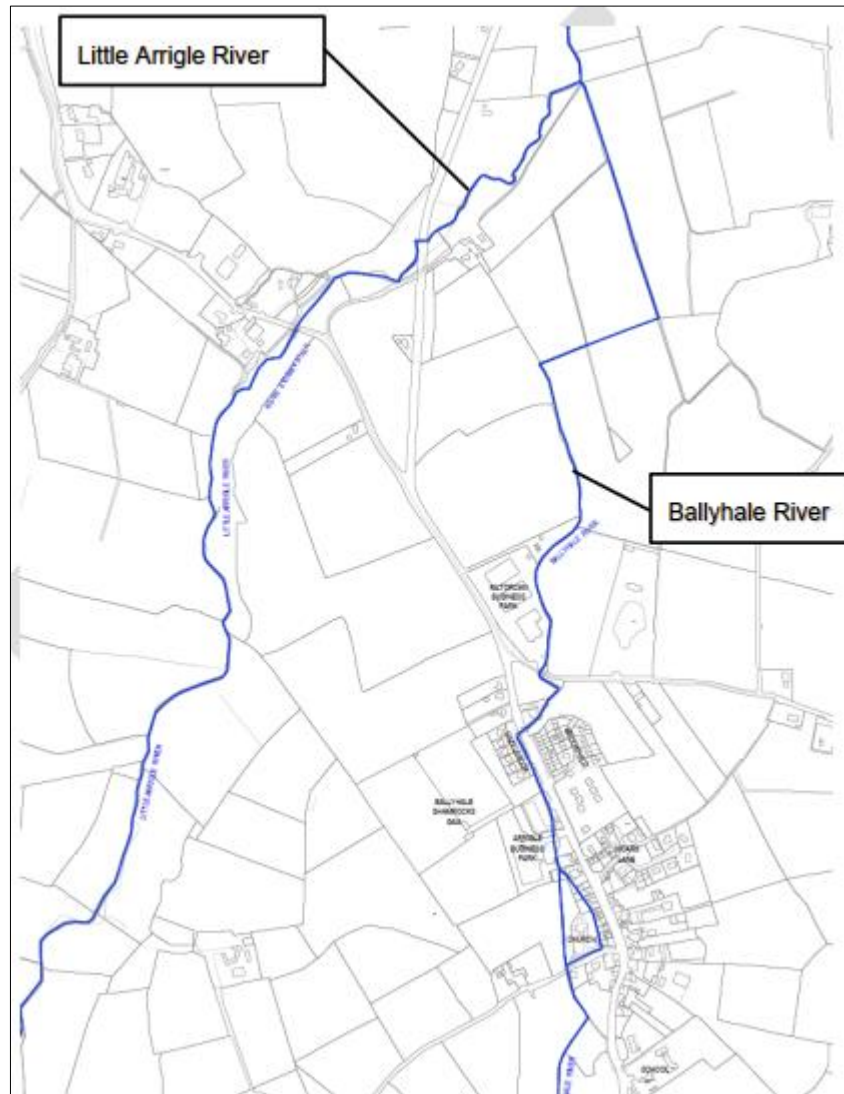
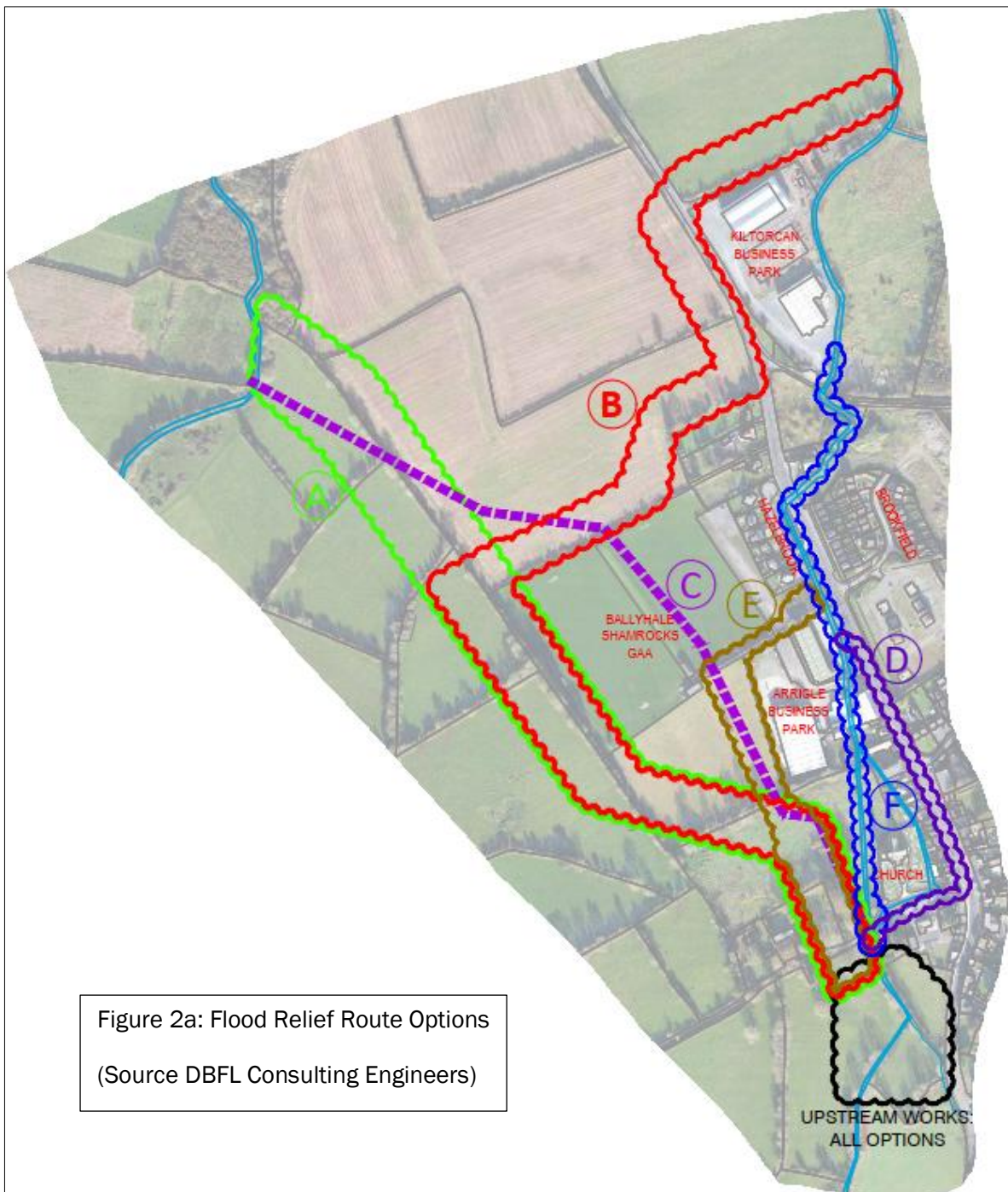


Figure 1: Watercourses in vicinity of Ballyhale, Co. Kilkenny (Source: 2005-REP-002 Constraints Report).

1.3.2 Proposed Project

The objective of the Ballyhale Flood Relief Scheme project is the identification, design and construction of a Flood Relief Scheme, that is technically, socially, environmentally and economical acceptable, to alleviate the risk of flooding to the community of Ballyhale (Source: DBFL Consulting).

As part of the constraints study, a number of options in relation to flood relief works have been proposed. These flood relief route options were used as the basis for the bat survey.



KEY (INDICATIVE ROUTE CORRIDOR)	OPTION	UPSTREAM WORKS	CONVEYANCE WORKS	NOTES
	A	FLOW DIVERSION STRUCTURE AND HARD DEFENSES	OPEN CHANNEL OVERFLOW ROUTE TO LITTLE ARRIGLE RIVER	
	B	FLOW DIVERSION STRUCTURE AND HARD DEFENSES	OPEN CHANNEL OVERFLOW ROUTE TO BALLYHALE RIVER	
	C	FLOW DIVERSION STRUCTURE AND HARD DEFENSES	OPEN CHANNEL OVERFLOW ROUTE TO LITTLE ARRIGLE RIVER	ROUTE PER OPW CFAM
	D	FLOW DIVERSION STRUCTURE AND HARD DEFENSES	UNDERGROUND PIPED OVERFLOW ROUTE ALONG EXISTING ROADS TO BALLYHALE RIVER	
	E	FLOW DIVERSION STRUCTURE AND HARD DEFENSES	PARTIALLY OPEN, PARTIALLY PIPED OVERFLOW ROUTE TO BALLYHALE RIVER	
	F	FLOW DIVERSION STRUCTURE AND HARD DEFENSES	UPGRADE WORKS TO EXISTING CHANNEL/STRUCTURES WHERE NEEDED	

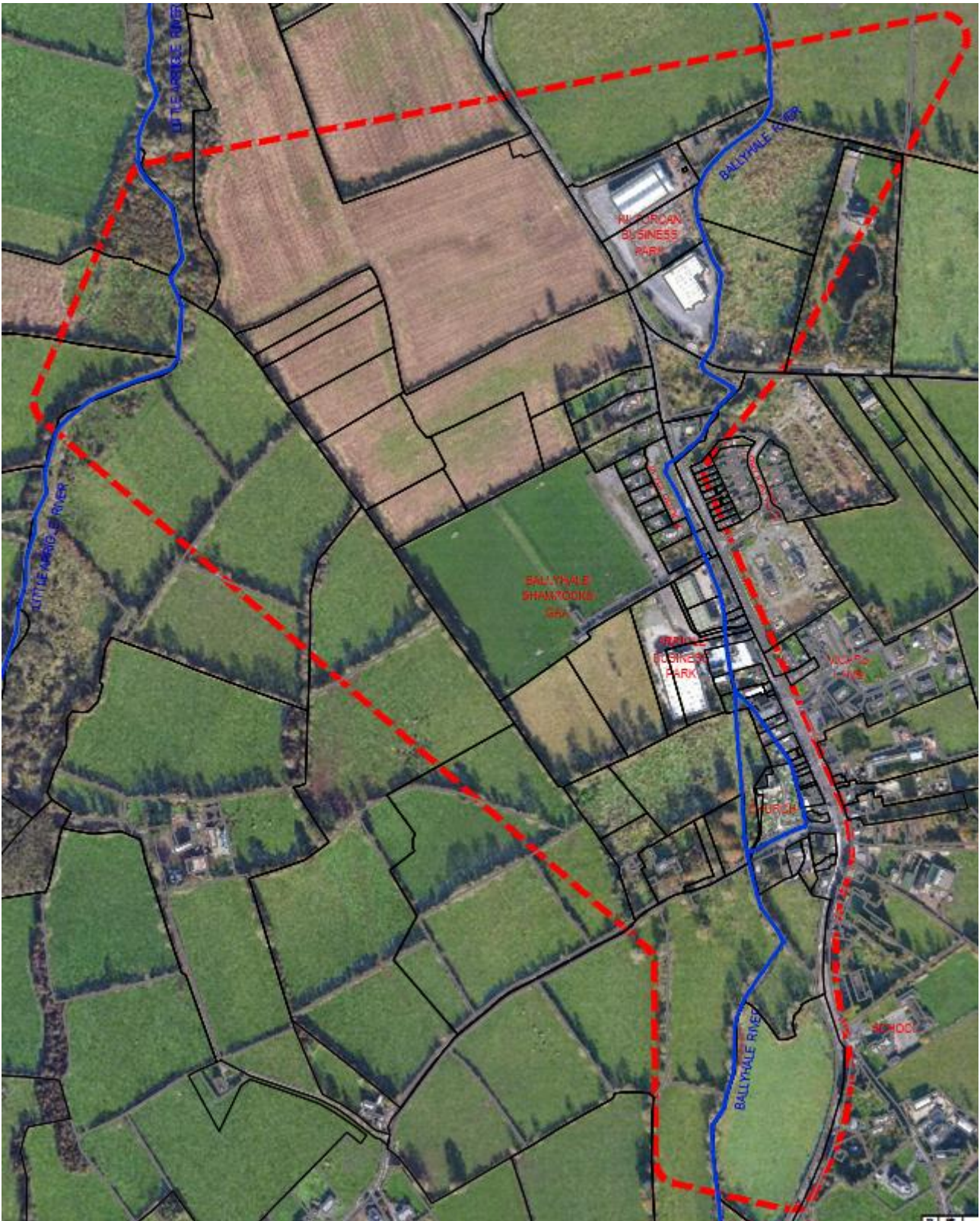


Figure 2b: Proposed bat survey area (Source DBFL Consulting Engineers)

1.3.3 Bat Survey Aims

The aims of the bat survey at the proposed project site are as follows:

- Collect robust data following good practice guidelines to allow an assessment of the potential impacts of the proposed project on local bat populations, both on and off-site (where possible);
- Facilitate the design of mitigation, enhancement and monitoring strategies for local bat populations recorded;
- Provide baseline information with which the results of post-construction monitoring surveys can be compared to, where appropriate;
- Provide information to enable NPWS and planning authorities to reach robust decisions with definitive required outcomes;
- Assist clients in meeting their statutory obligations;
- Facilitate the conservation of local bat populations.

Survey are comprised of many different types may differ from site to site depending on the goals of the survey. The following is a brief description of main types of surveys that can be completed. The surveys deemed suitable for a particular project is determine on a case-by-case basis.

- Emergence (dusk) surveys: surveying of buildings or structures to determine whether such building/structure is a bat roost. Undertaken from 10 minutes prior to sunset to 90 minutes after sunset.
- Walking transect: bat surveys completed on-foot where the surveyor(s) walk the survey site from 10 minutes prior to sunset to at least 110 minutes after sunset. Often this survey is completed post an emergence survey and therefore may be undertaken for a longer period of time after sunset.
- Driving transect: bat survey complete in a car and undertaken according to a strict survey protocol. Surveying is completed from 40 minutes after sunset till the end of the planned survey route. This is only undertaken for large survey area with a well-defined public road structure. Routes are planned and mapped prior to surveying.
- Dawn surveys: surveying of buildings or structures to determine whether such building/structure is a bat roost. Undertaken from 90 minutes prior to sunrise to 10 minutes after sunrise.
- Static surveys: placement of automated recording devices within the survey area. The units are set up during the daylight hours and left in place to record during the hours of darkness.
- Additional surveys required may include trapping / netting of bats. But this type of surveying is only undertaken where specific information is required (e.g. to determine if a roost is a maternity colony).

2. Bat Survey Methodology

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 type of bat roosts. Where possible, one of the objectives of the surveys is to be able to identify the types of roosts present, if any. However, the determination of the type of roost present depends on the timing of the survey and the number of bat surveys completed. Consequently, the definition of roost types, in this report, will be based on the following:

Table 3: 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

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

with the aid of a strong torch beam (LED Lenser P14.2) and endoscope (General DC5660A Wet / Dry Scope).

Bridge structures and similar stone structures are assessed using a 4-point classification system designed for bridges by Billington & Norman (1997) as follows:

Table 4: 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 are classified using the Bat Tree Habitat Key (BTHK, 2018) and the classification system used is from Collins (2016). The Potential Roost Features (PRFs) listed in this guide are used to determine the PBR value of trees.

Trees identified as PBRs are inspected during the daytime, where possible, for evidence of bat usage. Evidence of bat usage is in the form of actual bats (visible or audible), bat droppings, urine staining, grease marks (oily secretions from glands present 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.

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

Phase 2 inspections are, generally, recommended once a complete list of trees that have been identified as PBRs, and are mark for felling in order for the proposed development to be undertaken. The Phase 2 inspection will generally involve a closer examination of individual trees using a strong torch beam (LED Lenser P14.2) and endoscope (General DC5660A Wet / Dry Scope) and where required (and/or possible), height surveys are completed using a ladder. If a tree is deemed to be a roost site then further surveying involving dusk and dawn surveys of the actual trees may be recommended to determine what bat species are present etc.

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

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

2.1.3 Bat Habitat & Commuting Routes Mapping

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

2.2 Night-time Bat Detector Surveys

2.2.1 Dusk & Dawn Bat Surveys

Dusk surveys were started from 10 minutes before sunset to at least 100 minutes post sunset (extended survey period times occurred in relation to walking transects). During Dusk Emergence Surveys, the surveyors positioned themselves adjacent to the building / structure to be surveyed to determine if bats are roosting within, location of roost, number of bats, bat species etc. In relation to Ballyhale Bat Surveys, surveying was completed for 100 minutes for Dusk Emergence Surveys followed by an additional 100 minute walking transect.

Dawn surveys were completed from 90 minutes before sunrise to 10 minutes after sunrise. Surveys were completed during mild and dry weather conditions with air temperature 8°C or greater. All bat encounters are noted during surveys.

The following equipment is generally used:

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

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

Walking transects involve the surveyor(s) walking the survey area, noting the time, location and bat species encountered. If the mapping facility is used on the Wildlife Acoustics Echo Meter Touch2 Pro (Android) connected to Samsung Galaxy Tab S3, this is mapped using Google Earth with a KLM file produced for mapping purposes. Validation of bat records is completed by the principal bat

surveyor prior to mapping. Otherwise, Irish Grid references are recorded and an excel file of bat record locations is produced for mapping.

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 is position horizontally to reduce potential damage from rain. Bat Logger A+ units and Wildlife Acoustics Song Meter SM2, SM2 BAT+ SM4 Bat FS and SM3 BAT Platform Units use Real Time recording as a technique to record bat echolocation calls and using specific software, the recorded calls are identified. It is these sonograms (2-d sound pictures) that are digitally stored on the SD card (or micro SD cards depending on the model) and downloaded for analysis. These results are depicted on a graph showing the number of bat passes per species per hour/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

The recordings are analysed using various software. Recordings made by SongMeter SM2Bat+ (Unit 5), Song Meter Bat FS (Units 3-5) were analysed using Wildlife Acoustics Kaleidoscope Pro. Each sequence of bat pulses are noted as a bat pass to indicate level of bat activity for each species recorded. This is either expressed as the number of bat passes per hour or per survey night.

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

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

Static Unit Code	Bat Detector Type	Recording Function	Microphone
SM2 Unit 5	Wildlife Acoustics SongMeter 2 Bat+	Passive Full Spectrum	SMX-U1 (connected directly to unit)
SM4 Unit 3 SM4 Unit 4 SM4 Unit 5	Wildlife Acoustics SongMeter 4 Bat FS	Passive Full Spectrum	SMM-U2, 4m cable

2.3 Desktop Review

2.3.1 *Bat Conservation Ireland Database*

A data search for a 10km radius of Ballyhale, Co. Kilkenny was requested from Bat Conservation Ireland.

2.4 Photographic Record

A photographic record is completed for the survey and is presented in Section 9.

2.5 Survey Constraints

The following assessment has been completed in relation to Survey Constraints:

Table 7: Survey Constraint Assessment Results.

Category	Discussion
Timing of surveys	September – during bat activity season.
Weather conditions	Poor on the 11 th September but ideal on 12 th , 13 th & 14 th September 2020
Survey effort Static Surveillance: 90 hrs Dusk & Dawn Surveys – 9 hrs Daytime Inspections – 5 hrs TOTAL: 104 hrs	Static Surveillance – 4 units, 3 nights Dusk Surveys – 13/9/2020 (2 surveyors), 14/9/2020 (2 surveyors) – included walking transects on both nights. Dawn Survey – 14/9/2020 (2 surveyors) Daytime Surveys – Bridge inspections, Tree inspections
Equipment	SM4 Unit 5 failed to record. All other equipment in good working order.

It is therefore deemed that the survey work completed is Appropriate in order to completed the aims of the bat survey.

3. Bat Survey Results

3.1 Daytime Inspections

3.1.1 Building & Structure Inspection

All of the bridges and culverts within the village of Ballyhale were inspected on the 14/9/2020. No bats were recorded roosting in any of the structures. None of the structures were deemed suitable for roosting bats.

Table 8: Bridge & Culvert inspection results.

Bridge Code	Description	Roost Type / Suitability	Bat Species
1	Double culvert (adjacent to logistics building)	Only 1m above water. No crevices. NOT SUITABLE FOR BATS Bridge Category 0	None
2	Bridge adjacent to housing estate (Hazel Brook)	Only 1m above water. No crevices. NOT SUITABLE FOR BATS	None
3	Bridge / Culvert running under the Main Street between Hazel Brook and Tyre Centre	Double arch, pointed running from 1m to 1.5m height. NOT SUITABLE FOR BATS Bridge Category 0	None Please note: otter spraints, freshwater crayfish and Dipper recorded.
4	Bridge at access into GAA grounds	No crevices. NOT SUITABLE FOR BATS Bridge Category 0	None
5	Bridge at access into Bouncy Castle Centre	No crevices. NOT SUITABLE FOR BATS Bridge Category 0	None
6	Bridge at access into Arrigle Business Park	Double culvert. No crevices. NOT SUITABLE FOR BATS Bridge Category 0	None
7	Small pedestrian bridges to rear of residences	No crevices. NOT SUITABLE FOR BATS Bridge Category 0	None
8	Church grounds	Double culverts, 1m or less in height. No crevices. NOT SUITABLE FOR BATS Bridge Category 0	None
9	Bridge under local road to rear of church	Double arch. No crevices. NOT SUITABLE FOR BATS Bridge Category 0	None
10	Single arch concrete bridge in field to rear of church.	No crevices. NOT SUITABLE FOR BATS Bridge Category 0	None

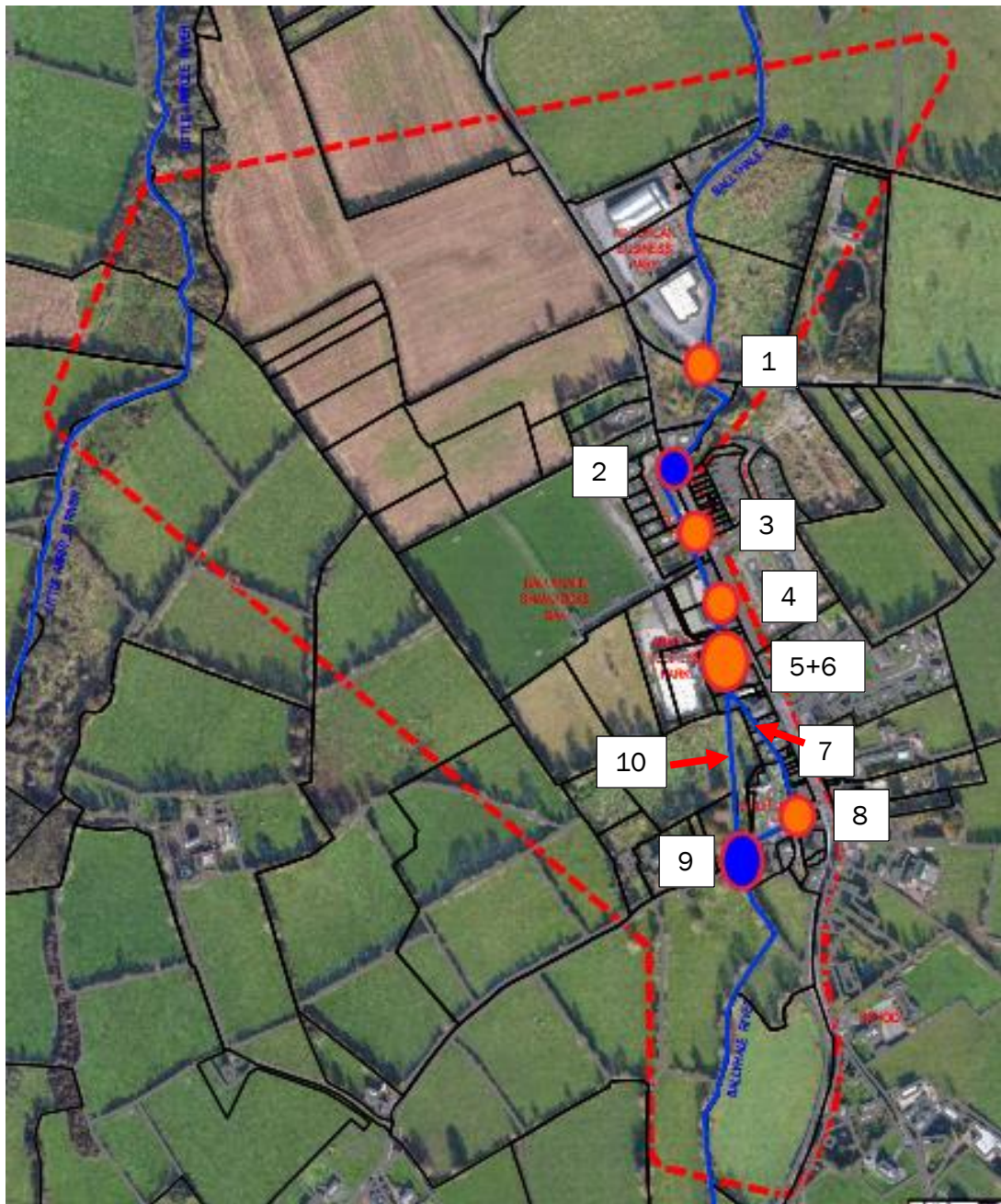


Figure 3a: Location of bridges and culverts surveyed, Ballyhale, Co. Kilkenny (Source DBFL Consulting Engineers).



Plate 1: Bridge 10, Ballyhale, Co. Kilkenny.



Plate 2: Bridge 8, Ballyhale, Co. Kilkenny.

3.1.2 Tree Potential Bat Roost (PBRs) Inspection

Mature trees within the survey area were inspected to determine their Potential Bat Roost (PBR) for bats. This was completed on 13/9/2020 and the following trees listed in Table 9 (Figure 3b) were deemed to have a PBR. All of the trees listed below have a Category 1 PBR rating because they have suitable features that can provide roosting sites for bats.

Table 9: Tree PBR inspection results.

Tree No.	Tree Species	Location	PRFs	Bat Usage	Value
Trees 1-5 Plate 3	Lime(x3) Sycamore (x2)	5 mature trees located in the field to the rear of the church.	Large number of tree holes, dead wood, spilt limbs	Five species of bat recorded foraging in vicinity of this treeline.	High Value for bats. Category 1 in relation to potential roosting.
Trees 6-7	Ash (x2)	2 mature ash trees located in field across from primary school	Large number of tree holes, dead wood, spilt limbs	Five species of bat recorded foraging in vicinity of this treeline. Particularly high level of Natterer's bat activity.	High Value for bats. Category 1 in relation to potential roosting.
Tree 8-10 Plate 4	Ash (x3)	Boundary of GAA grounds	Large number of tree holes, dead wood, spilt limbs	Four species of bat recorded foraging in vicinity of this treeline. Particularly high level of Natterer's bat activity.	High Value for bats. Category 1 in relation to potential roosting.

3.1.3 Bat Habitat & Commuting Routes Mapping

The surrounding landscape of Ballyhale, Co. Kilkenny is agricultural land with treelines and hedgerows. There is a high level of connectivity in the landscape which makes it suitable for commuting and foraging bat populations. A habitat map commissioned by Kilkenny County Council Heritage Office is presented below (Figure 3c).

The village of Ballyhale has extensive street lights which reduces it's suitability for foraging and commuting bats considered to be light sensitive (e.g. Daubenton's bats).

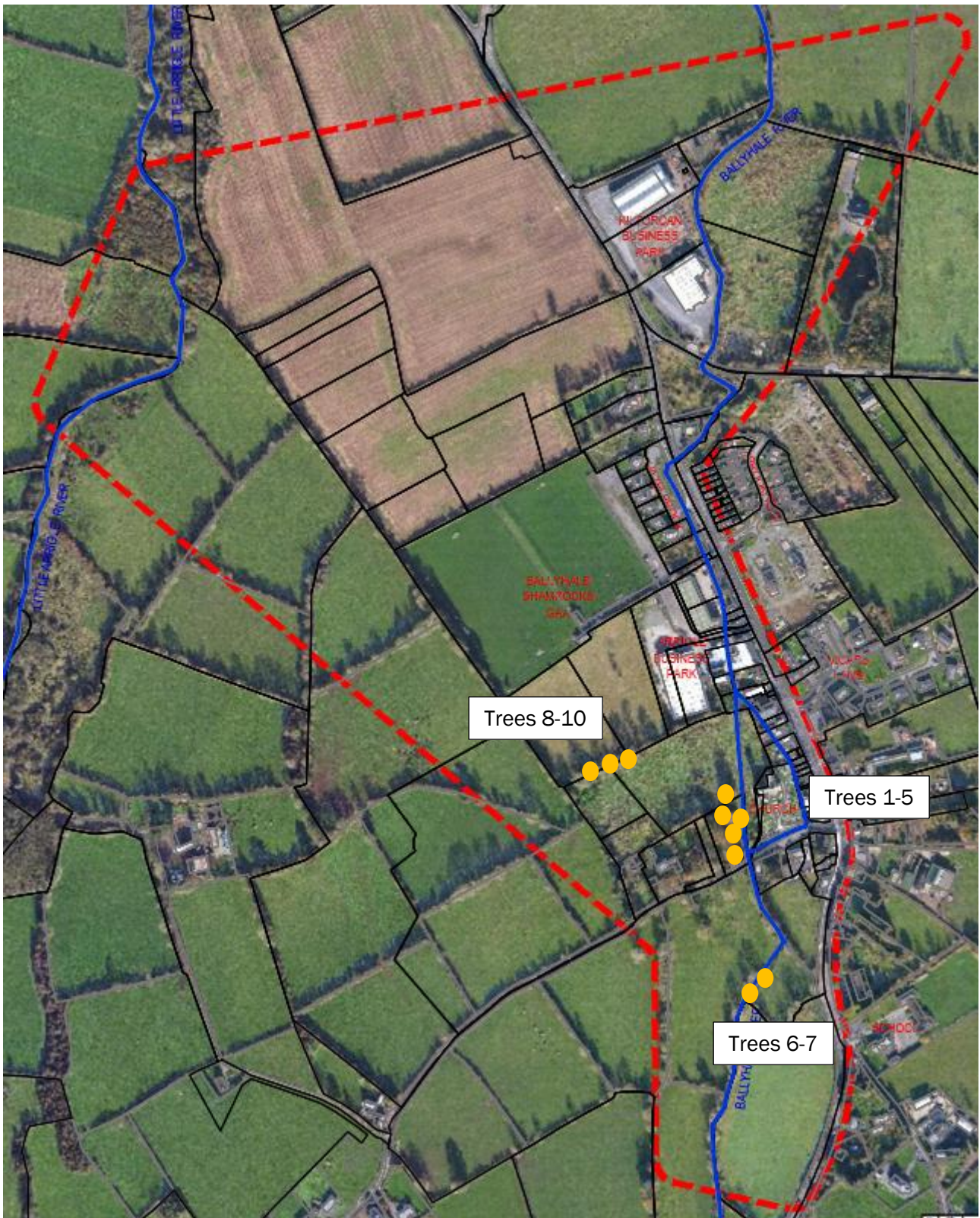


Figure 3b: Approximate location of trees deemed to have a PBR value – orange circles (Source DBFL Consulting Engineers). Please refer to Table 9 for more details.



Plate 3: Mature trees west of church, Ballyhale, Co. Kilkenny.



Plate 4: Mature treelines along the boundary of GAA pitch, Ballyhale, Co. Kilkenny.

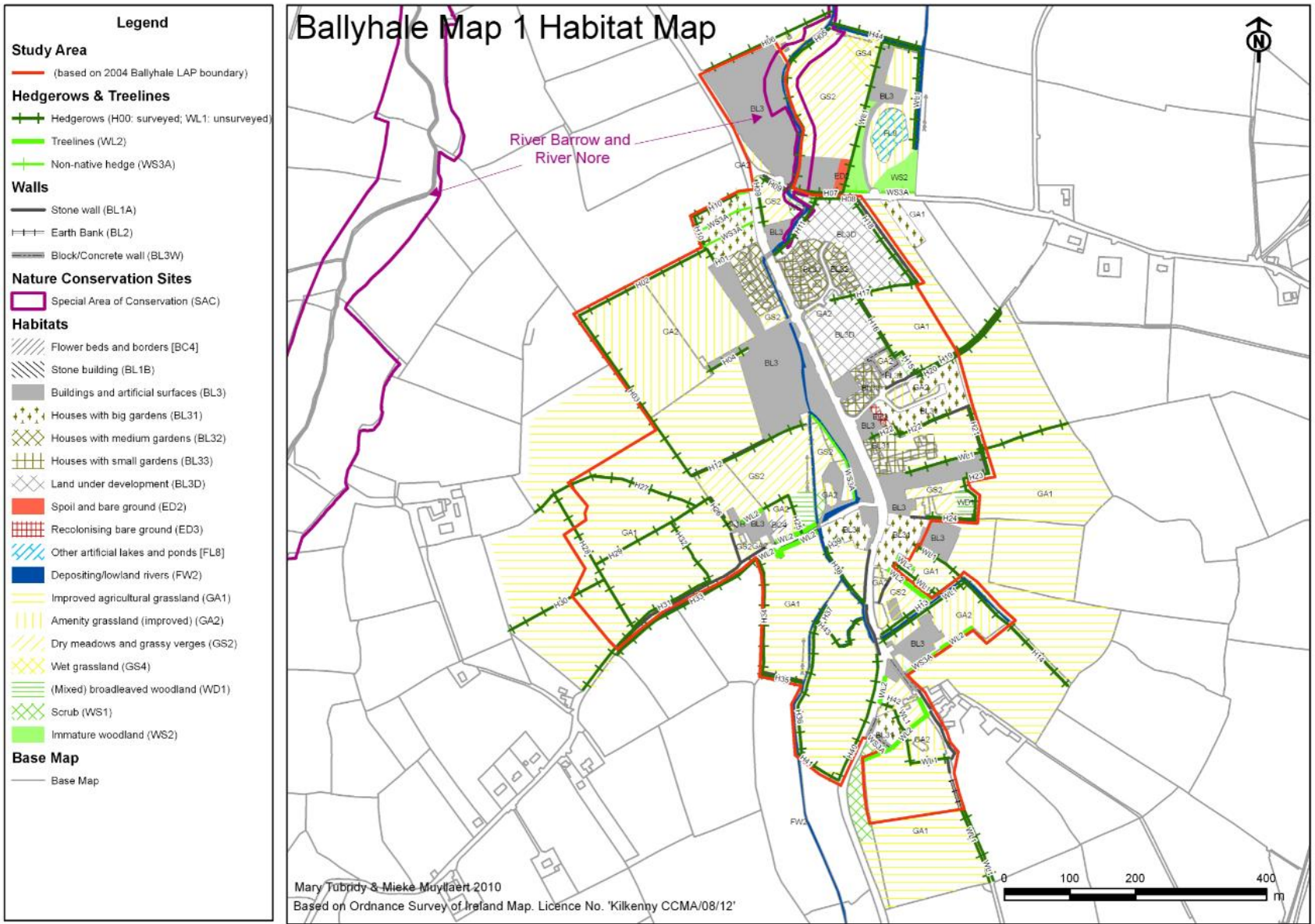


Figure 3c: Habitat Map for Ballyhale, Co. Kilkenny (Source: Heritage Office, Kilkenny Co. Co.)

3.2 Night-time Bat Detector Surveys

3.2.1 Dusk & Dawn Bat Survey

The following figure (Figure 4a) and Table 10 summarises the results of the bat detector surveys completed in relation to buildings located within the survey area.

The shed within the Business Park was surveyed by Surveyor 1 during the Dusk Survey on 13/9/2020. There was no access to the business park and therefore, the survey was conducted from the adjacent field. No bats were recorded emerging from the building but common pipistrelles and soprano pipistrelles were recorded commuting through the business park to the fields located to the rear of the business park.

During the Dawn Survey on 14/9/2020, it was noted that bats were swarming around a private residence located adjacent to the church. Therefore a Dusk Survey was completed in relation to this private residence and the church on eve of the 14/9/2020. A satellite roost for soprano pipistrelles was confirmed roosting in the private residence. No bats were recorded emerging from the church.

Table 10: Buildings / Structures survey results.

Building Code	Roost Type & Location	Bat Species (No. of bats)	Access Points	Vegetation / Lighting arrangement
Church (1) Plate 5	None	None	Not applicable	Yes - present
Private residence (2)	Roof space	Soprano pipistrelle (satellite roost)	Facia board/soffit	Yes - present
Shed (Business Park) (3) Plate 6	None	None	Not applicable	Yes - present



Figure 4a: Roost Surveys.



Plate 5: Church and tower, Ballyhale, Co. Kilkenny.



Plate 6: Shed, Ballyhale, Co. Kilkenny.

A total of six species of bat was recorded commuting and foraging within the survey area (common pipistrelles, soprano pipistrelles, Leisler's bats, Daubenton's bat, Natterer's bats and brown long-eared bats). Common pipistrelle and soprano pipistrelles was the most frequently recorded bat species. Leisler's bats were particularly recorded foraging over street lights along the main street of Ballyhale. The remaining three bat species were more associated with dense tree lines and dark areas away from the village of Ballyhale.

In summary, little bat activity was recorded associated with the river running through the town. The majority of bat activity was associated with the treelines of agricultural fields located west, south and north-east of the town. The following Google Maps display the bat encounter locations during all of the surveys completed.

Common pipistrelles were recorded foraging along the treelines and hedgerows of the agricultural land located within the survey area. Commuting routes (Red Arrows) were also recorded from the village of Ballyhale west along hedgerows.

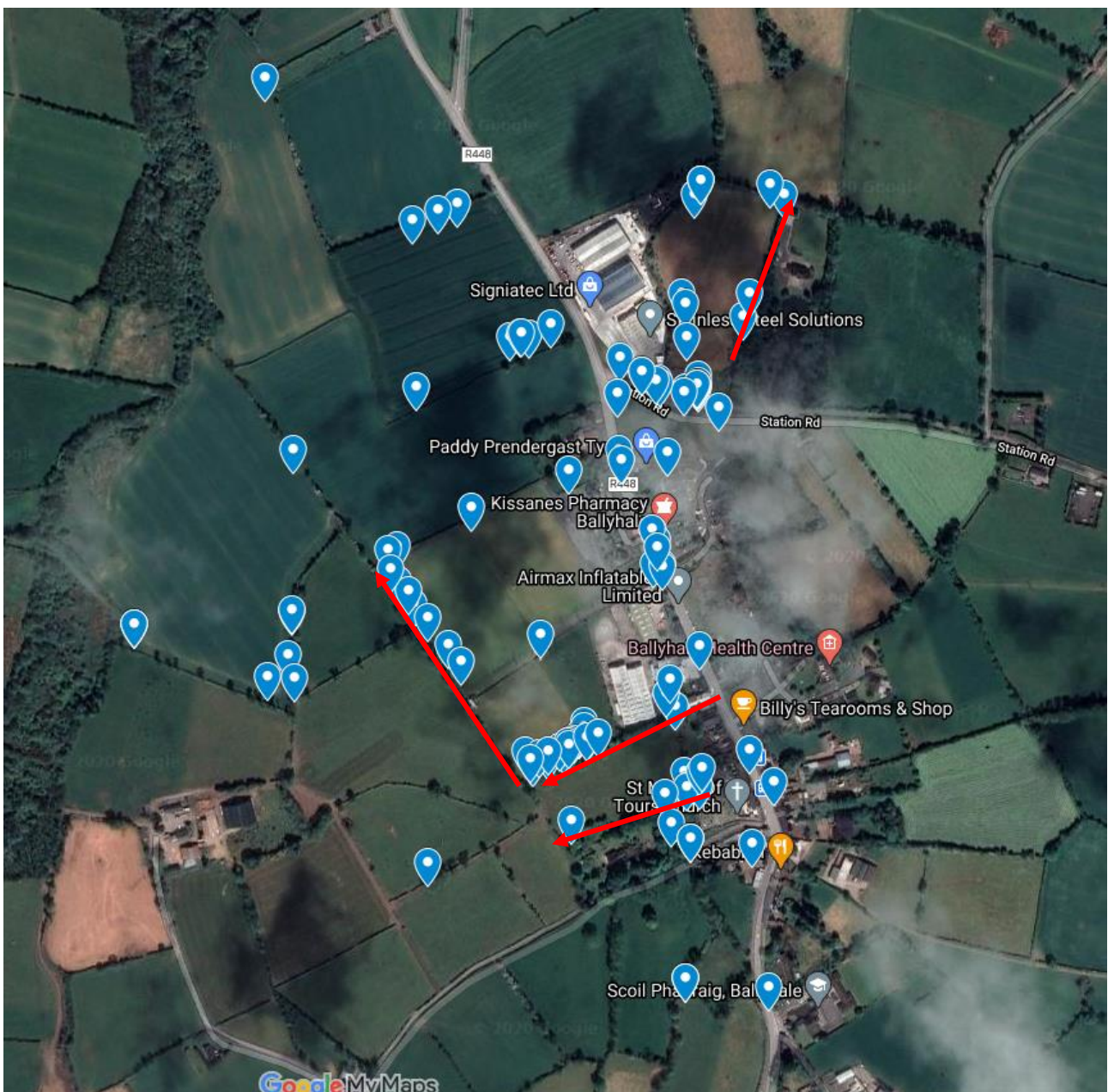


Figure 4b: Common pipistrelle bat encounters within survey area (blue Icons) & commuting routes (red arrows).

Soprano pipistrelles, similar to common pipistrelles, was recorded throughout the survey area. A high degree of activity was recorded around the mature trees located to the west of catholic church. Commuting routes (Red Arrows) were also recorded from the village of Ballyhale west along hedgerows.

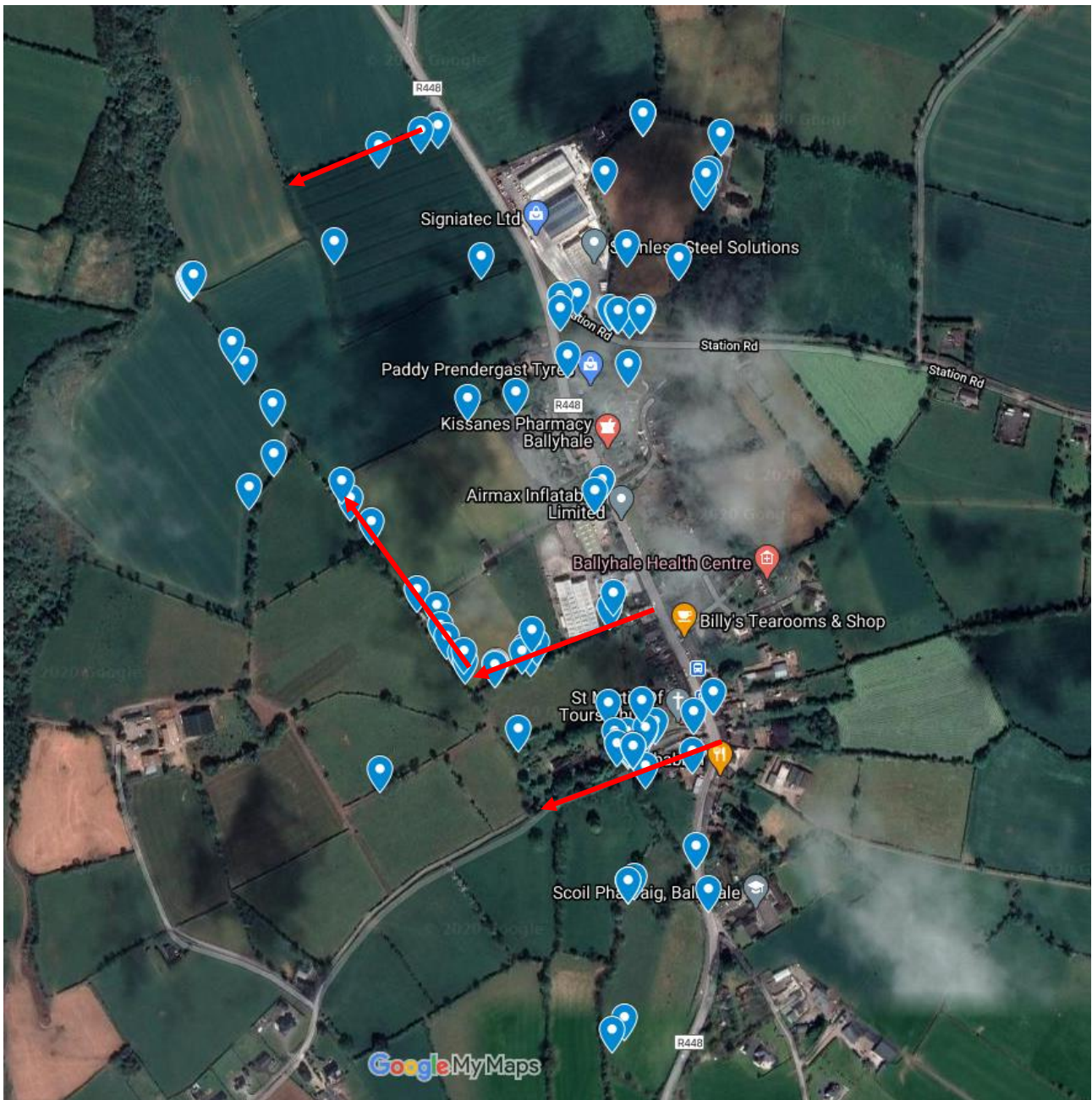


Figure 4c: Soprano pipistrelle bat encounters within survey area (blue icons) & commuting routes (red arrows).

Leisler's bats, as mentioned previously, were largely associated with the street light network of the village with consistent foraging in these areas.

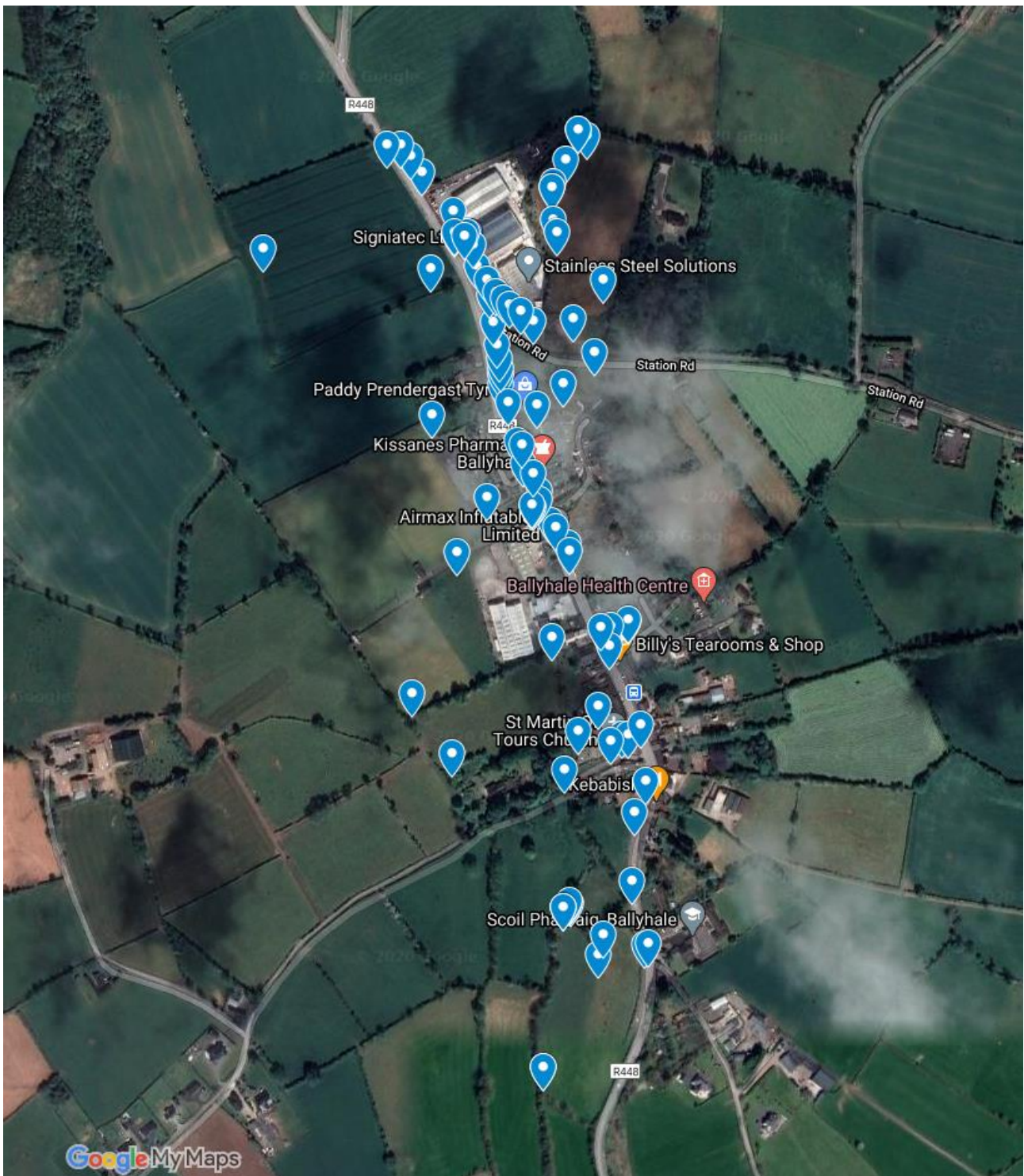


Figure 4d: Leisler's bat encounters within survey area (Blue Icons).

Daubenton's bats and Natterer's bats were recorded during the bat surveys. A high level of Natterer's bat encounters was recorded south of the village (Red Circle). There was a static unit located here recording for three nights and due the level of Natterer's bat activity, it is likely that there is a tree roost in vicinity of the static recording unit located in this area.

No Daubenton's bats was recorded on the Ballyhale River and this may be due to the degree of street lighting present. Both Natterer's bats and Daubenton's bats were only recorded in areas where there was no street lighting. Daubenton's bats and Natterer's bats are light sensitive bat species.



Figure 4e: *Myotis* species bat encounters (Natterer's bat & Daubenton's bat) within survey area (Blue Icons). Red Circle – location of static recording unit and area of high Natterer's bats encounters.

Brown long-eared bats were recorded in three areas and these areas were associated with dense treelines and also away from street lighting. This bat species is also light sensitive.

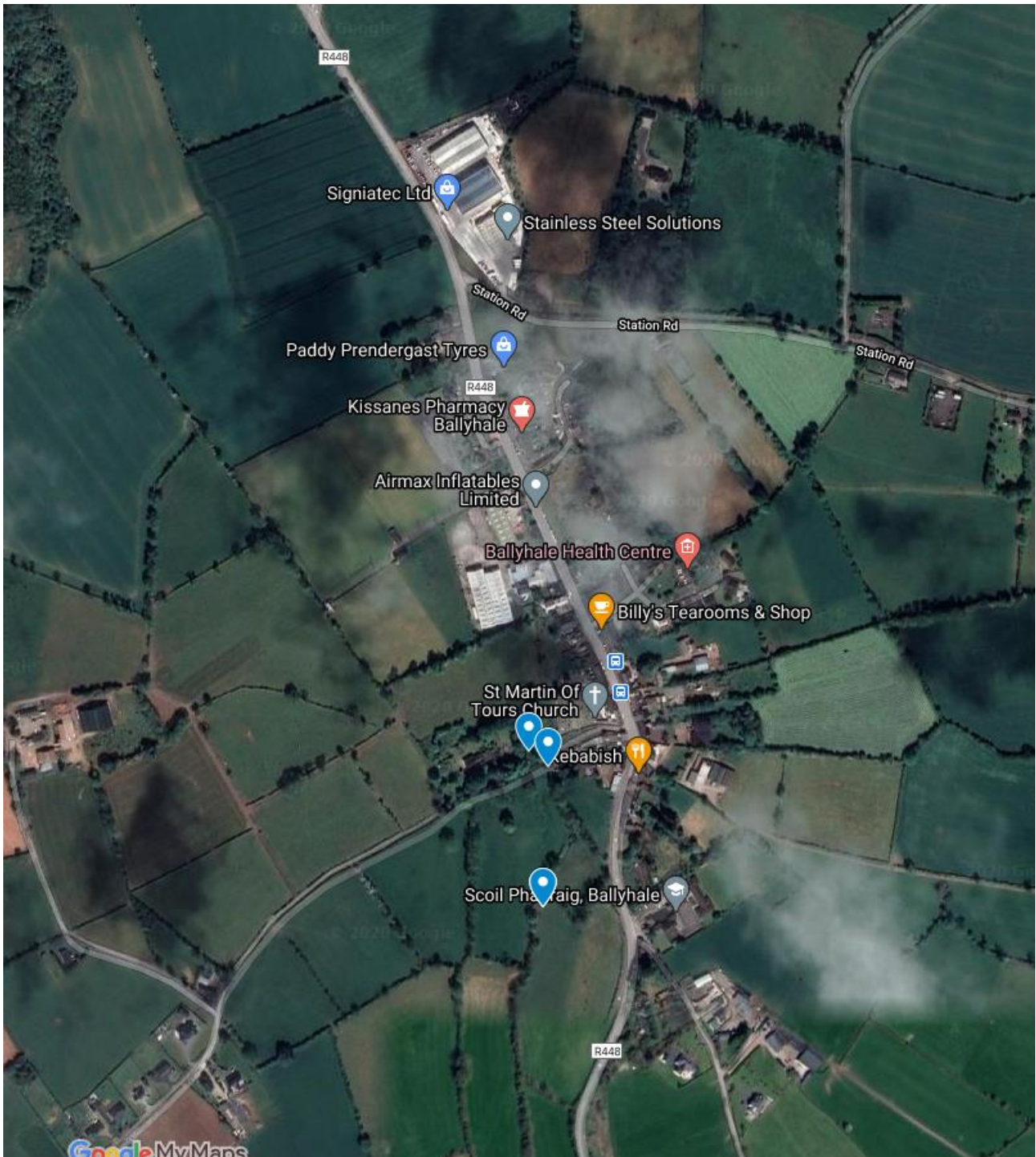


Figure 4f: Brown long-eared bat encounters within survey area (Blue Icons).

3.2.2 Passive Static Bat Detector Survey

The following table summarises the results recorded on the static units deployed (Please see Figure 5 and Appendix 2 for detailed surveillance results). The unit (SM4 U4) located across from the primary school recorded the highest number of bat species with a particularly high level of Natterer's bat activity. The unit (SM4 U3) located behind the church recorded the highest level of soprano pipistrelles and this is likely to be due to the presence of a bat roost adjacent to the church grounds. The unit (SM2 U5) located behind the logistics building recorded the highest level for common pipistrelles.

Table 11: Results of Static Bat Detectors deployed during Static Bat Detector Surveys.

Static Code	Location Description	Survey Period	Bat Species
SM4 U3	On tree to rear of church S5429935271	11 th – 14 th September 2020	Soprano pipistrelle Common pipistrelle Natterer's bat Daubenton's bat Brown long-eared bat
SM4 U4	On tree in fields across from school S5429635112	11 th – 14 th September 2020	Soprano pipistrelle Common pipistrelle Leisler's bat Natterer's bat Daubenton's bat Brown long-eared bat
SM4 U5	On tree behind logistics building S5430336017	11 th – 14 th September 2020	Soprano pipistrelle Common pipistrelle Leisler's bat
SM2 U5	On tree along river S5371635788	11 th – 14 th September 2020	FAILED TO RECORD



Figure 5: Location to static units during static surveillance.

3.3 Desktop Review

3.3.1 Bat Conservation Ireland Database

The Bat Conservation Ireland databases search provided the following records:

- 1km radius: two records (BATLAS 2010 & BAT:AS 2020) for the following bat species: soprano pipistrelle, common pipistrelle, Leisler's bat and *Myotis* species.
- 10km radius
 - o Roosts: 8 roost records (Leisler's bat, soprano pipistrelle, common pipistrelle, brown long-eared bats and whiskered bats).
 - o Transects: 7 waterway transects (Daubenton's bats, Leisler's bats and *Pipistrellus* spp).
 - o Ad Hoc: 33 Records:(Leisler's bat, soprano pipistrelle, common pipistrelle, brown long-eared bats, Daubenton's bats and Natterer's bats).

4. Bat Ecological Evaluation

4.1 Bat Species Recorded & Sensitivity

A total of six species of bats were recorded during the array of bat surveys completed within the survey area of Ballyhale, Co. Kilkenny: soprano pipistrelle, common pipistrelle, Leisler's bats, Natterer's bats, Daubenton's bats and brown long-eared bats.

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.

The remaining three bat species are less common but are associated with specific habitats. The Daubenton's bat, considered to be a water specialist, was not recorded on the Ballyhale River flowing through the village of Ballyhale. This is likely due to the fact that there is little clear water free of vegetation and due to the high level of light pollution from street lights. This species was recorded along the dark areas of treelines to the west of the village. This was also the case for Natterer's bats and brown long-eared bats. All of these three bat species are light sensitive and therefore avoid the village of Ballyhale. While the three common bat species (common pipistrelle, soprano pipistrelle and Leisler's bats) are bat species that can tolerate artificial street lighting and therefore were recorded foraging and commuting in the village environs.

4.2 Species Profiles

4.2.1 *Leisler's bat*

This bat species was recorded commuting through the study area. 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 (52,820km²). 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 <i>et al.</i> 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.

4.2.2 *Common pipistrelle*

This species was the most recorded species within the study area and it is generally considered to be the most common bat species in Ireland. The species is widespread and is found in all provinces. The modelled Core Area for common pipistrelles is a large area that covers much of the island of Ireland (56,485km²) which covers primarily the east and south east of the area (Roche *et al.*, 2014). The Bat Conservation Ireland Irish Landscape Model indicates 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 <i>et al.</i> 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)

4.2.3 *Soprano pipistrelle*

This species was the second most recorded species the study area and it is generally considered to be the second most common bat species in Ireland. The species is widespread and is found in all provinces, with particular concentration along the western seaboard. The modelled Core Area for soprano pipistrelle is a large area that covers much of the island of Ireland (62,020km²). The Bat Conservation Ireland Irish Landscape Model indicates 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 <i>et al.</i> 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).

4.2.4 *Brown long-eared Bat*

This species is generally considered to be widespread across the island. The modelled Core Area for Brown long-eared bats is a relatively large area that covers much of the island of Ireland (52,820km²) with preference suitable areas in the southern half of the island. The Bat Conservation Ireland Irish Landscape Model indicates 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	km ²
Irish Population Trend	2008-2013 Stable
Biographical Range	km ²
Estimate Core Area (Lundy <i>et al.</i> 2011)	49,929 km ²

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.

4.2.5 *Natterer's bat*

There are three species included in the *Myotis* species family and their echolocation calls are very similar across these three species.

The modelled Core Area for Natterer's bats is a relatively large area that covers much of the island of Ireland (52,864km²). The Bat Conservation Ireland Irish Landscape Model indicates that the Natterer's bat selects areas with broadleaf woodland, riparian habitats and areas with larger scale provision of mixed forest (Roche *et al.*, 2014). Therefore, it is likely that this species is more widespread within the survey area.

Irish Status	Least Concern
European Status	Least Concern
Global Status	Least Concern

Biographical Range	km ²
Irish Population Trend	Unknown
Estimated Irish Population Size	Unknown
Estimate Core Area (Lundy <i>et al.</i> 2011)	52,864

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

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

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

4.2.6 *Daubenton's bat*

The modelled Core Area for Daubenton's bats is a relatively large area that covers much of the island of Ireland (41,285km²) reflecting the distribution of sizeable river catchments. The Bat Conservation Ireland Landscape Model indicates 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	km ²
Irish Population Trend	2008-2013 Stable
Estimated Irish Population Size	81,000 to 103,000 (2007-2012)
Estimate Core Area (km²) (Lundy <i>et al.</i> 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.

5. Impact Assessment & Mitigation

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

The following section rates the different flood relief options and their possible impact on local bat populations.

5.1 Route Option A (Green Route, Figure 2a)

This route consists of flow diversion as an open channel to the Little Arrigle River. This would involve treeline and hedgerow loss to the west of the village where a high level of local bat population activity was recorded. This would involve possible disturbance to large mature trees located behind the church to the west of the village where a high level of local bat population activity was recorded.

5.2 Route Option B (Red Route, Figure 2a)

This route consists of flow diversion as an open channel to the Ballyhale River. This would involve treeline and hedgerow loss to the west and north of the village where a high level of local bat population activity was recorded. This would involve possible disturbance to large mature trees located behind the church to the west of the village where a high level of local bat population activity was recorded.

5.3 Route Option C (Dashed Purple Route, Figure 2a)

This route consists of flow diversion as an open channel to the Little Arrigle River. This would involve some limited loss of sections of treelines and hedgerows to the west of the village where a high level of local bat population activity was recorded.

5.4 Route Option D (Purple Route, Figure 2a)

This route options involves an underground piped route along existing roads in the Ballyhale village. Due to the fact that there are no bats roosts associated with the culverts and bridges and that there was little bat activity recorded associated with the river, this option will have little impact on local bat populations.

5.5 Route Option E (Brown Route, Figure 2a)

This route consists of flow diversion using partially open and partially piped overflow route to the Ballyhale River. This would involve possible disturbance to large mature trees located behind the church to the west of the village where a high level of local bat population activity was recorded.

5.6 Route Option F (Blue Route, Figure 2a)

This route consists of flow diversion using upgrade work to existing channel / structures where needed. Due to the fact that there are no bats roosts associated with the culverts and bridges and that there was little bat activity recorded associated with the river, this option will have little impact on local bat populations.

5.7 Impact Assessment – Overall

The Route Options D and F would be considered to have the least impact on local bat populations compared to the other Route Options discussed above (Please see Table 12 for details).

Table 12: Potential impact of the proposed flood relief options on the different bat species recorded during survey work.

Works	SP	CP	Leis	BLE	Daub	Natt
Route Option A	Minor-Moderate	Minor-Moderate	Minor	Moderate	Moderate	Moderate
Route Option B	Minor-Moderate	Minor-Moderate	Minor	Moderate	Moderate	Moderate
Route Option C	Minor-Moderate	Minor-Moderate	Minor	Minor-Moderate	Minor-Moderate	Minor-Moderate
Route Option D	Minor	Minor	Minor	None	None	None
Route Option E	Minor-Moderate	Minor-Moderate	Minor-Moderate	Moderate	Moderate	Moderate
Route Option F	Minor-Moderate	Minor-Moderate	Minor	None	None	None

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

5.8 Mitigation Measures

Since the Ballyhale Flood Relief Scheme project is at an early stage, the current information on the proposed works is limited and therefore detailed mitigation measures are not provided. The following general measures should be adhered to when selecting a preferred route and for the detailed design and construction of any flood relief scheme:

- Minimise the potential impact of proposed works on mature trees, treelines and hedgerows. Protect trees and their roots from proposed works. Any trees that required to be felled should be assessed for the Potential Bat Roost (PBR) level prior to felling and alternative roosting sites should be provide (e.g. bat boxes).
- Undertake additional bat survey work on any buildings that may be impacted by proposed works.
- Restrict the usage of artificial lighting in work zones and ensure that such are turned off during the hours of darkness.
- Any removal of treelines and hedgerows requires landscape replacement (native tree and shrub species).

This section should be re-addressed when greater detail is provided in relation to the preferred route option.

6. Survey Conclusions

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

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. The remaining three bat species are less common but are associated with specific habitats.

The flood relief route options were assessed in relation to potential impact on local bat populations. Due to the fact that the majority of bat activity was recorded west and north of the village of Ballyhale, any route options that involve loss of treelines and hedgerows will impact on local bat populations due to the removal of commuting routes and foraging habitat.

Therefore it is considered, in relation to the conservation of local bat populations, the route options that involve upgrading the existing channel and structures within the village environs will have less of an impact on local bat populations.

7. Bibliography



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8. Appendices

Appendix 1 Bat Habitat & Commuting Route Classifications

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

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



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

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

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

Appendix 1 Table A : Static Surveillance Results

Date	SP	CP	Leis	Daub	Natt	BLE	Location
11/09/2020	1908	157	0	0	1	1	S5429935271
12/09/2020	545	839	0	1	0	0	
13/09/2020	1213	675	0	3	0	2	
Total	3666	1671	0	4	1	3	
SM4 U3							
Date	SP	CP	Leis	Daub	Natt	BLE	Location
11/09/2020	175	95	2	5	50	1	S5429635112
12/09/2020	231	236	9	20	126	2	
13/09/2020	248	423	4	27	129	0	
Total	654	754	15	52	305	3	
SM4 U4							
Date	SP	CP	Leis	Daub	Natt	BLE	Location
11/09/2020	63	729	0	0	0	0	S5430336017
12/09/2020	32	1206	4	0	0	0	
13/09/2020	47	1243	1	0	0	0	
Total	142	3178	5	0	0	0	
SM5							
Date	SP	CP	Leis	Daub	Natt	BLE	Location
11/09/2020	0	0	0	0	0	0	S5371635788
12/09/2020	0	0	0	0	0	0	
13/09/2020	0	0	0	0	0	0	
Total	0	0	0	0	0	0	
SM4U6							

9. Photograph Catalogue



Plate A: Freshwater crayfish under Bridge 3, Ballyhale, Co. Kilkenny.