



# Wild Service

## St Peter's Church, Little Rissington

### Bat Surveys and Bat Management Plan Report

On behalf of Natural England

Project Code: EP2021009Av2

*Bats in Churches HF Project HG-16-02183: BiC-2021-021*

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#### Wild Service Office

Conservation Centre  
Robinswood Hill Country Park  
Reservoir Road  
Gloucester  
GL4 6SX

**Tel** 01452 383 333

**Email** [info@wildservice.net](mailto:info@wildservice.net)

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	<b>Name</b>	<b>Date</b>
Prepared by	Julia Morrison, Ecologist; Rebecca McKie, Graduate Ecologist and Elizabeth Pimley, Principal Ecologist	07/09/2021
Reviewed/updated by	Elizabeth Pimley, Principal Ecologist; Rebecca McKie, Graduate Ecologist	28/10/2021

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# 1 Summary

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## 1.1 Summary of Bat Surveys and Mitigation for Species using Church

### Brown long-eared Bats

1.1.1 A **maximum of six brown long-eared bats were recorded roosting internally** during any one survey visit (dusk emergence survey). During the dawn re-entry survey, a total of five brown long-eared bats were recorded re-entering the church via loose external roof tiles on the north-east corner of the chancel, above the guttering. **Two brown long-eared bats were recorded emerging from the western gable roof** of the church. In addition, DNA analysis of collected bat droppings identified the droppings in the church as being that of brown long-eared bats.

1.1.2 The presence of up to six brown long-eared bats indicates that this is a **small maternity roost<sup>1</sup>** as found on previous surveys. The church also appears to support a **non-maternity summer roost** for this species.

1.1.3 This species forms maternity roosts at lower number than other bat species. Therefore, if the desire is to exclude bats from the church (under a Bat Mitigation Licence) then a **bat loft will need to be constructed above the Vestry** to provide adequate mitigation for this species, especially considering they form a maternity roost. Bat boxes do not provide sufficient space for maternity roosts for this species.

### Common Pipistrelle Bats

1.1.4 A **maximum of five common pipistrelle bats were recorded emerging** during any survey visit, and these five emerged from the western gable roof of the church. **One common pipistrelle bat was also recorded emerging from an external feature in the roof valley** between the north aisle and nave and **one common pipistrelle emerged from a loose tile below the ridge on the southern elevation of the nave**, to the east of the south porch and also re-entered this feature during the dawn survey.

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<sup>1</sup> Dietz, C., von Helversen, O. and Nill, D. 2009. Bats of Britain, Europe and Northwest Africa. A & C Black Publishers Ltd.

1.1.5 Therefore, the church supports **three summer non-maternity day roost for common pipistrelle bats.**

1.1.6 Although the **common pipistrelle bats tend to use exterior roosting features** at the church, it would be best practice to install **bat boxes** to ensure adequate mitigation for this species if the desire is to exclude bats from the church.

Soprano pipistrelle bats

1.1.7 A maximum of **one soprano pipistrelle** was recorded emerging from north elevation of the bell tower (during first dusk emergence survey).

1.1.8 Therefore, the church supports **a summer non-maternity day roost for soprano pipistrelle bats.**

1.1.9 The soprano pipistrelle bat was noted emerging from the bell tower, which is being left open for bats, therefore **mitigation for this species is not essential**, however, installation of bat boxes will provide additional roosting opportunities.

Myotis bats

1.1.10 **Two Brandt's/whiskered bats emerged** from the south-west corner of the church roof during the bat walk.

1.1.11 Therefore, the church supports **a summer non-maternity day roost for Brandt's/whiskered bats.**

1.1.12 Mitigation for *Myotis* bats tends to be in the form of a **bat loft**, which is also proposed for the brown long-eared bats.

## 2 Introduction

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### 2.1 Scope

2.1.1 Wild Service was commissioned by Natural England as part of the Bats in Churches Project to carry out three dusk emergence surveys, one dawn re-entry survey and a bat walk at St Peter's Church, Little Rissington, Gloucestershire, GL54 2NA (hereafter referred to as the 'Site').

2.1.2 The bat surveys were requested in order to inform a bat management plan to devise a way to reduce bat damage to the church, and in this case the surveys can also be used to inform a Natural England European Protected Species (EPS) mitigation licence application tailored to the Bats in Churches (BIC) project. The surveys were commissioned as part of the Bats in Churches project, led by Natural England and involving Church of England, the Bat Conservation Trust, the Churches Conservation Trust and Historic England. The parish acknowledges that the church 'does not have a huge problem with bats' but has expressed a wish that bats could be excluded from the interior of the church (Statement of Significance).

### 2.2 Site Description

2.2.1 St Peter's Church building is located in rural Gloucestershire, approximately 200m north of Little Rissington, the village it serves. The church plan comprises a chancel, nave with north aisle and south porch, and a northwest tower (Figure 1a).

2.2.2 The habitat immediately around the church is composed of a church yard on the brow of a hill, with agricultural fields bounded by hedgerows around it. Tree lines and hedgerows link the church to a wooded stream corridor and a small area of rough grassland, which provides suitable foraging habitat for a variety of bat species.

## 2.3 Background Information

### 2.3.1 Heritage Considerations

2.3.2 The church was listed Grade II in 1960 and is of high archaeological, architectural and historical significance for the surviving medieval fabric, especially the eastern parts of the nave, the north nave arcade and the chancel (Statement of Significance 2019).

2.3.3 The fifteenth century font and memorials are of moderate-high significance, while the remaining furnishings are of moderate significance (Statement of Significance 2019).

2.3.4 Early furnishings of note include:

- The fifteenth century stone font at the west end of the nave, which has an octagonal bowl with inset quatrefoil decoration and an octagonal stem
- A modest baroque memorial tablet of 1682 on chancel north wall, with cherubs and a skull
- An early eighteenth-century black stone ledger slab at the east end of the north aisle, now partly under the organ case.

2.3.5 Nineteenth century and later furnishings of interest include:

- The oak nave benches, apparently introduced circa 1850
- Elaborate Minton floor tiles in the chancel
- Simpler red, cream and black floor tiles in the nave and north aisle, probably 1850s
- Oak poppyhead choir stalls, perhaps 1850s
- Octagonal stone pulpit introduced in 1850
- Stained glass in the east window
- Elaborate marble memorial tablet on the chancel south wall
- The west window is an RAF memorial installed in 1983.

2.3.6 The Statement of Significance (2019) details the church features and impacts from bats (in the form of droppings, staining and urine splashes) The features impacted by bats, in order of most impacted in relation to their significance, are included below.

Area/item	Significance	Impact	Total
Seating (nave and aisles)	3	3	9
Wall monuments	3	3	9
Altar/communion table	2	3	6
Floor memorials/ brasses	3	2	6
Floor surfaces	3	2	6
Lectern	3	2	6
Pulpit	3	2	6
Seating (chancel)	3	2	6
Font	5	1	5
Organ	2	2	4
<b>Overall impact on significance</b>			<b>63</b>

2.3.7 Previous bat assessments have been undertaken at the Site and include a bat roost visit in August 2017 (Boulter, 2017), during The congregation already manage the problem of bat droppings and staining by weekly cleaning and covering sensitive furnishings, such as the altar and altar rail. At the same time, there is some staining of monuments and urine splashes and droppings on most of the pews and other wooden furnishings (Statement of Significance 2019).

#### 2.3.8 Previous Bat Survey Findings

2.3.9 Previous bat assessments have been undertaken at the Site and include a bat roost visit in August 2017 (Boulter, 2017), during which brown long-eared *Plecotus auritus* bat droppings, and possible *Pipistrellus* species droppings, were identified within the church, scattered up and down the main aisle and on windowsills at either end of the church. The Bat Roost Visit Report Form (2017) confirmed previous visits to the Site in 2011 and 2012 found similar evidence of a potential small number of brown

long-eared bats roosting within the church all year round. In 2019, a daytime bat assessment and two emergence/two re-entry surveys were undertaken by Link Ecology Ltd (2020). The 2019 surveys also confirmed the presence of brown long-eared bats within the church, and both common pipistrelle *Pipistrellus pipistrellus* and soprano pipistrelle *Pipistrellus pygmaeus* bats were also recorded within the church. The report concluded that the church is used as a small maternity day roost for brown long-eared bats, though no firm conclusions were drawn on where the bats were roosting within the building (Link Ecology Ltd, 2020).

2.3.10 This report presents the findings of the bat emergence/re-entry surveys and bat walk undertaken by Wild Service in 2021 and identifies ecological constraints and opportunities. Bat management options are considered following discussion with the church warden and .

2.3.11 The central Ordnance Survey Grid Reference for the Site is SP 18940 19978.

## 2.4 Legislation

2.4.1 This report has been prepared in accordance with relevant legislation and policy. Further detail is provided in Appendix 1, however the following primary documents are of relevance:

- The Wildlife and Countryside Act 1981 (as amended) (WCA 1981);
- The Countryside and Rights of Way Act (CRoW Act), 2000 (as amended);
- The Natural Environment and Rural Communities Act (NERC Act), 2006; and
- The Conservation of Habitats and Species Regulations 2017 (as amended) (CHS 2017).

2.4.2 No part of this report should be considered as legal advice and when dealing with individual cases, the client is advised to consult the full texts of the relevant legislation and obtain further legal advice.



## **3 Methods**

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### **3.1 Preliminary Roost Assessment**

3.1.1 The church building was evaluated for evidence of bats and to determine where bats may be roosting within the building by way of an internal and external building inspection undertaken by Elizabeth Pimley (Natural England licence number: 2015-13418-CLS-CLS, WML CL18 (Bat Survey Level 2) on 7<sup>th</sup> May 2021. The survey was undertaken in accordance with best practice guidelines (based on Collins, 2016).

3.1.2 The building's exterior was observed from ground level using binoculars and a high-powered torch, paying attention to potential roosting and access points for bats. Internal areas were also accessed where possible. Areas of particular suitability include crevices in stonework, gaps beneath roof tiles and any dark loft spaces. Any suitable areas were searched thoroughly for evidence of use by bats. Signs of bats include live animals, corpses, droppings, urine staining, feeding remains (e.g. moth and butterfly wings) and scratches.

### **3.2 Dusk Emergence & Dawn Re-entry Surveys**

3.2.1 Surveyors were positioned around and within the church building so that potential roosting features could be viewed. Surveyors were also positioned inside the church with red lights to observe any interior roosting locations. Surveyors had a radio to facilitate communication regarding bat roosting and foraging behaviour and for health and safety reasons. The dusk surveys began approximately 15 minutes prior to sunset and ended between approximately 90–120 minutes after sunset. The dawn survey began 90 minutes before sunrise and ended at sunrise.

3.2.2 The survey team comprised Elizabeth Pimley (Natural England licence number: 2015-13418-CLS-CLS, WML CL18 (Bat Survey Level 2)), Julia Morrison, Michelle Newman, Rebecca McKie, and Gemma Waters (Natural England licence number: 2015-1560-CLS-CLS, WML CL18 (Bat Survey Level 2)). Following the guidance of the Bats in Churches Project, volunteers from the local community were also present on the dusk emergence surveys, as organised by Nick Cole as Church Warden. The objective of engaging community volunteers is to produce a sustainable network of skilled

volunteers able to support churches in order to ensure a future legacy beyond the funded Bats in Churches project. As experience bat surveyors, members of the Wild Service team were positioned to view features of the building where bats were most likely to be roosting, based on previous assessments and the Preliminary Roost Assessment, and these positions are mapped in Figure 1a. Volunteer positions are mapped where volunteers recorded an emergence/re-entry result.

- 3.2.3 Bat detectors were used to record bat echolocation calls in order to identify the species present. Detectors used comprised Echometer Touch 2 Pro, Pettersson detectors (M500-384 USB Pettersson detectors) and an EM3 detector, all set to time expansion mode. A heterodyne Batbox Duet was also used.
- 3.2.4 Bat surveyors used a red light to inspect the interior of buildings for any bats at intervals during the survey to gain a more detailed understanding of where bats are roosting/feeding.
- 3.2.5 Each surveyor is trained and has prior experience in carrying out dusk emergence/dawn re-entry surveys and the use of bat detectors.
- 3.2.6 Surveys were undertaken in suitable weather conditions over spring/summer 2021 as detailed in the survey tables below.

### 3.3 **DNA Analysis**

- 3.3.1 A sample of bat droppings were collected from inside the church during the Preliminary Roost Assessment and sent to the University of Warwick for DNA analysis to confirm the species present.

### 3.4 **Bat Walk**

- 3.4.1 A bat walk led by Elizabeth Pimley was held on 24<sup>th</sup> August 2021 at dusk, arranged in collaboration with the project Engagement Officer representing the church, and the Parochial Church Council (PCC). Where bats were recorded emerging from the building during the bat walk event, these results are included in this report, along with a list of species recorded during the event.

### 3.5 **Limitations and Constraints**

- 3.5.1 While every attempt has been made to collect accurate baseline data, all ecological surveys represent a 'snapshot' of activity. Ecological features are dynamic and often transient, and it is not possible to confirm the absence of a species through survey. It may be necessary to update the ecological surveys if sufficient time elapses since the surveys and data collection presented in this report were carried out.

## 4 Results and Plan of Bat Access points and roosts

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### 4.1 Preliminary Roost Assessment & Dusk/dawn emergence/re-entry surveys

- 4.1.1 The church is mostly built of local limestone rubble, rock-faced at the west end of the nave and in the north aisle (Statement of Significance 2019). The pitched roofs of the nave, north aisle and chancel are all covered with Cotswold stone slates. The fabric of the church building is mainly of the late twelfth and thirteenth centuries, with a tower added in the fifteenth century (Statement of Significance 2019). The church has been restored several times in the nineteenth century and the north aisle, the roofs and most of the furnishings date from that period (Statement of Significance 2019).
- 4.1.2 The roof over the tower has an exposed structure consisting of a central oak ridge beam with oak joists. Above the joists are thin oak boards onto which the lead is directly laid (Boulter 20217). The nave roof has an exposed roof structure, with exposed rafters and pine boarding. The north aisle has an exposed roof structure consisting of two king post roof trusses, with rafters and pine boarding (Boulter 2017). The chancel has an exposed roof structure, with exposed rafters plastered between. It was also noted that there is no loft space in the church.
- 4.1.3 External opportunities for roosting exist in the form of gaps between the stone tiles although it is considered unlikely that these would consistently lead to access into the church. The most likely route would be via gaps under tiles on the outside roof pitch of the north-east corner of the Chancel and the southern side of the church to the west of the entrance, as shown on Figure 1a. The wooden rafters and purlins within the roof area offer numerous roosting opportunities internally, and access into the interior of the church could be possible via small gaps under the eaves. Bat droppings were found inside the church in a variety of locations, although less were found compared to previous surveys presumably due to increased cleaning frequency.
- 4.1.4 Roost locations noted from previous surveys and locations of bat droppings are shown in Figure 1b and comprise spaces between wooden rafters and ceiling in
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various locations: east end of north aisle, east end of chancel (above alter) and west ends of chancel (northern side and central part at roof apex), plus the central part of nave at apex of roof and the west end of nave. (It should be noted that these areas were not all found to still support roosting bats during these surveys.)

- 4.1.5 Survey weather data is recorded in Table 1. The results of the dusk emergence/dawn re-entry surveys are summarised below, and full survey results are provided in Tables 2.1., 2.2., 2.3., and 2.4., **and emergence/re-entry (i.e. bat access) points are indicated on Figure 1a (pg 12) and roost locations are shown on Figure 1b (pg 13).**
- 4.1.6 During the first dusk emergence survey, a total of six brown long-eared bats emerged from the apex of the internal wall of the chancel, adjacent to the nave. All six bats were seen inside the church at the end of the survey, one hanging on the wall of the chancel under the emergence point, and the other five hanging along the central beam of the nave. One common pipistrelle bat emerged from an external feature on in the roof valley between the north aisle and nave, but the exact emergence point could not be determined as this area is not visible from the ground. One soprano pipistrelle emerged from north elevation of the bell tower.
- 4.1.7 During the second dusk emergence survey, a total of four brown long-eared bats were recorded roosting inside the church at the start of the survey and were located along the central ridge of the nave. At the end of the survey, only one brown long-eared bat was seen roosting inside the church, along the central ridge of the nave. No bats were seen emerging from external features of the church building during the survey.
- 4.1.8 During the dawn re-entry survey, a total of five brown long-eared bats were recorded re-entering the church via loose external roof tiles on the north-east corner of the chancel, above the guttering. One common pipistrelle re-entered the church via a loose roof tile just below the ridge on the southern elevation of the nave, to the east of the south porch. In addition, several bats were seen exhibiting re-entry behaviour, though no re-entry was observed. A common pipistrelle and a brown long-eared bat were observed flying up the roof valley and circling over the southern slope of the north aisle, possibly re-entering here. It is not possible to view the area of possible re-entry from ground level. *Myotis* species and brown long-eared bats

were observed circling the western gable end of the building, often flying behind the bell tower. It is possible the bats re-entered the building here, but this area is not visible from ground level. Two *Myotis* species were also seen looping close to southern sloped elevation of chancel area of church repeatedly, possibly exhibiting re-entry behaviour or foraging.

- 4.1.9 During the third dusk emergence survey, one brown long-eared bat emerged internally from the apex of chancel, adjacent to the nave and hung on the wall beneath emergence point. The same bat was seen roosting inside the church throughout the survey and remained inside the church at the end of the survey. Two common pipistrelle bats were recorded emerging from external features of the church: one from the roof valley between the north aisle and chancel, and the other from a loose tile below the ridge on the southern elevation of the nave, to the east of the south porch.

## 4.2 DNA Analysis

- 4.2.1 The DNA analysis of the collected bat droppings from inside the church (chancel) identified the droppings as being that of brown long-eared bats. Full DNA analysis result can be found in Appendix 4.

## 4.3 Bat Walk

- 4.3.1 The following species were recorded during the bat walk; common pipistrelle *P. pipistrellus*, soprano pipistrelle *P. pygmaeus*, Natterer's *Myotis nattereri*, barbastelle *Barbastella barbastellus*, Daubenton's *M. Daubentonii*, whiskered bat *M. myctacinus*/Brandt's bat *M. brandtii*, noctule *Nyctalus noctula*, and brown long-eared bat. Five common pipistrelles emerged from the western gable roof, and two brown long-eared bats and two whiskered/Brandt's bats emerged from the south-west corner of the church roof.

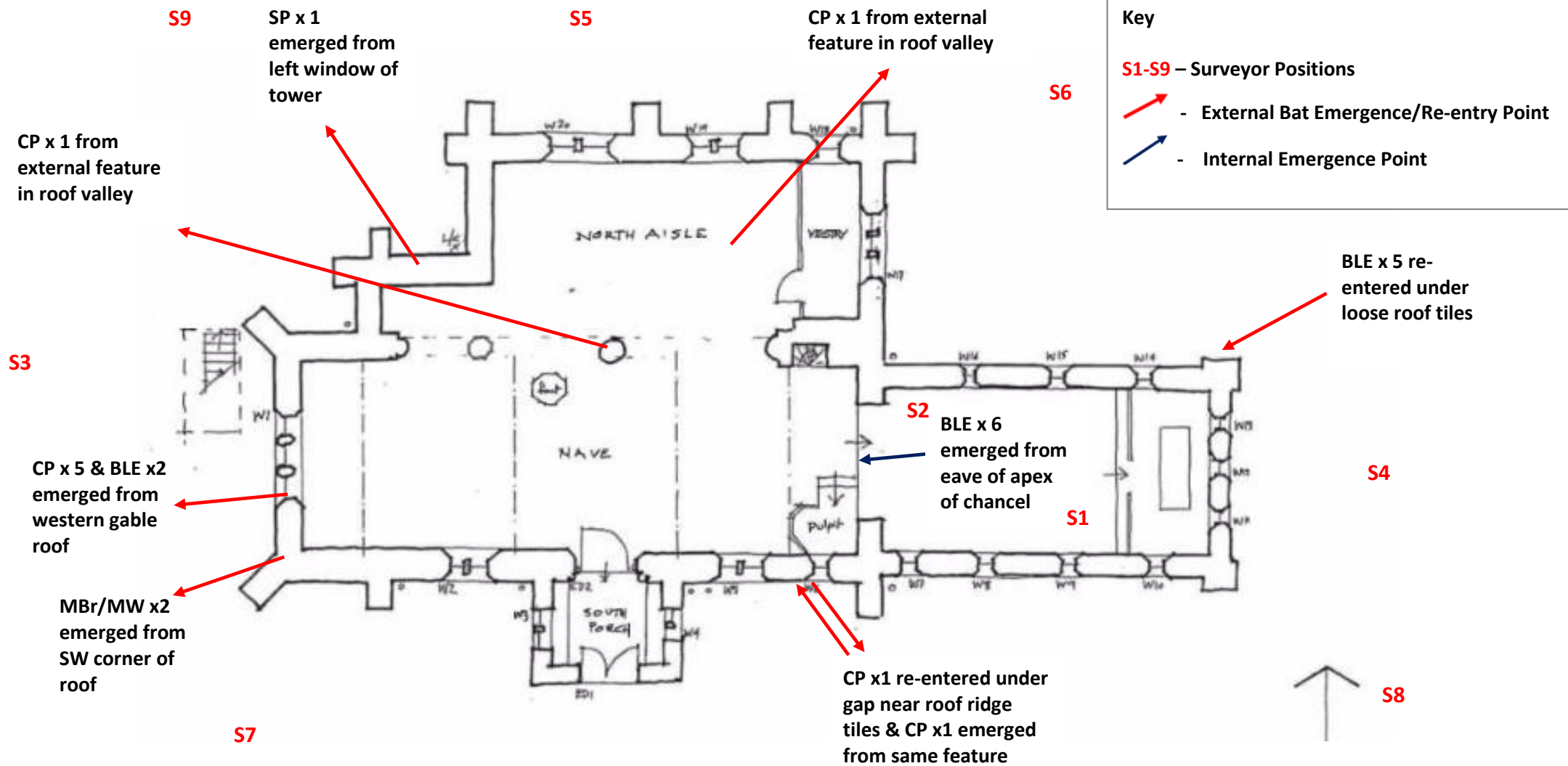


Figure 1a. Plan of St. Peter's Church, Little Rissington (provided by client) showing Bat Emergence/Re-entry Points (i.e. bat access points)  
 (CP = Common pipistrelle, SP = Soprano pipistrelle. BLE = Brown long-eared bat, MBr/MW = Brandt's/Whiskered bat)

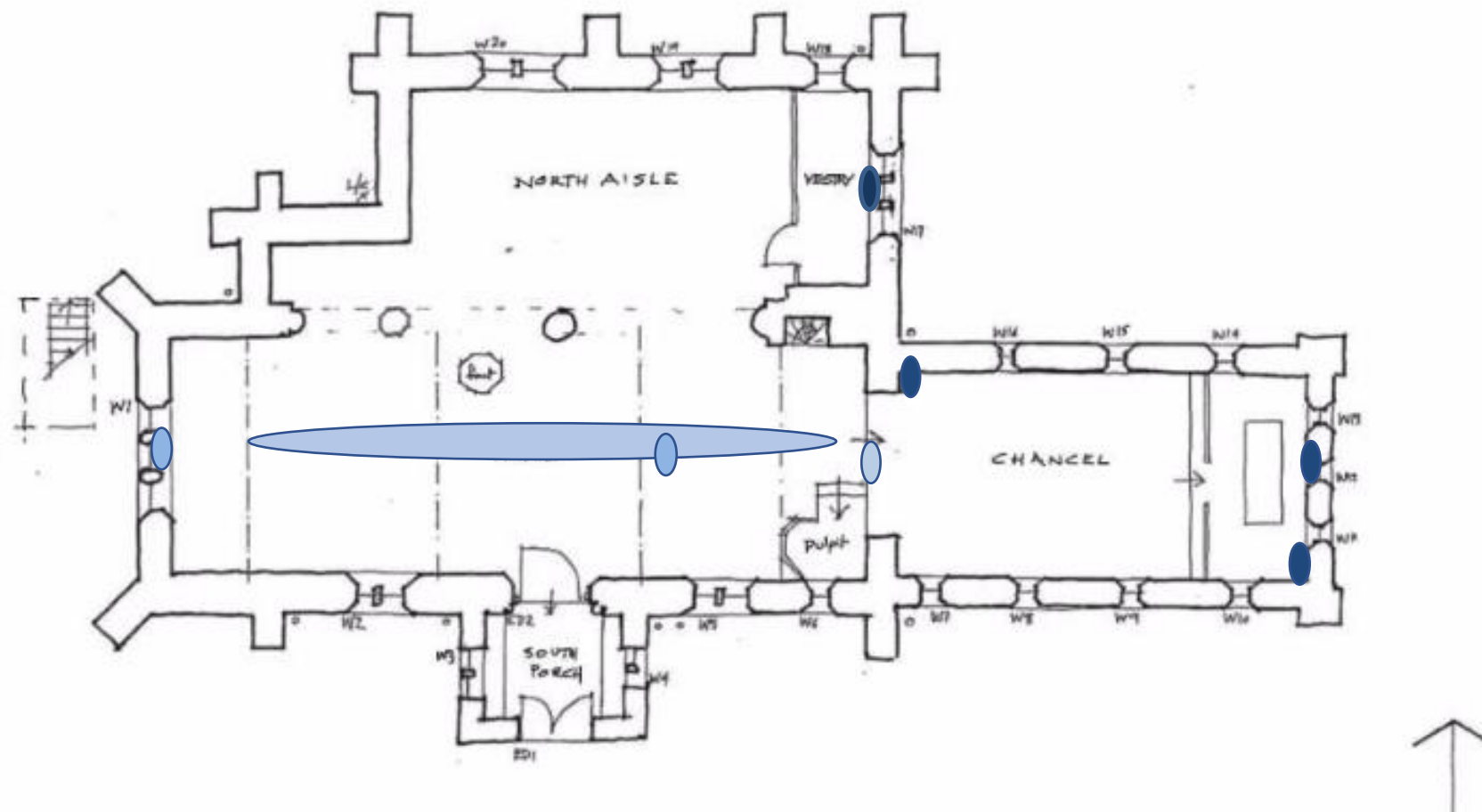


Figure 1b. Plan of St. Peter's Church, Little Rissington (provided by client) showing bat roosts

Dark blue circle = historic bat roosts plus droppings, pale blue = current bat roosts 2021



**Table 1: Survey Conditions**

Survey date	Sunset/ sunrise time	Start/end of Survey	Temperature outside (°C)	Temperature inside (°C)	Wind (beaufort scale)	Rain
07/06/2021 Dusk Survey	21:23	Start 21:03	17.1	19.6	0	None
		End 22:53	16.3	18.7	0	None
22/06/2021 Dusk Survey	21:30	Start 21:15	13.1	15.3	0	None
		End 23:00	11.6	15.3	0	None
01/07/2021 Dawn Survey	04:52	Start 03:22	12.2	Not recorded – no access.	0	None
		End 04:52	11.6	Not recorded – no access.	0	None
18/08/2021 Dusk Survey	20:23	Start 20:08	17.3	Not recorded.	2-3	None
		End 21:53	16.6	18.8	0	None

Table 2.1 Dusk Emergence Survey Results – 7<sup>th</sup> June 2021. Sunset: 21:23

Activity		Details			
Time	Details	Species	No. of bats	Surveyor No.	Location/Behaviour
21:48	Commuting	<i>N. noctula</i>	1	4	Echolocation call detected. Bat not seen.
21:50	Commuting	<i>N. noctula</i>	1	4	Echolocation call detected. Bat not seen.
<b>21:50</b>	<b>Emergence - External</b>	<b><i>P. pipistrellus</i></b>	<b>1</b>	<b>3</b>	<b>Bat seen flying from the middle area of the roof of the church (roof valley), then flew west.</b>
21:50	Pass	<i>P. auritus</i>	1	5	Echolocation call detected. Bat not seen.
21:54	Commuting	<i>P. pipistrellus</i>	1	4	Echolocation call detected. Bat not seen.
21:54	Foraging	<i>P. pipistrellus</i>	1	3	Bat seen foraging around church.
<b>21:58</b>	<b>Emergence - Internal</b>	<b><i>P. auritus</i></b>	<b>1</b>	<b>1</b>	<b>Bat emerged from apex of chancel, adjacent to the nave and hung on the wall beneath emergence point.</b>
21:59	Foraging	<i>P. pygmaeus</i>	1	4	Bat flew west to east in front of church.
22:00	Pass	<i>P. pygmaeus</i>	1	3	Echolocation call detected. Bat not seen.
<b>22:01</b>	<b>Emergence - Internal</b>	<b><i>P. auritus</i></b>	<b>1</b>	<b>1</b>	<b>Second bat emerged from apex of chancel, adjacent to the nave and hung on the wall beneath emergence point.</b>
22:02	Foraging	<i>P. pygmaeus</i> and <i>P. pipistrellus</i>	1 of each	4	Bats seen flying around graveyard for several minutes.
22:02	Foraging	<i>P. pygmaeus</i>	1	3	Bat seen foraging around church.
<b>22:05</b>	<b>Emergence - Internal</b>	<b><i>P. auritus</i></b>	<b>1</b>	<b>1</b>	<b>Third bat emerged from apex of chancel, adjacent to the nave and hung on the wall beneath emergence point.</b>
<b>22:06</b>	<b>Emergence - Internal</b>	<b><i>P. auritus</i></b>	<b>1</b>	<b>1</b>	<b>Fourth bat emerged from apex of chancel, adjacent to the nave and hung on the wall beneath emergence point.</b>
<b>22:10</b>	<b>Re-enter - Internal</b>	<b><i>P. auritus</i></b>	<b>4</b>	<b>1</b>	<b>All four bats re-entered the apex where they emerged from.</b>
22:16	Pass	<i>P. pygmaeus</i>	1	3	Echolocation call detected. Bat not seen.

22:18	Pass	<i>N. noctula</i>	1	3	Echolocation call detected. Bat not seen.
22:19	Commuting	<i>N. noctula</i>	1	4	Echolocation call detected. Bat not seen.
<b>22:20</b>	<b>Emergence - Internal</b>	<b><i>P. auritus</i></b>	<b>1</b>	<b>1</b>	<b>Bat emerged from apex of chancel, adjacent to the nave and hung on the wall beneath emergence point.</b>
22:21	Pass	<i>Myotis</i> sp.	1	3	Echolocation call detected. Bat not seen.
22:22	Commuting	<i>P. pipistrellus</i>	1	4	Echolocation call detected. Bat not seen.
22:22	Foraging	<i>P. pygmaeus</i> and <i>P. pipistrellus</i>	1 of each	3	Bats seen foraging around church.
<b>22:22</b>	<b>Emergence - External</b>	<b><i>P. pygmaeus</i></b>	<b>1</b>	<b>5</b>	<b>Bat seen emerging from church tower from the north elevation.</b>
<b>22:23</b>	<b>Emergence - Internal</b>	<b><i>P. auritus</i></b>	<b>2</b>	<b>1</b>	<b>Bats emerged from apex of chancel, adjacent to the nave and hung on the wall beneath emergence point.</b>
<b>22:27</b>	<b>Emergence - Internal</b>	<b><i>P. auritus</i></b>	<b>2</b>	<b>1</b>	<b>Bats emerged from apex of chancel, adjacent to the nave and hung on the wall beneath emergence point.</b>
<b>22:29</b>	<b>Emergence - Internal</b>	<b><i>P. auritus</i></b>	<b>1</b>	<b>1</b>	<b>Bat emerged from apex of chancel, adjacent to the nave and hung on the wall beneath emergence point.</b>
22:37	Pass	<i>P. auritus</i>	1	3	Bat seen.
<b>22:40</b>	<b>Roosting - Internal</b>	<b><i>P. auritus</i></b>	<b>6</b>	<b>1</b>	<b>At the end of the survey, one of the six bats which emerged was clinging to the wall under the emergence point. The other five bats were all hanging along the central ridge of the nave.</b>
22:41	Commuting	<i>Myotis</i> species	1	4	Echolocation call detected. Bat not seen.
22:41	Foraging	<i>P. pipistrellus</i>	1	3	Bat seen foraging above church building.
22:45	Pass	<i>P. auritus</i>	1	3	Echolocation call detected. Bat not seen.
22:45	Foraging	<i>P. pygmaeus</i>	1	3	Bat seen foraging around church.
22:47	Pass	<i>Myotis</i> sp.	1	3	Echolocation call detected. Bat not seen.
22:47	Survey terminated.				

Table 2.2. Dusk Emergence Survey Results – 22<sup>nd</sup> June 2021. Sunset 21:30

Activity		Details			
Time	Details	Species	No. of bats	Surveyor No.	Location/Behaviour
21:30	Internal inspection	<i>P. auritus</i>	-	2	Bat droppings and dead insects seen on alter and windowsills of chancel.
21:50	Commuting	Unidentified	1	9	Bat seen flying by church.
21:54	Pass	<i>P. pygmaeus</i>	1	8	Echolocation call detected. Bat not seen.
21:54-21:57	Roosting – Internal	<i>P. auritus</i>	4	2	Four brown long-eared bats seen hanging along the central ridge of the nave, inside the church.
21:56	Commuting	<i>P. pipistrellus</i>	1	6	One bat flew past the church, from west to east.
21:56	Commuting	<i>P. pygmaeus</i>	1	7	One bat seen flying from east to west past church building.
22:00	Pass	<i>P. auritus</i>	1	6	Echolocation call detected. Bat not seen.
22:00	Commuting	Unidentified	1	9	Bat seen flying by church.
22:01	Commuting	Unidentified	1	9	Bat seen flying by church.
22:02	Commuting	Unidentified	1	9	Bat seen flying by church.
22:03	Commuting	Unidentified	1	9	Bat seen flying by church.
22:04	Pass	<i>P. auritus</i>	1	6	Echolocation call detected. Bat not seen.
22:04	Commuting	Unidentified	2	9	Two bats seen flying by church.
22:05	Pass	<i>P. pipistrellus</i>	1	6	Echolocation call detected. Bat not seen.
22:05	Commuting	Unidentified	2	9	Two bats seen flying by church.
22:06	Commuting	Unidentified	1	9	Bat seen flying by church.
22:08	Pass	<i>P. pygmaeus</i>	1	9	Echolocation call detected. Bat not seen.
22:11	Pass	<i>P. pipistrellus</i>	1	6	Echolocation call detected. Bat not seen.
22:12	Pass	<i>N. noctula</i>	1	9	Echolocation call detected. Bat not seen.

22:15	Pass	<i>P. pygmaeus</i>	1	8	Echolocation call detected. Bat not seen.
22:16	Pass	<i>P. pygmaeus</i>	1	1	Faint echolocation call detected. Bat not seen.
22:16	Pass	<i>P. pygmaeus</i>	1	7	Echolocation call detected. Bat not seen.
22:18	Pass	<i>P. pygmaeus</i>	1	6	Echolocation call detected. Bat not seen.
22:18	Pass	<i>P. pygmaeus</i>	1	7	Echolocation call detected. Bat not seen.
22:18	Pass	<i>N. noctula</i>	1	9	Echolocation call detected. Bat not seen.
22:19	Pass	<i>N. noctula</i>	1	9	Echolocation call detected. Bat not seen.
<b>22:20</b>	<b>Roosting – Internal</b>	<b><i>P. auritus</i></b>	<b>4</b>	<b>1</b>	<b>Four brown long-eared bat seen hanging along the central ridge of the chancel, inside the church.</b>
22:20-21	Foraging	<i>P. pipistrellus</i>	1	6	Echolocation call detected. Bat not seen.
22:22	Pass	<i>P. pygmaeus</i>	1	6	Echolocation calls detected, feeding sounds heard. Bats not seen.
22:22	Foraging	<i>P. pygmaeus</i>	1	7	One bat seen flying in circles in churchyard.
22:22	Pass	<i>N. noctula</i>	1	9	Echolocation call detected. Bat not seen.
22:24	Foraging	<i>P. pygmaeus</i>	1	8	One bat seen foraging in the churchyard to the south of the church building.
22:24	Pass	<i>P. pygmaeus</i>	1	9	Echolocation call detected. Bat not seen.
22:25	Pass	<i>P. pipistrellus</i>	1	6	Echolocation call detected. Bat not seen.
22:26	Pass	<i>N. noctula</i>	1	6	Echolocation call detected. Bat not seen.
22:27	Pass	<i>P. pygmaeus</i>	1	6	Echolocation call detected. Bat not seen.
22:27	Pass	<i>N. noctula</i>	1	8	Echolocation call detected. Bat not seen.
22:27	Pass	<i>P. pygmaeus</i>	1	7	Echolocation call detected. Bat not seen.
22:27	Pass	<i>P. pygmaeus</i> & <i>P. pipistrellus</i>	1 of each	9	Echolocation calls detected. Bats not seen.
22:28	Commuting	<i>P. pipistrellus</i>	1	6	One bat flew past the church from the car park, from west to east.
22:28	Pass	<i>P. pygmaeus</i>	1	6	Echolocation call detected. Bat not seen.

22:28	Roosting – Internal	<i>P. auritus</i>	3	2	<b>Three brown long-eared bats seen hanging along the central ridge of the nave, inside the church.</b>
22:28	Foraging	<i>P. pygmaeus</i>	1	8	Echolocation call detected. Bat not seen. Several passes for several minutes.
22:29	Pass	<i>P. pipistrellus</i>	1	6	Echolocation call detected. Bat not seen.
22:29	Pass	<i>P. pipistrellus</i>	1	9	Echolocation call detected. Bat not seen.
22:30	Pass	<i>P. pipistrellus</i>	1	6	Echolocation call detected. Bat not seen.
22:30	Pass	<i>P. pygmaeus</i> & <i>P. pipistrellus</i>	1 of each	9	Echolocation calls detected. Bats not seen.
22:31	Pass	<i>P. pygmaeus</i>	1	9	Echolocation call detected. Bat not seen.
22:31-32	Passes	<i>P. pipistrellus</i>	1	6	Echolocation calls detected, feeding sounds heard. Bats not seen.
22:31-43	Foraging/ socialising	<i>P. pipistrellus</i>	2	6	Two bats seen foraging in the churchyard. Social calls detected.
22:32	Pass	<i>P. pipistrellus</i>	1	7	Echolocation call detected. Bat not seen.
22:32	Pass	<i>P. pygmaeus</i>	1	9	Echolocation call detected. Bat not seen.
22:33	Pass	<i>P. pygmaeus</i>	1	7	Echolocation call detected. Bat not seen.
22:33	Pass	<i>P. pygmaeus</i> & <i>P. pipistrellus</i>	1 of each	9	Echolocation calls detected. Bats not seen.
22:33-37	Foraging	<i>P. pipistrellus</i>	2	6	Two bats seen in the churchyard flying around each other for several minutes.
22:34	Pass	<i>N. noctula</i>	1	6	Echolocation call detected. Bat not seen.
22:34	Roosting – Internal	<i>P. auritus</i>	1	2	<b>Brown long-eared bat seen hanging along the central ridge of the nave, inside the church.</b>
22:34	Pass	<i>N. noctula</i>	1	8	Echolocation call detected. Bat not seen.
22:34	Pass	<i>P. pygmaeus</i>	1	8	Echolocation call detected. Bat not seen.
22:34	Pass	<i>P. pipistrellus</i>	1	9	Echolocation call detected. Bat not seen.
22:35	Pass	<i>P. pygmaeus</i>	1	7	Echolocation call detected. Bat not seen.
22:35	Pass	<i>Pipistrellus nathusii</i>	1	9	Echolocation call detected. Bat not seen.

22:36	Pass	<i>N. noctula</i>	1	9	Echolocation call detected. Bat not seen.
22:37	Foraging	<i>P. pipistrellus</i>	1	8	Echolocation call detected. Bat not seen. Several passes.
22:37	Pass	<i>P. pygmaeus</i>	1	7	Echolocation call detected. Bat not seen.
<b>22:38</b>	<b>Roosting – Internal</b>	<b><i>P. auritus</i></b>	<b>2</b>	<b>2</b>	<b>Brown long-eared bats seen hanging along the central ridge of the nave, inside the church.</b>
22:39	Pass	<i>P. pygmaeus</i>	1	7	Echolocation call detected. Bat not seen.
22:39	Pass	<i>N. noctula</i>	1	9	Echolocation call detected. Bat not seen.
22:40	Pass	<i>Myotis</i> sp.	1	8	Echolocation call detected. Bat not seen.
22:40	Pass	<i>N. noctula</i>	1	7	Echolocation call detected. Bat not seen.
22:41	Pass	<i>Myotis</i> sp.	1	9	Echolocation call detected. Bat not seen.
22:42	Pass	<i>N. noctula</i>	1	9	Echolocation call detected. Bat not seen.
22:43	Commuting	<i>P. pygmaeus</i>	1	7	One bat seen flying from west to east past church building.
22:43	Pass	<i>P. pygmaeus</i>	1	9	Echolocation call detected. Bat not seen.
22:44	Pass	<i>P. pipistrellus</i>	1	9	Echolocation call detected. Bat not seen.
22:45	Pass	<i>P. pygmaeus</i>	1	8	Echolocation call detected. Bat not seen.
22:45	Pass	<i>P. pygmaeus</i> & <i>P. pipistrellus</i>	1 of each	9	Echolocation calls detected. Bats not seen.
22:45	Pass	<i>P. pipistrellus</i>	1	9	Echolocation call detected. Bat not seen.
22:45-52	Foraging	<i>P. pipistrellus</i>	2	6	Two bats heard, not seen, foraging in the churchyard. Feeding sounds detected.
22:46	Pass	<i>P. pygmaeus</i> & <i>P. pipistrellus</i>	1 of each	9	Echolocation call detected. Bat not seen.
<b>22:47</b>	<b>Roosting – Internal</b>	<b><i>P. auritus</i></b>	<b>2</b>	<b>2</b>	<b>Brown long-eared bats seen hanging along the central ridge of the nave, inside the church.</b>
22:47	Pass	<i>P. pygmaeus</i> & <i>P. pipistrellus</i>	1 of each	9	Echolocation calls detected. Bats not seen.
22:47	Pass	<i>P. pygmaeus</i>	1	9	Echolocation call detected. Bat not seen.
22:48	Pass	<i>N. noctula</i>	1	6	Echolocation call detected. Bat not seen.

22:48	Pass	<i>N. noctula</i>	1	8	Echolocation call detected. Bat not seen. Several passes.
22:48	Pass	<i>N. noctula</i>	1	7	Echolocation call detected. Bat not seen.
22:48	Pass	<i>P. pygmaeus &amp; P. pipistrellus</i>	1 of each	9	Echolocation calls detected. Bats not seen.
22:49	Pass	<i>N. noctula</i>	1	9	Echolocation call detected. Bat not seen.
22:49	Pass	<i>P. pipistrellus</i>	1	9	Echolocation call detected. Bat not seen.
22:50	Pass	<i>N. leisleri</i>	1	6	Echolocation call detected. Bat not seen.
22:50	Pass	<i>P. nathusii</i>	1	8	Echolocation call detected. Bat not seen.
22:50	Pass	<i>P. pipistrellus</i>	1	7	Echolocation call detected. Bat not seen.
22:51	Pass	<i>N. noctula</i>	1	8	Echolocation call detected. Bat not seen.
<b>22:57</b>	<b>Roosting - Internal</b>	<b><i>P. auritus</i></b>	<b>1</b>	<b>2</b>	<b>Brown long-eared bat seen hanging along the central ridge of the nave, inside the church.</b>
23:00	Survey terminated.				



**Table 2.3. Dawn Re-entry Survey Results – 1<sup>st</sup> July 2021. Sunrise 04:52**

Activity		Details			
Time	Details	Species	No. of bats	Surveyor No.	Location/Behaviour
03:23	Foraging	<i>P. pipistrellus</i>	1	9	Echolocation call detected. Bat not seen.
03:23	Pass	<i>P. pipistrellus</i>	1	7	Echolocation call detected. Bat not seen.
03:27	Pass	<i>Myotis</i> sp.	1	6	Echolocation call detected. Bat not seen.
03:28	Pass	<i>Myotis</i> sp.	1	7	Echolocation call detected. Bat not seen.
03:29	Pass	<i>Myotis</i> sp.	1	6	Echolocation call detected. Bat not seen.
03:29	Pass	<i>P. pipistrellus</i>	1	8	Echolocation call detected. Bat not seen.
03:31	Pass	<i>Myotis</i> sp.	1	9	Echolocation call detected. Bat not seen.
<b>03:32</b>	<b>Possible re-entry behaviour/ foraging</b>	<b><i>Myotis</i> sp.</b>	<b>2</b>	<b>6</b>	<b>Two bats seen looping close to southern sloped elevation of chancel area of church repeatedly, possibly exhibiting re-entry behaviour or foraging.</b>
<b>03:32</b>	<b>Possible re-entry</b>	<b><i>Myotis</i> sp.</b>	<b>2</b>	<b>7</b>	<b>Two bats seen flying close to south porch, close to building.</b>
03:32	Pass	<i>P. auritus</i>	1	7	Echolocation call detected. Bat not seen.
03:33	Commuting	<i>Myotis</i> sp.	1	7	One bat flew from west to east, past the south elevation of the church.
03:34	Commuting	<i>Myotis</i> sp.	1	9	One bat flew past western gable end of church, from south to north.
03:36	Foraging	<i>Myotis</i> sp.	2	8	Two bats seen flying low in circles over the roof to the southern elevation of the chancel.
03:36	Commuting	Unidentified	1	7	One bat seen flying around the church door of the south porch. No echolocation call detected.
03:40	Commuting	<i>Myotis</i> sp.	1	6	One bat flew from north to south across the roof of the chancel.
03:43	Commuting	Unidentified	1	7	One bat seen flying around the church door of the south porch (flew from the south). No echolocation call detected.

03:44	Pass	<i>Myotis</i> sp. & <i>P. pygmaeus</i>	1 of each	9	Echolocation call detected. Bat not seen.
03:45	Commuting	<i>P. pipistrellus</i>	1	7	One bat flew around the west gable end of the church, from south to north.
03:47	Pass	<i>Myotis</i> sp.	1	6	Echolocation call detected. Bat not seen.
03:48	Foraging	<i>P. pipistrellus</i>	1	6	One bat seen foraging in churchyard.
03:48	Commuting	<i>P. auritus</i>	1	7	One bat flew from north-east to south-west, towards trees to the west of the church.
03:48	Pass	<i>Myotis</i> sp.	1	7	Echolocation call detected. Bat not seen.
03:49	Pass	<i>Myotis</i> sp.	2	8	Echolocation call detected. Bat not seen.
03:49	Pass	<i>P. auritus</i>	1	9	Echolocation call detected. Bat not seen.
03:51	Pass	<i>P. pipistrellus</i>	1	9	Echolocation call detected. Bat not seen.
03:51	Commuting	<i>P. auritus</i>	1	7	One bat flew from west to east past the front of the church.
<b>03:52</b>	<b>Re-entry</b>	<b><i>P. auritus</i></b>	<b>1</b>	<b>6</b>	<b>One bat re-entered church via loose external roof tiles on the north-east corner of the chancel, above the guttering.</b>
03:53	Pass	<i>P. auritus</i>	1	9	Echolocation call detected. Bat not seen.
03:53	Commuting	<i>P. auritus</i>	1	7	One bat flew from west to east, toward the central roof of the church.
<b>03:56-04:00</b>	<b>Re-entry</b>	<b><i>P. auritus</i></b>	<b>4</b>	<b>6</b>	<b>Four bats re-entered church via loose external roof tiles on the north-east corner of the chancel, above the guttering.</b>
03:56	Pass	<i>P. auritus</i>	1	9	Echolocation call detected. Bat not seen.
03:56	Commuting	<i>N. noctula</i>	1	7	One bat flew from west to east past the front of the church.
<b>03:56-04:20</b>	<b>Possible re-entry</b>	<b><i>P. pipistrellus</i> &amp; <i>P. auritus</i></b>	<b>1 or each</b>	<b>6</b>	<b>Two bats were observed flying up the roof valley and circling over the southern slope of the north aisle, possibly re-entering here (visibility not possible).</b>
<b>03:57</b>	Pass	<i>P. pipistrellus</i>	<b>1</b>	8	Echolocation call detected. Bat not seen.
03:57	Commuting	<i>P. auritus</i>	1	7	One bat flew along southern elevation of church, around

					western gable end, toward bell tower.
03:58	Possible re-entry	<i>P. auritus</i>	1	9	<b>One bat seen flying behind bell tower, above the north aisle.</b>
03:59	Possible re-entry behaviour	<i>Myotis</i> sp.	2	7	<b>Two bats seen circling the western gable end of the building.</b>
04:00	Possible re-entry	<i>P. auritus</i>	1	9	<b>One bat seen flying over the north aisle, toward the north-east corner.</b>
04:01	Commuting	<i>P. auritus</i>	2	8	One bat flew over the church roof at the western gable end, and another flew over the eastern gable end of the church.
04:01	Possible re-entry behaviour	<i>P. auritus</i>	1	7	<b>One bat seen circling the western gable end of the building.</b>
04:03	Commuting	<i>P. pipistrellus</i> & <i>P. auritus</i>	1 of each	8	Bats seen flying around churchyard.
04:03	Pass	<i>P. pipistrellus</i>	1	9	Echolocation call detected. Bat not seen.
04:05	Pass	<i>P. auritus</i>	1	9	Echolocation call detected. Bat not seen.
04:05	Commuting	<i>P. pipistrellus</i>	1	7	One bat flew from north-east to south-west, towards trees to the west of the church.
04:06	Possible re-entry behaviour	<i>P. auritus</i>	2	7	<b>Two bats seen circling the western gable end of the building.</b>
04:08	Possible re-entry	Unidentified	1	9	<b>One bat flew behind bell tower. No echolocation call detected.</b>
04:10-04:12	Re-entry	<i>P. pipistrellus</i>	1	7 & 8	<b>One bat re-entered church via loose roof tile just below the ridge on the southern elevation of the nave, to the east of the south porch.</b>
04:15	Pass	<i>P. pipistrellus</i>	1	9	Echolocation call detected. Bat not seen.
04:16	Commuting	<i>P. auritus</i>	2	7	Two bats seen flying from west to east, past the southern elevation of the church.
04:17	Pass	<i>Myotis</i> species	1	9	Echolocation call detected. Bat not seen.
04:20	Re-entry behaviour	<i>P. auritus</i>	1	8	<b>Bat seen flying around the eastern gable end of the church building.</b>
04:20	Pass	<i>P. pygmaeus</i>	1	7	Echolocation call detected. Bat not seen.

04:21	Commuting	<i>P. auritus</i>	1	9	One bat flew from west to east, past the south-west corner of the church.
04:24	Commuting	Unidentified	1	7	One bat flew from north-east to south-west, towards trees to the west of the church.
04:27-04:29	Foraging	<i>P. pygmaeus</i>	1	7	One bat seen flying around western gable end of church.
04:32	Pass	<i>N. noctula</i>	1	9	Echolocation call detected. Bat not seen.
04:32	Pass	<i>N. noctula</i>	1	7	Echolocation call detected. Bat not seen.
04:52	Survey terminated.				

Table 2.4. Dusk Emergence Survey Results – 18<sup>th</sup> August 2021. Sunset 20:23

Activity		Details			
Time	Details	Species	No. of bats	Surveyor No.	Location/Behaviour
20:34	Pass	<i>P. pygmaeus</i>	1	7	Echolocation call detected. Bat not seen.
<b>20:38</b>	<b>Emergence - External</b>	<b><i>P. pipistrellus</i></b>	<b>1</b>	<b>6</b>	<b>One bat emerged from the roof valley and flew north-east.</b>
20:38	Commuting	<i>Pipistrellus</i> species	1	9	One bat seen flying from north-west to south-east across churchyard.
20:39-20:40	Foraging	<i>P. pipistrellus</i>	1	6	One bat seen foraging in the churchyard.
<b>20:40</b>	<b>Emergence - External</b>	<b><i>P. pipistrellus</i></b>	<b>1</b>	<b>7</b>	<b>One bat emerged from a loose roof tile just below the ridge on the southern elevation of the nave, to the east of the south porch.</b>
20:40	Pass	<i>Myotis</i> sp.	1	7	Echolocation call detected. Bat not seen.
20:41	Commuting	<i>P. pipistrellus</i>	1	6	One bat flew past the eastern gable end of the church, from south-west to north-east.
20:41	Pass	<i>P. pipistrellus</i>	1	8	Echolocation call detected. Bat not seen.
20:41	Foraging	<i>P. pipistrellus</i>	1	7	One bat seen flying around churchyard.
20:43	Foraging	<i>Myotis</i> sp.	1	7	One bat flew from the direction of the church towards the trees to the west of the church.
20:44	Pass	<i>P. pipistrellus</i>	1	6	Echolocation call detected. Bat not seen.
20:44	Pass	<i>P. pipistrellus</i>	1	8	Echolocation call detected. Bat not seen.
20:45	Foraging	<i>Myotis</i> sp.	1	7	One bat flew from the direction of the church towards the trees to the west of the church.
20:48	Pass	<i>Myotis</i> sp.	1	8	Very faint echolocation call detected. Bat not seen.
20:48	Foraging	<i>Myotis</i> sp.	1	7	One bat flew from the direction of the church towards the trees to the west of the church.
<b>20:48</b>	<b>Emergence - Internal</b>	<b><i>P. auritus</i></b>	<b>1</b>	<b>2</b>	<b>Bat emerged from apex of chancel, adjacent to the nave and hung on the wall beneath emergence point.</b>

20:52-21:04	Foraging	<i>Myotis</i> sp.	1	8	One bat seen foraging around the fields and trees to the south of the church building.
20:57	Foraging	<i>P. auritus</i>	1	7	One bat seen flying around churchyard.
<b>20:57</b>	<b>Roosting</b>	<b><i>P. auritus</i></b>	<b>1</b>	<b>2</b>	<b>One bat seen flying around rafters in the nave of the church, near the chancel.</b>
<b>21:00</b>	<b>Roosting</b>	<b><i>P. auritus</i></b>	<b>1</b>	<b>2</b>	<b>One bat seen perched on the wooden roof beam in the nave, cleaning itself.</b>
21:01	Pass	<i>Eptesicus serotinus</i>	1	7	Echolocation call detected. Bat not seen.
21:03	Pass	<i>P. auritus</i>	1	7	Echolocation call detected. Bat not seen.
21:04	Pass	<i>Myotis</i> sp.	1	7	One bat seen in churchyard.
21:05	Pass	<i>P. pygmaeus</i>	1	8	Echolocation call detected. Bat not seen.
<b>21:05</b>	<b>Roosting</b>	<b><i>P. auritus</i></b>	<b>1</b>	<b>2</b>	<b>One bat seen on the ceiling in the nave.</b>
21:06	Pass	<i>P. pygmaeus</i>	1	7	One bat seen in churchyard.
21:09	Commuting	<i>Myotis</i> sp.	1	9	One bat seen flying from south to north past the western gable end of the church.
21:09	Pass	<b><i>P. auritus</i></b>	1	2	Echolocation call detected in the nave of the church. Bat not seen.
21:10-21:12	Pass	<i>P. auritus</i>	1	7	One bat flying in churchyard several times.
21:11	Commuting	<i>Myotis</i> sp.	1	9	One bat seen flying from south to north past the western gable end of the church.
21:12	Pass	<i>P. auritus</i>	1	7	Echolocation call detected. Bat not seen.
21:13	Pass	<i>N. noctula</i>	1	6	Echolocation call detected. Bat not seen.
21:13	Foraging	<i>N. noctula</i>	1	8	Echolocation call detected. Bat not seen.
21:13	Pass	<i>Myotis</i> sp.	1	9	Echolocation call detected. Bat not seen.
21:14	Pass	<i>P. auritus</i>	1	7	Echolocation call detected. Bat not seen.
21:14	Pass	<i>N. noctula</i>	1	7	One bat seen flying over churchyard.
21:15	Foraging	<i>Myotis</i> sp.	1	7	One bat flew over the church and then seen foraging around the church.

21:22	Pass	<i>Myotis</i> sp.	1	7	Echolocation call detected. Bat not seen.
21:22	Pass	<i>Myotis</i> sp.	1	9	Echolocation call detected. Bat not seen.
21:22	Foraging	<i>P. pipistrellus</i>	1	9	One bat seen foraging in the churchyard to the north of the church.
21:26	Pass	<i>P. pygmaeus</i>	1	6	Echolocation call detected. Bat not seen.
21:26	Pass	<i>P. pygmaeus</i>	1	8	Echolocation call detected. Bat not seen.
21:27	Pass	<i>P. pygmaeus</i>	1	9	Echolocation call detected. Bat not seen.
21:31	Pass	<i>P. auritus</i>	1	6	Echolocation call detected. Bat not seen.
21:31	Pass	<i>P. pipistrellus</i>	1	8	Echolocation call detected. Bat not seen.
21:35	Pass	<i>P. auritus</i>	1	7	Echolocation call detected. Bat not seen.
21:36	Pass	<i>Pipistrellus</i> sp.	1	9	Echolocation call detected. Bat not seen.
<b>21:36</b>	<b>Roosting</b>	<b><i>P. auritus</i></b>	<b>1</b>	<b>2</b>	<b>One bat flew across the nave and into the chancel.</b>
21:38	Pass	<i>P. auritus</i>	1	7	Echolocation call detected. Bat not seen.
21:44	Pass	<i>E. serotinus</i>	1	8	Echolocation call detected. Bat not seen.
21:44	Pass	<i>E. serotinus</i>	1	7	Echolocation call detected. Bat not seen.
21:46	Pass	<i>B. barbastellus</i>	1	6	Echolocation call detected. Bat not seen.
21:46	Pass	<i>Myotis species</i>	1	9	Echolocation call detected. Bat not seen.
21:47	Pass	<i>B. barbastellus</i>	1	7	Echolocation call detected. Bat not seen.
21:48	Pass	<i>P. auritus</i> & <i>P. pygmaeus</i>	1 of each	6	Echolocation call detected. Bat not seen.
21:48	Pass	<i>P. pygmaeus</i>	1	8	Echolocation call detected. Bat not seen.
21:48	Pass	<i>P. auritus</i>	1	8	Echolocation call detected. Bat not seen.
21:49	Pass	<i>P. auritus</i>	1	7	Echolocation call detected. Bat not seen.
21:49	Pass	<i>P. pygmaeus</i>	1	7	Echolocation call detected. Bat not seen.
21:51	Pass	<i>P. auritus</i> & <i>P. pygmaeus</i>	1 of each	6	Echolocation call detected. Bat not seen.

21:51	Pass	<i>P. pygmaeus</i>	1	8	Echolocation call detected. Bat not seen.
21:51	Pass	<i>E. serotinus</i>	1	8	Echolocation call detected. Bat not seen.
21:51	Pass	<i>N. noctula</i>	1	9	Echolocation call detected. Bat not seen.
21:52	Pass	<i>P. pygmaeus</i>	1	6	Echolocation call detected. Bat not seen.
21:52	Pass	<i>B. barbastellus</i>	1	7	Echolocation call detected. Bat not seen.
21:53	Pass	<i>N. noctula</i>	1	9	Echolocation call detected. Bat not seen.
21:53	Survey terminated.				



## 5 Discussion: Surveys Summary and Recommendations

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### 5.1 Summary of Bat Surveys

#### 5.1.1 Brown long-eared Bats

5.1.2 A maximum of six brown long-eared bats were recorded roosting internally during any one survey visit (recorded during first dusk emergence survey). During the dawn re-entry survey, a total of five brown long-eared bats were recorded re-entering the church via loose external roof tiles on the north-east corner of the chancel, above the guttering. Two brown long-eared bats were recorded emerging from the western gable roof of the church during the bat walk. In addition, DNA analysis of collected bat droppings identified the droppings in the church as being that of brown long-eared bats.

5.1.3 The presence of up to six brown long-eared bats indicates that this is a small maternity roost as found on previous surveys. Nursery colonies for this species can range between 5-50 females (Dietz *et al.* 2009). The church also appears to support non-maternity summer roost for this species. This species forms maternity roosts at lower number than other bat species. Therefore, if the desire is to exclude bats (under a Natural England Bat licence) then a bat loft will be necessary to provide adequate mitigation for this species, especially considering they form a maternity roost. Bat boxes do not provide sufficient space for maternity roosts for this species.

#### 5.1.4 Common Pipistrelle Bats

5.1.5 A maximum of five common pipistrelle bats were recorded emerging during any survey visit, and these five emerged from the western gable roof of the church (recorded during the bat walk). One common pipistrelle bat was also recorded emerging from an external feature in the roof valley between the north aisle and nave, but the exact emergence point could not be determined as this area is not visible from the ground (during first and third dusk emergence surveys), and one common pipistrelle emerged from a loose tile below the ridge on the southern elevation of the nave, to the east of the south porch (third dusk emergence survey) and also re-entered this feature during the dawn survey.

5.1.6 Therefore, the church supports three summer non-maternity day roost for common pipistrelle bats.

5.1.7 Although the common pipistrelle bats tend to use exterior roosting features at the church, it would be best practice to install bat boxes to ensure adequate mitigation for this species if the desire is to exclude bats from the church.

5.1.8 Soprano pipistrelle bats

5.1.9 A maximum of one soprano pipistrelle was recorded emerging from north elevation of the bell tower (during first dusk emergence survey).

5.1.10 Therefore, the church supports a summer non-maternity day roost for soprano pipistrelle bats.

5.1.11 The soprano pipistrelle bat was noted emerging from the bell tower, which is being left open for bats, therefore mitigation for this species is not essential, however, installation of bat boxes will provide additional roosting opportunities.

5.1.12 Myotis bats

5.1.13 Two Brandt's/whiskered bats emerged from the south-west corner of the church roof during the bat walk. It should be noted that differentiating these two species from call type is not fully reliable and as the DNA analysis of droppings did not identify which of these species was roosting in the church, it is considered most appropriate to consider them together, especially as the mitigation requirements are similar.

5.1.14 Therefore, the church supports a summer non-maternity day roost for Brandt's/whiskered bats. Mitigation for Myotis bats tends to be in the form of a bat loft, which is also proposed for the brown long-eared bats.

## 5.2 **Bat Management Recommendations**

### 5.2.1 Consideration of Options

5.2.2 A meeting was held 22/06/21 at the church with Nick Joyce (church architect), Nick Cole (church warden), Elizabeth Pimley (ecologist), Rachel Arnold (BiC heritage advisor), to explore bat management options. Following the bat surveys an online

meeting was held 13/05/21 between Nick Joyce (church architect), Nick Cole (church warden), Carmen Bowes (Gloucester DAC), Elizabeth Pimley (ecologist), Rachel Arnold (BiC heritage advisor), Rose Riddell (BiC engagement officer) to review bat management options.

- 5.2.3 Construction of a bat loft within the church and installation of bat boxes on the exterior alongside blocking off bat access points (all to be undertaken EPS Mitigation/BiC licence) along with the potential costs (see Appendix 6) were discussed.
- 5.2.4 Other measures considered were increased cleaning and installation of bat droppings catchers and deflectors and these measures would not require licensing. However, they also come with associated costs, as it will not be possible to use volunteers (N. Coles, pers. comm.), consequently professional cleaning companies would need to undertake deep cleans of the church and professional builders would need to undertake the installation of droppings catchers and deflectors.
- 5.2.5 As it appears possible to exclude bats from the church (due to the relatively low numbers compared to other churches) and there is scope for construction of a suitably sized bat loft above the Vestry with external access, this was considered the preferred option. It was acknowledged that the exclusion process may take more than the first year to be successful and that bat monitoring, to check if the bat loft is being used by bats and that bats are not still entering the rest of the church, would be necessary.
- 5.2.6 Bat Licensing and Bat Loft Construction (including Blocking of Access points)
- 5.2.7 Due to the confirmed presence of common pipistrelles, brown long-eared bats and Brandt's/whiskered bats roosting in St Peter's church, an EPS bat mitigation licence tailored to the Bats in Churches (BIC) project will be required from Natural England before works to prevent bats from entering the church and thereby reduce amount of droppings and urine damage can proceed. Natural England have been consulted for their opinion on whether they are likely to grant such a licence. It is our

understanding that approval from the church is also necessary prior to commencement of any mitigation works especially the construction of the bat loft.

- 5.2.8 Should Natural England grant the EPS bat mitigation/BIC licence and the church approve the proposals<sup>2</sup>, it will be necessary to complete the work relating to the bat roosts (i.e. installing the new bat loft and blocking up access points into the church) under the supervision of a bat licenced ecologist. It is also our understanding that roof works may be required for maintenance reasons, any necessary tile repairs/replacements should also be detailed on the licence and overseen by the bat licensed ecologist.
- 5.2.9 Works including any roof works, bat loft construction and blocking of holes will need to be timed for a period when bats are likely to be roosting elsewhere, so between late October and early April. A bat licensed ecologist will inspect the church prior to construction of the bat loft and immediately prior to blocking up of access holes, when the ecologist will undertake an endoscope inspection of each area to be blocked up.
- 5.2.10 Assuming that the EPS bat mitigation licence can be obtained, prior to blocking off any bat access and assuming church approval given, a bat loft will be constructed at the eastern end of the North Aisle above the Vestry as shown in plans in Appendix 3. The dimensions will be 2100mm high from apex to loft floor, 2500mm width and 4400mm length. An access slot 300mm long by 200mm high will be cut into the small glass window on the Eastern gable of the North Aisle. The remaining glass will be blacked out to keep the loft dark for the sole use of bats. The access slot will be fitted with cowling to prevent the ingress of elements and a hopper box would be fitted inside the loft at the entrance to prevent jackdaws and similar species entering the bat loft (as shown in Appendix 3).
- 5.2.11 The bat loft will need to be installed with insulation boarding to ensure an even temperature and it is recommended that a temperature logger is fitted to monitor the temperature of the bat loft. As the church provides habitat for a maternity roost

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<sup>2</sup> Natural England have been approached for their views on the likely success of an EPS Mitigation licence application to exclude bats from the church by providing them with alternative roosting opportunities in the form of a bat loft above the Vestry and external bat boxes.

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of brown long-eared bats, it is important to ensure that the temperature inside the bat loft is kept at around 25 to 40 degrees centigrade over the summer maternity period. Therefore, should the bats fail to use the new roost, informed measures can be taken to increase the temperature by adding insulation/heater if the temperature is significantly lower than desired for maternity roosts.

5.2.12 Two internal wooden baffles (roughened timbers to be used to enable bats to cling to) will be included within the bat loft and will come part way (approx. 0.5m) down from the ceiling enabling bats to fly below them and create microclimates.

5.2.13 Any lining to be used on the inner faces of the lofts should be traditional bitumastic felt, Type 1, rather than modern breathable membranes such as Tyvek to ensure that any bats using the loft space do not become entangled in the fibres of the breathable membrane and to ensure they can grip the surface of the felting. Timbers should be left exposed and any new wooden supports should be roughened to enable bats to cling. The loft will be retained for the sole use of bats and therefore remain undisturbed and not used for storage. All timber treatments will be suitable for use in bat roosts as per the link below:

[https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/589611/timber-treatment-table1.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/589611/timber-treatment-table1.pdf)

5.2.14 Likely bat access points are those that lead into the church and tend to be used by brown long-eared bats in particular, namely, under raised tiles on northeast corner of Chancel and gap under tiles on southern side of building west of entrance, as these species tend to prefer such interior roosting areas. The south-west corner of the roof also may provide an access point for whiskered/Brandt's bats. Further access points may be found during the process of blocking up the holes.

5.2.15 Bat access points will be blocked up with rock wool once the bat mitigation licence is obtained from Natural England and the bat loft and its access slot has been constructed. Such bat access points comprise: loose external roof tiles on the north-east corner of the chancel, above the guttering, western gable end roof. Possible bat access points are those that could purely serve as an external roosting feature for bats such as pipistrelle species. These comprise: a roof feature between north aisle

and nave (exact point couldn't be determined from ground), loose tile on southern elevation of nave, south-west corner of church roof.

5.2.16 Roosting provision for common pipistrelle bats will be provided in the form of a minimum of a minimum of two bat boxes attached to the church tower. These boxes should be positioned at minimum height of 4m and face in different directions, ideally facing southeast and southwest. The boxes should not be illuminated. Suitable boxes include Schwegler 1FF and a bat box making guide is also included in Appendix 3.

5.2.17 It is possible that the exclusion process may take more than the first year to be successful. Bat monitoring will be necessary in order to check if the bat loft is being used by bats and that bats are not still entering the rest of the church. Monitoring will also be a condition of the bat mitigation licence. Bat monitoring should comprise one annual dusk emergence survey (to be undertaken in suitable weather during the maternity season between June and July) in years 1, 2 and 3 after installation of the bat loft. A licence return will be sent to Natural England and St Peter's Church following each monitoring visit as a condition of the bat mitigation licence and to inform any necessary modifications to the bat management/mitigation plans.

#### 5.2.1 Lighting Recommendations

5.2.2 It is our understanding that no new lighting is proposed for the church, which is strongly recommended as the not only does the church provide exterior roosting features as well as interior ones, but the churchyard provides suitable habitat for foraging bats. Bats are deterred from roosting and foraging in illuminated areas. Should any lighting be required in the future, the following recommendations should be followed. Any proposed lighting should be designed sensitively to minimise light spill and potential impacts on bats in accordance with best practice. The following recommendations are based on Bats and Lighting in the UK (Stone, 2013):

- All luminaires should lack UV elements when manufactured. Metal halide, fluorescent sources should not be used.
- LED luminaires should be used where possible due to their sharp cut-off, lower intensity, good colour rendition and dimming capability.

- A warm white spectrum (ideally <2700Kelvin or >550nm) should be adopted to reduce blue light component, as redder light is preferable for bats.
- <0.2 lux on horizontal plane good, hedgerow lighting tends to be <1 lux
- Luminaires should feature peak wavelengths higher than 550nm to avoid the component of light most disturbing to bats.
- Blue/white light should be avoided, or if mercury lamps are installed, these should be fitted with UV filters.
- Internal luminaires can be recessed where installed in proximity to windows to reduce glare and light spill.
- Accessories such as baffles, hoods or louvres can be used to reduce light spill and direct it below horizontal plane.
- The use of specialist bollard or low-level downward directional luminaires to retain darkness above can be considered.
- Column heights should be carefully considered to minimise light spill.
- Reducing the height of light units to keep the light as close to the ground as possible and reduce the volume of illuminated space.
- Only luminaires with an upward light ratio of 0% should be used.
- Luminaires should always be mounted on the horizontal, i.e. no upward tilt. Ideally the angle of the luminaire should be less than 70 degrees to avoid upward light spill.
- Any external security lighting should be set on people-activated motion-sensors and short (1min) timers.

### 5.2.3 Habitat Enhancement Recommendations

- 5.2.4 Planting additional flowering species (single flowering varieties) in the church yard will encourage insects and thus enhance the area for bats and other wildlife. Further details are provided in Appendix 3.

## 6 Bat Management Costings

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Work Type	Average Cost/£ (pre VAT)
<b>Deep cleaning of church and windows (including scaffolding)</b>	<b>3700.00</b>
Exclusion /Blocking up / building work	6403.00
Install Bat Roof Void at the eastern end of the North Aisle	5850.00
<b>2 Bat boxes to go up on tower walls (if Schwelger 1FF bat boxes used)</b>	<b>200.00</b>
Scaffolding for bat exclusion	3238.00
Porta loos	500.00
<b><a href="#">EPS Bat Mitigation Licence (assuming no reasoned statement needed)</a><sup>3</sup></b>	<b>1300.00</b>
<b>Ecological Supervision for roost installation/ per day cost (incl travel)</b>	<b>520.00</b>
<b>Dusk Monitoring Survey: one per annum for 3 years (incl travel &amp; bat licence return)</b>	<b>3900.00</b>
Total	25 611.00

The rows in bold represent actual costs specific to St Peter's Church, while the other rows represent estimates based on average costs from other BiC projects (provided by Judith Milne of Natural England).

More accurate costings are to be provided by local builders contacts of Nick Cole.

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<sup>3</sup> Natural England have been consulted for confirmation that an EPS Mitigation licence to provide alternate roosting provision and to exclude bats would be likely to be successful



## 7 References

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Mitchell-Jones, A.J. and McLeish, A.P. 1999 (revised 2004). The Bat Workers Manual. Joint Nature Conservation Committee, Peterborough.

Statement of Significance. 2019. Statement of Significance: St Peter, Little Rissington, Gloucestershire.

Stone, E.L. 2013. Bats and Lighting: Overview of Current Evidence and Mitigation Guidance. University of Bristol.

UK Biodiversity Framework <http://jncc.defra.gov.uk/page-6189>

## Appendix 1 – Policy and Legal Considerations

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Statutory nature conservation sites and protected species are a ‘material consideration’ in the UK planning process (DCLG, March 2012). Where planning permission is not required, for example on proposals for external repair to structures, consideration of protected species remains necessary given their protection under UK law.

The **Conservation of Habitats and Species Regulations 2017** transpose the requirements of European Directives such as the Habitats Directive and Birds Directive<sup>4</sup> into UK law, enabling the designation of protected sites and species at a European level.

The **Wildlife and Countryside Act 1981** (as amended) forms the key piece of UK legislation relating to the protection of habitats and species. The **Countryside and Rights of Way Act 2000** provides additional support to the 1981 Act, for example, increasing the protection of certain reptile species. Specific protection for badger is provided by the **Protection of Badger Act 1992**. The **Wild Mammals (Protection) Act 1996** sets out the welfare framework with respect to wild mammals prohibiting a range of activities which may cause unnecessary suffering.

The Government has a duty to ensure that parties take reasonable practicable steps to further the conservation of habitats and species of Principal Importance for Conservation in England listed under Section 41 of the **Natural Environment and Rural Communities Bill 2006**<sup>5</sup>. In addition, the 2006 Act places a Biodiversity Duty on public authorities who ‘must, in exercising [their] functions, have regard, so far as is consistent with the proper exercise of those functions, to the purpose of conserving biodiversity’ (Section 40 (1)). Criteria for selection of priority habitats and species include, for example, international threat (such that species may be protected in their strong holds) and marked national decline.

The **National Planning Policy Framework 2019** states that the planning system should minimise impacts on biodiversity, providing net gains in biodiversity, wherever possible. Section 15 states that when determining planning applications, local planning authorities should apply the following principles:

- a) if significant harm to biodiversity resulting from a development cannot be avoided (through locating on an alternative site with less harmful impacts), adequately mitigated, or, as a last resort, compensated for, then planning permission should be refused;
- b) development on land within or outside a Site of Special Scientific Interest, and which is likely to have an adverse effect on it (either individually or in combination with other developments), should not normally be permitted. The only exception is where the benefits of the development in the location proposed clearly outweigh both its likely impact on the features of the site that make it of special scientific interest, and any broader impacts on the national network of Sites of Special Scientific Interest;
- c) development resulting in the loss or deterioration of irreplaceable habitats (such as ancient woodland and ancient or veteran trees) should be refused, unless there are wholly exceptional reasons<sup>6</sup> and a suitable compensation strategy exists; and
- d) development whose primary objective is to conserve or enhance biodiversity should be supported; while opportunities to incorporate biodiversity improvements in and around developments should be encouraged, especially where this can secure measurable net gains for biodiversity.

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<sup>4</sup>Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora, and Council Directive 79/409/EEC on the Conservation of Wild Birds, respectively.

<sup>5</sup>The **NERC Act** refers to “*species of principle importance for the conservation of biodiversity*”, which translates to BAP habitats and species occurring in England.

<sup>6</sup> For example, infrastructure projects (including nationally significant infrastructure projects, orders under the Transport and Works Act and hybrid bills), where the public benefit would clearly outweigh the loss or deterioration of habitat.

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## Appendix 2 – Photographs

No	Photo	Description
1	 <p>A photograph showing the exterior of St Peter's church, a stone building with a gabled roof and a small tower, situated in a rural landscape. A dirt path leads through a grassy field towards the church. The sky is overcast with grey clouds.</p>	<p>St Peter's church and surrounding habitat</p>
2	 <p>A photograph showing the interior of St Peter's church, focusing on the chancel. The view is from the nave looking towards the altar. The ceiling is high with dark wooden beams. The altar is covered with a red cloth and has a blue curtain behind it. There are three tall, narrow windows above the altar. Two people are standing in the nave, one on the left and one on the right, providing a sense of scale.</p>	<p>Interior of church - showing chancel</p>

No	Photo	Description
----	-------	-------------

3



Interior of church showing nave and BLE bat roost located at gable end as shown by arrow.

4



Interior of church showing area where bat loft proposed above vestry

5




Exterior of church (south side) showing stone tiles of roof which provide external roosting features for bats especially pipistrelles.

6

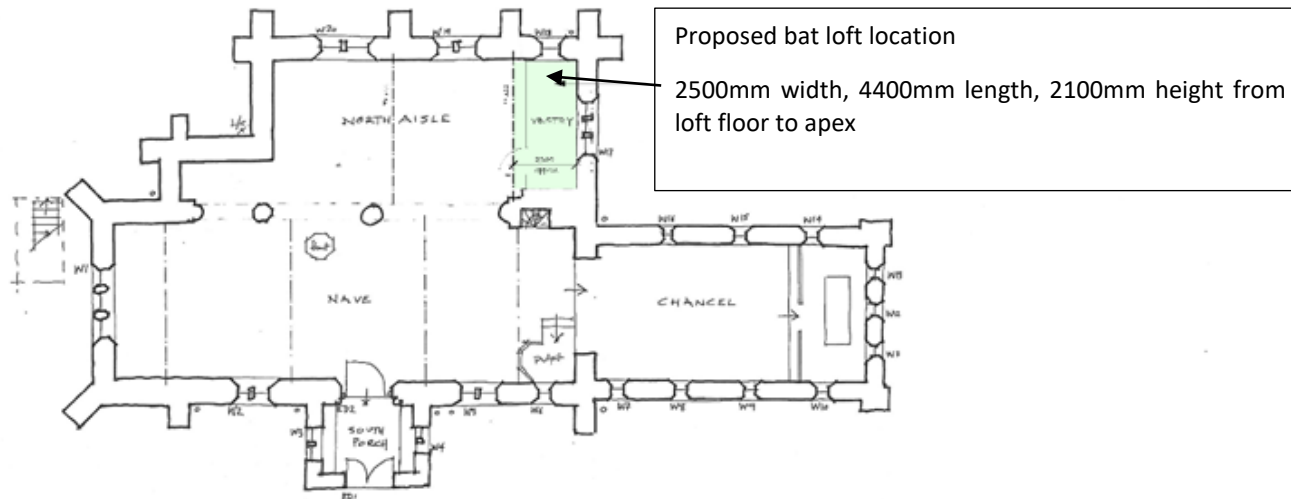


Interior of church showing location of BLE bat roost above chancel entrance shown by arrow



No	Photo	Description
7	 A photograph showing the interior of a church, specifically the nave gable end. The image captures a radiator and the wall above it. The radiator is heavily stained with brown and black marks, indicating damage from bat urine and burnt droppings. The wall above the radiator is also stained and discolored, with a prominent vertical stain on the left side. A wooden bench or pew is visible on the left side of the frame.	<p>Interior of church, nave gable end where radiator damaged by bat urine and bat droppings burnt on.</p>

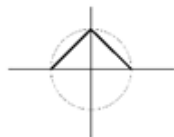
## Appendix 3 – Bat mitigation/enhancements



NOTES

DO NOT SCALE OFF THIS DRAWING

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**nick joyce architects ltd**

architects and historic building consultants

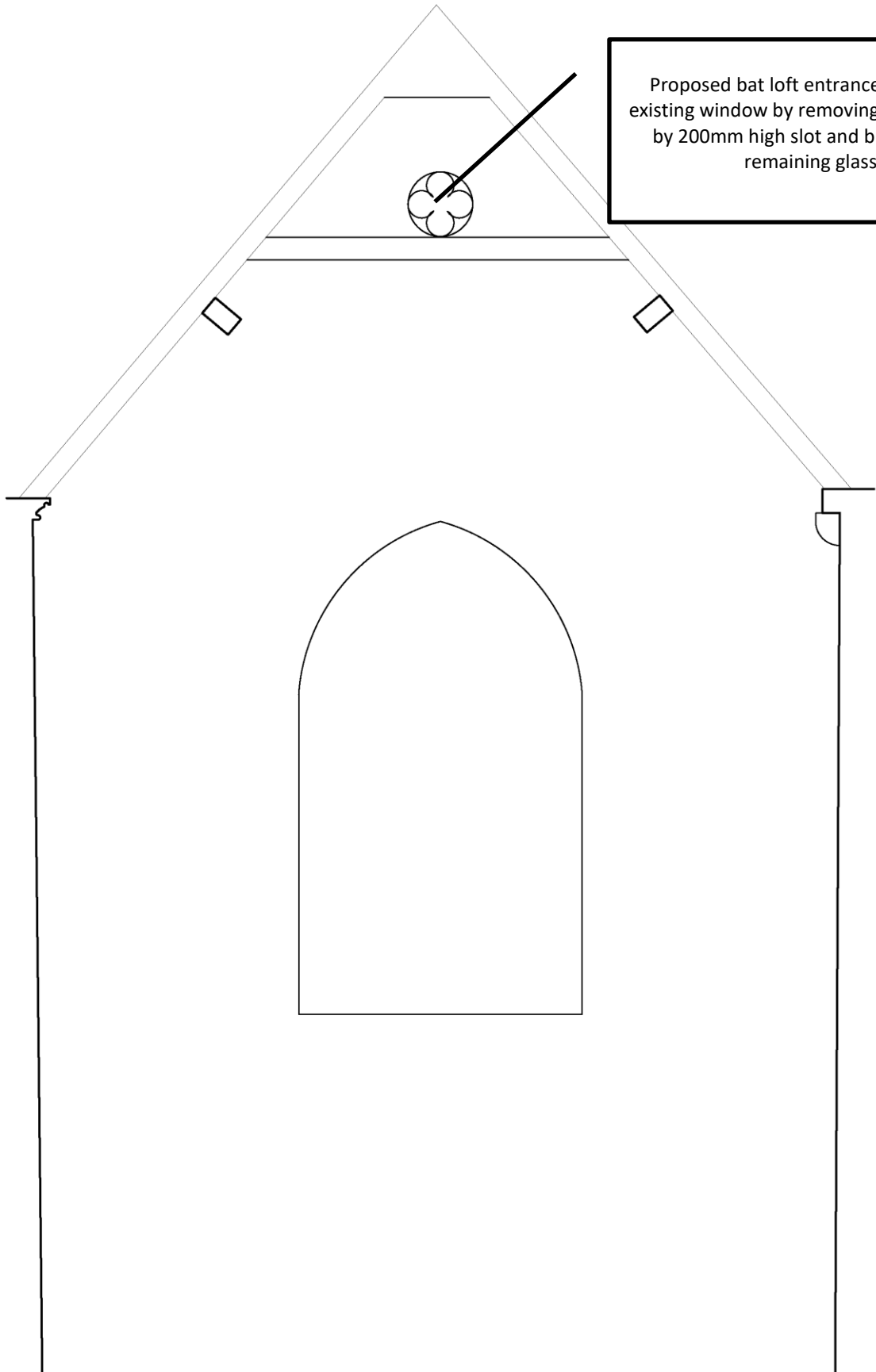
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5 BARBOURNE ROAD WORCESTER WR1 1RS  
TELEPHONE 01852 24597/25511 FAX 01852 24597

St Peter's Church - Little Rissington

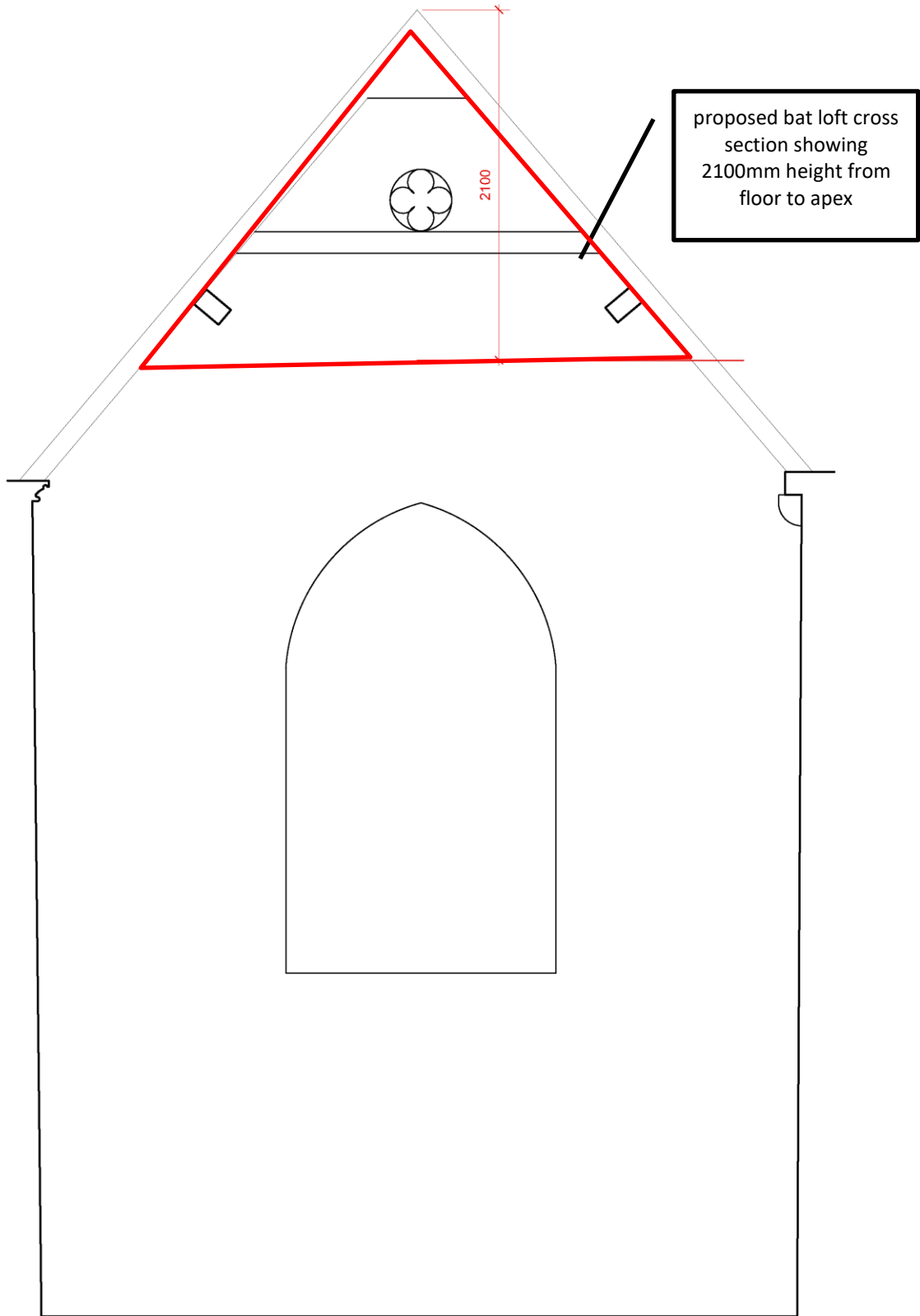
Floor plan

SCALE - NTS	DRAWN -	DRG No -
DATE - July 2021	CHECKED -	2354-04



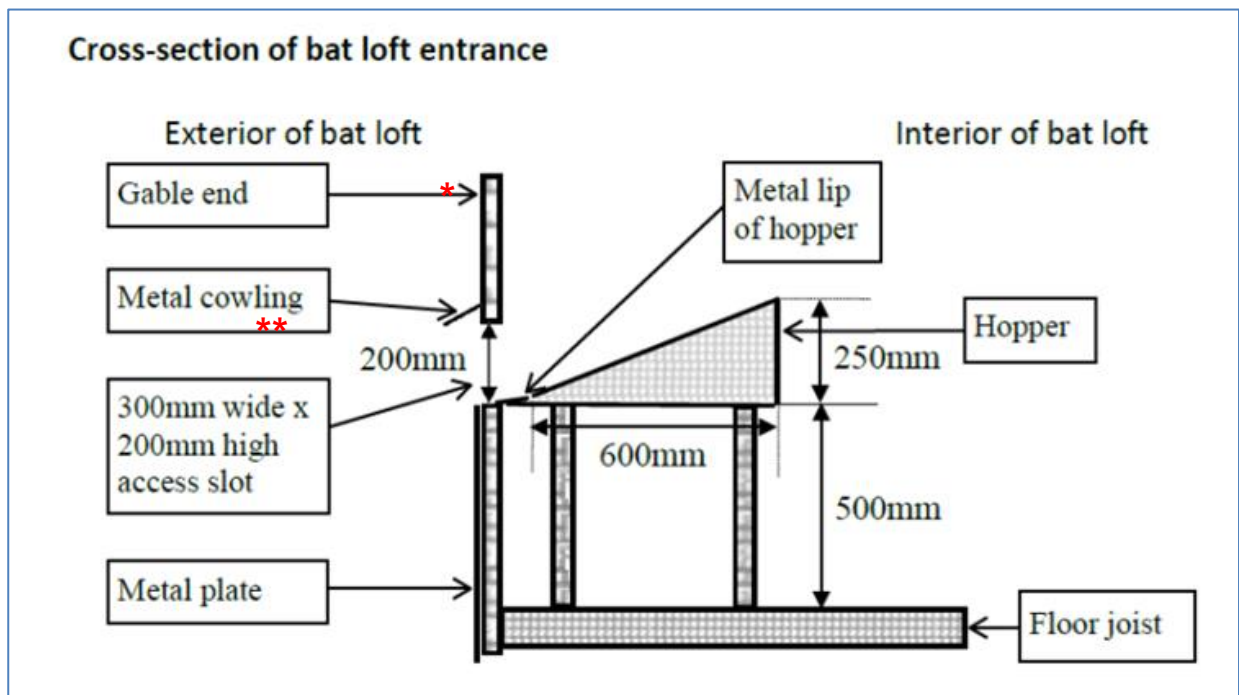
Proposed bat loft entrance created in existing window by removing 300mm long by 200mm high slot and blacking out remaining glass





St Peter's Church - Little Rissington - Gloucestershire East Gable End North Aisle 1:20  
Nick Joyce Architects Ltd - 5 Barbourne Road - Worcester - WR1 1RS Tel. 01905 726307 e- enquiries@nickjoycearchitects.co.uk

Bat loft Photographs and Diagram

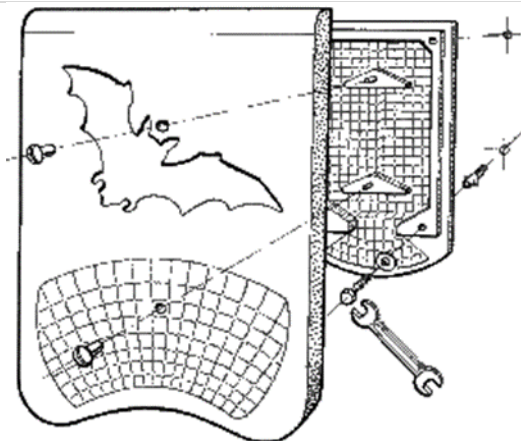


**BAT ROOSTING FEATURES**

**Schwegler 1FF bat box**



**Schwegler 1WQ Summer & Winter bat**



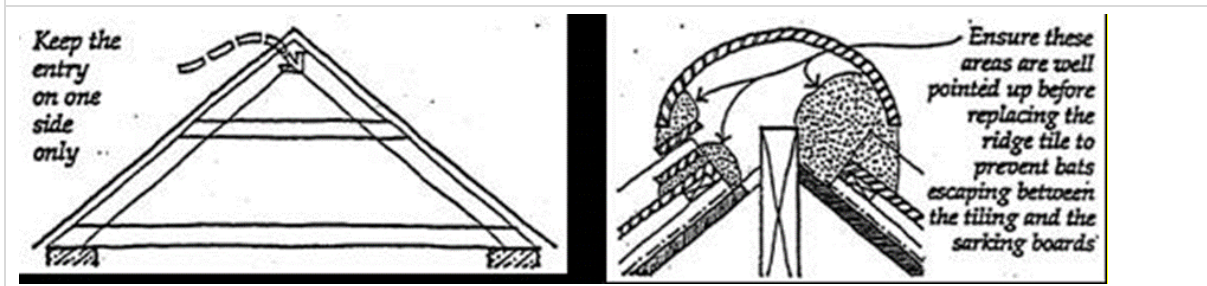
**Habibat 001 Bat Box – integral bat box, fitted into wall**



**Schwegler 2FN bat box for installation in trees**



**Diagrammatic view of ridge tile and cross section through ridge tile** showing access point (taken from Scottish Natural Heritage 1996). Bitumastic lining must be used near/on the ridge beam to ensure bats can only have contact with this type of membrane to avoid any possible entanglement with a breathable membrane.





## Appendix: The Kent bat box (D.I.Y. instructions)

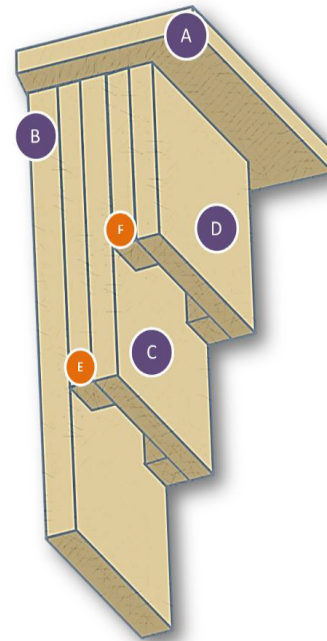
### Design and measurements

Simple to construct, self-cleaning and low maintenance, the Kent bat box (designed by the Kent Bat Group) is a great extra home for bats to hang out and rest on a hunting night out. These boxes won't be spacious enough to be used as maternity roosts but are a great way to encourage bats in your garden or your green space. The box should be rainproof and draught-free

The only critical measurement is the width of the crevices: between 15-25mm. Other measurements are approximate. Timber should be approximately 20mm thick.

Measurements for one Kent bat box kit would be as follows:

Part	Quantity	Size (mm)
Roof (A)	1	250 x 160 x 20
Back (B)	1	450 x 200 x 20
Centre (C)	1	330 x 200 x 20
Front (D)	1	210 x 200 x 20
Centre Rails (E)	2	330 x 20 x 20
Front Rails (F)	2	210 x 15 x 15
Stand-offs (optional)	2	200 x 20 x 20



### Material and Tools

This kit requires approximately 1.6m of rough wood and 25 screws (8 x 1 ½ inches) to assemble. You can rough it up by scraping with a suitable tool – possibly a saw blade or even a screwdriver but make sure you use untreated wood as some preservative chemicals can kill bats.

Pre-drill the holes to prevent the wood splitting. The hanging screws may either be at the edges of the front panel or in the side centre block (not in the rails!). Fixing may be by use of brackets, durable nylon cord or wires. Alternatively you can assemble your bat box kit with nails although they tend to be less robust than boxes made with screws.

*Photos and illustrations in this document by the Bat Conservation Trust unless otherwise stated.*

The Bat Conservation Trust (known as BCT) is a registered charity in England and Wales (1012361) and in Scotland (SC040116).

Registered office: Quadrant House, 250 Kennington Lane, London SE11 5RD  
 Email: [enquiries@bats.org.uk](mailto:enquiries@bats.org.uk) National Bat Helpline: 0845 1300 228



Many wildlife species benefit greatly from considerate planting choices that still meet our practical and aesthetic needs. Plants and trees provide food for wildlife as well as places to nest and rest. Vegetation providing a variety of these functions creates an environment more beneficial for wildlife.

## Non native species

Native species provide the best habitat for UK wildlife but there are also many non-native species, which are single flowering and/or provide fruits/nuts/seeds that can be used as food sources for insects, birds and small mammals. When using these non-native species in planting schemes, care should be taken to avoid invasive species such as Cotoneaster and Rhododendron. This is especially important when sites are adjacent to open countryside particularly nature reserves.



Butterfly bush

## Uses of Wildlife Planting

Wildlife value can be easily incorporated into visually pleasing and useful green areas and amenity spaces, such as borders, grass verges and tree screens.

**Attractive Borders:** Well selected decorative borders can be valuable for many insects and birds. Native plants can be mixed with single flowering ornamental species to add aesthetic interest and increase the flowering period of a planting scheme.

**Shrubs and hedges:** Native spiky species like blackthorn and hawthorn are effective barriers when used in hedges. They also provide an attractive feature at all times of year especially when in blossom and fruit. Bushy areas of foliage provide useful nesting and feeding areas for birds and small mammals, as well as foraging/commuting corridors for bats.

**Grasses mixes and verges:** Leaving uncut areas of suitable grasses provides great wildlife value and is economical to manage. Diverse grassy areas and verges also create an attractive human environment with different flowers and colours. There are a range of native grass and flower mixes for various soil types available on the market.



Wild flower grass mix





## Selecting Suitable Species

There are wildlife friendly species suitable for all situations, from fields, verges, shady corners or small gardens. Listed below are native wildlife friendly plant species organised by type and suitability for different locations.

### Large Trees

Ash *Fraxinus excelsior*  
Beech *Fagus sylvatica*  
English Elm *Ulmus procera*  
Oak *Quercus robur* or *Q. petraea*  
Small-leaved lime *Tilia cordata*  
White willow *Salix alba*  
Wild cherry *Prunus avium*



White willow

### Medium/small trees

Alder *Alnus glutinosa*  
Aspen *Populus tremula*  
Crab apple *Malus sylvestris*  
Field maple *Acer campestre*  
Holly *Ilex aquifolium*  
Rowan *Sorbus aucuparia*  
Silver birch *Betula pendula*  
Yew *Taxus baccata*



Tussock grassland

### Native shrubs

Blackthorn *Prunus spinosa*  
Dogwood *Cornus sanguinea*  
Elder *Sambucus nigra*  
Guelder rose *Viburnum opulus*  
Hawthorn *Crataegus monogyna*  
Hazel *Corylus avellana*



Blackthorn

### Plants for shady areas

Archangel *Lamium galeobdolon*  
Betony *Stachys officinalis*  
Bluebell *Hyacinthoides non-scriptus*  
Bugle *Ajuga reptans*  
Foxglove *Digitalis purpurea*  
Ground ivy *Glechoma hederacea*  
Lily of the valley *Convallaria majalis*  
Lords-and ladies/cuckoopint *Arum maculatum*  
Nettle-leaved bellflower *Campanula trachelium*  
Primrose *Primula vulgaris*  
Sweet violet *Viola odorata*  
Wild daffodil *Narcissus pseudo-narcissus*

### Plants for marshy areas & pond edges

Bugle *Ajuga reptans*  
Hemp agrimony *Eupatorium cannabinum*  
Marsh marigold *Caltha palustris*  
Marsh woundwort *Stachys palustris*  
Meadowsweet *Filipendula ulmaria*  
Purple loosestrife *Lythrum salicaria*  
Ragged robin *Lychnis flos-cuculi*  
Water avens *Geum rivale*  
Water forget-me-not *Myosotis scorpioides*  
Water mint *Mentha aquatica*  
Water violet *Hottonia palustris*  
Yellow flag *Iris pseudacorus*



**Beneficial cultivated plants  
(generally non-natives)**

Grecian windflower *Anemone blanda*  
Angelica *Angelica archangelica*  
Aubretia *Aubretia deltoidea*  
California poppy *Eschscholtzia californica*  
Candytuft *Iberis sempervirens*  
Christmas rose *Helleborus niger*  
Cosmos *Cosmos bipinnatus*  
Evening primrose *Oenothera biennis*  
Fleabane *Erigeron spp.*  
Forget-me-not *Myosotis spp.*  
French marigold *Tagetes patula*  
Globe thistle *Echinops ritro*  
Grape hyacinth *Muscari botryodes*  
Hollyhock *Althaea rosea*  
Honesty *Lunaria rediviva*  
Ice plant *Sedum spectabile*  
Lenten rose *Helleborus orientalis*  
Tree mallow *Lavatera spp.*  
Michaelmas daisy *Aster novae-belgii*  
Mint *Mentha x rotundifolia*  
Perennial cornflower *Centaurea montana*  
Perennial sunflower *Helianthus decapetalus*  
Phlox *Phlox paniculata*  
Poached-egg plant *Limnanthes douglasii*  
Red valerian *Centranthus ruber*  
Snapdragon *Antirrhinum majus*  
Spring crocus *Crocus chrysanthus* and hybrids  
Sweet alyssum *Lobularia maritima*  
Sweet bergamot *Monarda didyma*  
Sweet William *Dianthus barbatus*  
Tobacco plant *Nicotiana affinis*  
Wallflower *Cheiranthus cheiri*  
Alpine rock-cress *Arabis alpina*  
Winter aconite *Eranthis hyemalis*  
Yellow alyssum *Alyssum saxatile*

**Native wildflowers for borders**

Agrimony *Agrimonia eupatoria*  
Betony *Stachys officinalis*  
Bluebell *Hyacinthoides non-scriptus*  
Chicory *Cichorium intybus*  
Chives *Allium schoenoprasum*  
Common poppy *Papaver rhoeas*  
Corncockle *Agrostemma githago*  
Cornflower *Centaurea cyanus*  
Corn marigold *Chrysanthemum segetum*  
Cowslip *Primula veris*  
Cuckooflower *Cardamine pratensis*  
Dame's-violet *Hesperis matronalis*  
Devil's-bit scabious *Succisa pratensis*  
Field scabious *Knautia arvensis*  
Foxglove *Digitalis purpurea*  
Goldenrod *Solidago virgaurea*  
Great mullein *Verbascum thapsus*  
Greater knapweed *Centaurea scabiosa*  
Harebell *Campanula rotundifolia*  
Herb-robert *Geranium robertianum*  
Lady's bedstraw *Galium verum*  
Marjoram *Origanum vulgare*  
Meadow cranesbill *Geranium pratense*  
Common mallow *Malva sylvestris*  
Oxeye daisy *Leucanthemum vulgare*  
Primrose *Primula vulgaris*  
Red campion *Silene dioica*  
Snowdrop *Galanthus nivalis*  
Spiked speedwell *Veronica spicata*  
Tansy *Tanacetum vulgare*  
Teasel *Dipsacus fullonum*  
Toadflax *Linaria vulgaris*  
White campion *Silene alba*  
Wild thyme *Thymus drucei*  
Yellow loosestrife *Lysimachia vulgaris*



Marjoram



Cornflower



Perennial sunflower



## Appendix 4 – DNA Analysis Results



17 August 21

Re: Identification Results for Elizabeth Pimley, Wild Service

Job number 16989, received 04 August 2021

Sample labelled: EP2021019 St Peters, Pimley, 8/5/21

PCR amplification successful. DNA sequence:

ATGACCAACATTTCGAAAGTCCCACCCTCTCATAAAAATTATCAATGACTCATTTCATTG  
ACTTACCTGCTCCCTCAAATATTTTCATCATGATGAAACTTTGGATC

Phylogenetic analysis identification: *Plecotus auritus*

Confirmed by maximum likelihood, maximum parsimony, bootstrap 100%.

Best regards,

Professor Robin Allaby

The results and conclusions in this report are based on an investigation of mtDNA sequence analysis. The results obtained have been reported with accuracy. The interpretation represents the most probable conclusion for the DNA sequence obtained rather than the sample provided given current levels of species data. It should be borne in mind that different circumstances might produce different results. Therefore, care must be taken with interpretation of the results especially if they are used as the basis for commercial recommendations.

**Professor Robin Allaby**

School of Life Sciences,  
Gibbet Hill Campus,  
University of Warwick,  
Coventry CV4 7AL  
Tel: 02476575059  
Fax: 02476574500  
Email: r.g.allaby@warwick.ac.uk

## Appendix 5 – Ecological Experience

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**Elizabeth Pimley:** Head of Ecology & Principal Ecologist, BSc (Hons) PhD, CEnv MCIEEM

Elizabeth has worked in both the academic and consultancy ecology sectors since 2000 with a focus on mammalian ecology, particularly badgers, dormice, bats, water voles and otters. Elizabeth manages the Consultancy as well as being involved in project delivery. She has managed ecological projects, ranging in size and type, both in the UK and abroad. She regularly advises clients on the planning process in relation to Ecology. Elizabeth has expertise in a wide variety of ecological survey techniques including Preliminary Ecological Appraisals/Phase 1 habitat assessments and a variety of protected species surveys (e.g. the aforementioned mammal species as well as reptiles and great crested newts).

Elizabeth also devises ecological mitigation schemes, both as part of protected species mitigation licences (e.g. bats, great crested newts, badgers, dormice, water voles, otters) and for projects not requiring licensing (e.g. reptiles). She has produced a wide variety of preliminary ecological appraisals, BREEAM/CSH Ecology Assessments, mitigation licences for protected species (including Bat Mitigation Class Licences), Ecological Impact Assessments (EclIA), Construction Ecological Management plans, Habitat Regulations Assessments, Biodiversity Net Gain assessments, Biodiversity Enhancement Schemes, Ecological Design Strategies as well as writing for scientific journals, books and magazines. As a Building with Nature Assessor, Elizabeth also has expertise in providing green infrastructure advice to projects.

Elizabeth offers a scientific approach to projects with additional skills in radiotracking, bat call analysis, statistical analysis, home range and compositional habitat analysis and Geographical Information Systems (GIS) mapping. Elizabeth holds Natural England and Natural Resources Wales licences for bats and dormice as well as Natural England licences for great crested newts and water voles. She is also a Registered Consultant of the Bat Mitigation Class Licence (BMCL) and holds a CSCS card.

**Gemma Waters** – Associate Ecologist BSc (Hons) MCIEEM

Gemma has 15 years' experience in ecological consultancy with a focus on bat and bird ecology and surveying. She is also an experienced environmental educator. She worked on two Bats in Churches projects in Gloucestershire in 2019: undertaking dusk/dawn surveys for St Peter Church, Little Rissington and Church of St Mary, Edgeworth. Gemma has previously worked on Natural England's bat helpline where she provided advice to churches with bat concerns, liaised with volunteers and helped members of the public with bat issues. She has also been a bat warden for Natural England since 2006, providing surveys and advice for householders with bats. Gemma is a Natural England licence holder for bats (Licence number: 2015- 1560-CLS-CLS, WML CL18: Bat Survey Level 2) and is also a volunteer bat roost visitor (2015-10271-CLS-CLS). Gemma is experienced in providing EPS mitigation on a variety of projects, including cultural heritage projects for the National Trust and the Wye Valley AONB.

Gemma has undertaken voluntary research with Gloucestershire Bat Group (GBG) and Dr Roger Ransome, assisting in research of greater horseshoe, Bechstein's and barbastelle bats. With GBG, Gemma has also led bat walks and talks for the public. Gemma has over a decade of teaching experience; from primary students, up to University level.

**Michelle Newman:** Senior Ecologist, BSc (Hons) GradCIEEM

Michelle has worked in Ecological Consultancy for several years and has also volunteered for a number of nature conservation organisations over the years. She is experienced in undertaking Phase 1 habitat surveys and protected species surveys including those for bats, birds, otters, water voles, badgers, great crested newts and reptiles (including adder handling experience). She has also undertaken a variety of invertebrate surveys, specialising in bumble bee surveys. She holds a CSCS card and has worked as an Ecological Clerk of Works (ECoW) on a wide variety of sites. Michelle has prepared Preliminary Ecological Appraisals, Landscape and Ecological Mitigation Plans, Construction and Environmental Management Plans and Habitat Enhancement Schemes for a range of projects. In addition to project delivery, she is also involved with the management of Wild Service projects and advises clients on the

ecological aspects of the planning process. She is experienced in analysing bat call data using a variety of software packages. Michelle holds a Natural England great crested newt licence. She is currently working towards her Natural England bat and white-clawed crayfish licences.

**Julia Morrison:** Ecologist, BSc (Hons) MSc

Julia has worked with Wild Service for several years and has recently gained her MSc in Applied Ecology from the University of Gloucestershire. Julia's dissertation project involved large-scale data analysis of biometric bird ringing data to assess biometric changes in UK wintering waterbirds. Julia has a keen interest in bat ecology and in addition to undertaking professional bat surveys and assessments, she has also studied bats in Ghana, West Africa. She is experienced in a range of ecological surveys including Phase 1 habitat assessments, protected species surveys, reptile surveys and translocations, great crested newt and dormouse surveys. Julia's additional skills include advanced data analysis and GIS mapping using various software packages including QGIS and ArcGIS. In addition to project delivery, she also assists with the management of Wild Service projects. Julia has also spent time volunteering on conservation projects with the Gloucestershire Bat Group and the Gloucestershire Wildlife Trust. Julia is a Qualifying member of CIEEM and holds a CSCS card. She is currently working towards her Natural England bat and great crested newt licences.

**Rebecca McKie:** Graduate Ecologist, BSc (Hons)

Beccy joined Wild Service in 2020 having completed an Undergraduate Degree in Environmental Science. Beccy has professional experience of undertaking bat surveys and assessments, reptile surveys and translocations, great crested newt surveys, Ecological Clerk of Works (ECoW), as well as assisting in the preparation of ecological reports and production of maps in QGIS (including Phase 1 habitat maps).

During her BSc studies, Beccy gained knowledge and experience in GIS mapping using QGIS, and environmental law, as well as undertaking various fieldwork projects, such as studying the effect of climate change on invertebrates in hot springs in the Sierra Nevada. She has also completed Ecology Training UK's 'Certificate in Ecological Consultancy', during which she

gained experience in Phase 1 Habitat and PEA Surveys, survey techniques for protected species, botany, wildlife law, hedgerow assessments and invasive species. Beccy has also carried out practical volunteering with the Wildlife Trusts, as well as being involved in hedgehog conservation through volunteering at Help a Hedgehog Hospital.



# Wild Service

ECOLOGICAL SERVICES

MITIGATION

CONSERVATION

- We provide ecological surveys and assessments, mitigation, advice and guidance regarding wildlife, plants and habitats for both development and conservation projects throughout the UK.
- Wild Service is the Ecological Consultancy for Gloucestershire Wildlife Trust. As such, the company reinvests its profits into local conservation work.
- We are also part of a wider network of Wildlife Trust Consultancies enabling us to offer national delivery with local expertise.

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- We offer the following types of service to clients:

**Ecological Surveys**  
**Protected Species Licences**  
**Ecological Management Plans**  
**Biodiversity Net Gain**  
**Ecological Impact Assessments (EcIA)**  
**BREEAM Assessments**  
**Mitigation and Enhancement**  
**Arboricultural Surveys**  
**Landscape Consultancy Services**  
**Green Infrastructure Planning (Building with Nature)**

Contact us at  
 Wild Service,  
 Conservation Centre  
 Robinswood Hill Country Park  
 Reservoir Road, Gloucester, GL4 6SX  
 TEL: 01452 383 333; Email: [info@wildservice.net](mailto:info@wildservice.net)  
 Website: <https://wildservice.net/>

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