Norwich Western Link

Environmental Statement Chapter 11: Bats

Appendix 11.5: 2022 Summer Bat Report

Author: WSP

Document Reference: 3.11.05

Version Number: 00

Date: March 2024

Contents

Tables

Figures

1 Introduction

1.1 Project Background

1.1.1 The Norwich Western Link Road (NWL) is a highway Scheme linking the A1270 Broadland Northway from its junction with the A1067 Fakenham Road to the A47 trunk road near Honingham.

1.1.2 The NWL, hereafter referred to as the Scheme, will comprise:

- Dualling the A1067 Fakenham Road westwards from its existing junction with the A1270 to a new roundabout located approximately 400m to the northwest.
- Construction of a new roundabout.
- Constructing a dual carriageway link from the new roundabout to a new junction with the A47 near Honingham.

1.1.3 As part of a separate planned Scheme, Highways England proposes to realign and dual the A47 from the existing roundabout at Easton to join the existing dual carriageway section at North Tuddenham. This scheme received development consent in August 2022 and it is expected that Highways England will construct the Honingham junction, and the Norwich Western Link will connect to the north-eastern side of that junction.

1.1.4 The Scheme will cross the River Wensum and its flood plain by means of a viaduct. In addition, six other structures are proposed to cross minor roads and to provide habitat connectivity. The Scheme will include ancillary works such as provision for non-motorised users, necessary realignment of the local road network, including the stopping up of some minor roads, and the provision of environmental mitigation measures.

1.1.5 In July 2019 the Norfolk County Council (NCC) Cabinet decided on the preferred route for the Scheme. The decision making was informed by an

Option Selection Report (OSR) which considered seven shortlisted route options.

1.1.6 The impact of each of the shortlisted options on biodiversity was presented in the OSR. The biodiversity assessment considered the likely impact on the River Wensum Special Area of Conservation (SAC), barbastelle bats, other statutory designations, non-statutory designations, habitats, and other species. A constraints plan was used to inform the option selection process that included available baseline information for these features. Whilst the table items were not scored or weighted, likely impacts upon the SAC were influential in the decision-making process given the legal protection afforded to this internationally designated site.

1.1.7 As stated within Table 8.2 of the OSR, Options C and both variants of Option D were assessed to be the best performing, being identified as having a 'large adverse' impact on biodiversity and ecological features, compared to Option A and Option B. Options A and B were assessed to have a 'very large adverse' impact on biodiversity and ecological features. Option C was taken forward as the preferred route for the Proposed Scheme. Subsequently, a barbastelle bat roost within the northern woodlands elements of the Scheme was located through surveys in 2021. The northern woodlands are a complex of woodland blocks in the northern extent of the Scheme encompassing Primrose Grove, the Nursery, Rose Carr and Spring Hills. Parts of the northern woodlands lie within the Site Boundary and will be directly impacted by the Scheme. This led to the selection of an alignment refinement as reported in the July 2022 Report to NCC Cabinet (NCC, 2022).

1.2 Ecological Background

1.2.1 WSP was commissioned in 2019 to complete baseline bat surveys to inform the route optioneering process (WSP UK Ltd, 2020). This included ground level tree assessments, bat activity surveys, bat radio tracking and bat hibernation surveys.

1.2.2 Following selection of a preferred route (Route C), a suite of bat surveys was undertaken in 2020 covering a refined survey area in order to obtain baseline data to inform appropriate mitigation measures for the chosen preferred route (herein referred to as the "Scheme"). This included bat-tracking surveys which were conducted in order to maximise the information collected over the 2020 activity period due to the cancellation of planned radio-tracking surveys in August 2020. In May, June and August 2021, it was possible to complete radio-tracking surveys therefore, bat-tracking surveys were not carried forward as part of the 2021 survey scope. Survey data from 2020 is reported in an interim bat survey report which covers both roost and activity surveys (WSP UK Ltd, 2021).

1.2.3 This technical report presents the methods and results of roosting bat surveys and bat activity surveys undertaken in 2022 as a result of the route refinement and should be read in conjunction with the bat radio tracking report (WSP UK Ltd, 2022b), bat activity report (WSP UK Ltd, 2022a) and bat roost report (WSP UK Ltd, 2022c), which together with earlier interim reporting, capture the results of survey completed between 2019 and 2021 to inform the Scheme.

1.2.4 Bat surveys have also been completed to inform a separate planned Scheme to realign and dual the A47 to the south of the Scheme (Highways England, 2021a-c), and construction of the Northern Broadway to the north-east of the Scheme (Mott Macdonald, 2020 & 2021; BSG, 2010; Greena Ecological Consultancy, 2013a-b).

1.3 Brief and Objectives

1.3.1 WSP UK Ltd was commissioned by Norfolk County Council to complete a suite of bat activity and bat roost surveys for the Scheme in summer 2022:

- Vantage point surveys - A1067– to establish the extent and seasonality of barbastelle and *Myotis* species activity in relation to the A1067, as well as determining key commuting routes/features.

- Vantage point surveys – Scheme (as refined) - to corroborate the vantage point 1 (VP1) baseline results, ensuring a robust baseline to the south of VP1 is held for the Scheme (as refined) within the Nursery woodland; to inform the Environmental Statement and for the purposes of post-development monitoring.
- Summer automated detector surveys – to establish the extent and seasonality of barbastelle and *Myotis* species activity in relation to the A1067, as well as providing further data towards the assessment of commuting routes/features. Also, to complete the baseline dataset to inform the Environmental Statement for the purposes of post-development monitoring, if required.
- Ground Level Tree Assessment (GLTA) surveys – to complete GLTA surveys of all trees within 25m of the Site Boundary (as refined) and/or 100m from the Proposed Scheme alignment (as refined) which fell outside previous Survey Areas. Due to the differing extents of the Site Boundary and the Proposed Scheme alignment, occasionally trees surveyed fell within the 100m route alignment buffer, but outside the 25m Site Boundary buffer, and vice versa.
- Aerial inspections – to complete aerial inspections of trees graded as of moderate to high suitability to support bat roosts, across the Survey Area (as defined above and in Section 1.4), targeting trees identified as a result of the above 2022 GLTA surveys, detailed above.
- Dusk emergence and dawn re-entry surveys – to complete dusk emergence/dawn re-entry surveys of trees graded as of moderate or high suitability, which were considered unsafe to climb or where tree climbing inspection proved inconclusive. This survey was targeted any new trees identified as a result of the 2022 GLTA and/or aerial inspection surveys, detailed above.

1.4 Survey Areas

1.4.1 The areas covered by each survey types are hereafter referred to as the 'Survey Areas'. The Survey Areas are detailed in Table 1.1 below. The survey approaches are described in Section 2.

Table 1.1 – Summary of survey area for bat surveys

Survey type	Survey Area
Vantage point surveys	Four pre-determined locations, with three located along the A1067 and one location within the Site Boundary in the Nursery Woodland as shown in Figure A-1, Appendix A.
Automated detector surveys	Nine pre-determined locations along the A1067, as shown in Figure B-1, Appendix B.
Ground level tree assessments Aerial inspections of trees and dusk emergence/dawn re-entry surveys of trees	All trees within 25m of the Site Boundary (as refined) and/or 100m from the Proposed Scheme alignment (as refined) which fell outside previous Survey Areas as shown in Figure C-1, Appendix C.

2 Methods

2.1 Overview

2.1.1 The methodology applied for all survey techniques and bat call analysis was completed with reference to best practice guidance and industry standards (Collins, 2016) (Russ, 2012) (Berthinussen & Altringham, 2015).

2.2 Vantage Point Surveys

Surveys

2.2.1 Radio-tracking completed during 2021 identified patterns of barbastelle movement across the A1067 to the north of the Scheme (WSP UK Ltd, 2022b). Therefore, vantage point surveys were proposed in 2022 in order to fully establish and assess commuting routes/features used by bats in

locations where existing hedgerow and woodland vegetation is located close to the A1067 carriageway.

2.2.2 As per the 2020 and 2021 surveys, a series of vantage point bat surveys were completed between the months of May to September (inclusive). This report pertains to 2022 surveys on four new vantage point locations. These surveys were designed using the DEFRA guidelines (Berthinussen & Altringham, 2015) and were intended to contribute to the overall bat activity dataset, and specifically gather activity information for barbastelle and *Myotis* species, at four pre-determined locations.

2.2.3 Of the four new vantage point locations, three were situated along the A1067. These locations were identified as requiring further survey to gather data regarding bat activity, and specifically flight paths above the road. The final vantage point was located within the Nursery Woodland, south of the previous vantage point location VP1. This location required further survey due to the change in Site Boundary where the Scheme bisects the woodland, to corroborate the (VP1) baseline results, ensuring a robust baseline to the south of VP1 is collected along the Scheme (as refined) within the Nursery woodland. The vantage point locations are shown on Figure A-1. and described in Table 2.1.

2.2.4 Surveys generally comprised one survey visit per month to each vantage point between May and August (inclusive), in one location it was not possible to complete a survey during June so to compensate a further visit was completed in September. Each vantage point surveys began 15 minutes after sunset and continued for 2 hours 45 minutes in total (concluding 3 hours after sunset). Dates, start and end times, and meteorological data of these surveys are provided in Appendix A, Table A.1.

2.2.5 The survey set-up, as detailed in Table 2.1, was determined by the feature being surveyed. In most cases this was determined on the first occasion each vantage point was surveyed. Occasionally the survey set-up changed

between surveys, in order to optimise survey results or due to health and safety reasons (e.g. surveyor safety).

2.2.6 During each survey the surveyors noted the bat species heard and seen, including the time, location, and where possible gathered commentary on behaviour, flight height and flight direction. In addition, where bats were observed by the surveyor, approximate height of flight was noted. Surveyors were equipped with bat detectors (EchoMeter Touch (EMT) © Wildlife Acoustics, Inc) to listen to and record bat activity. Calls registered by the bat detectors were recorded for later analysis using specialist computer software Kaleidoscope Pro (© Wildlife Acoustics, Inc), details are provided below.

2.2.7 As well as bat detectors, surveyors were equipped with a thermal imaging camera (model used were FLIR E95 © Teledyne FLIR LLC) to enable bats to be visualised after dark. As part of the analysis, the thermal imaging footage was matched with seen/heard bats documented by the surveyor in order to comment on the likely behaviour (i.e. commuting/foraging), direction and height of flight, if not detected in the field.

Data Analysis

2.2.8 Analysis of vantage point survey data focussed on barbastelle (given that this is an Annex II species, protected under the Habitats Directive (1992), and rare species known to be present within the local area) and *Myotis* species (woodland specialist species, which may be impacted by woodland loss to a greater extent than other more generalist species).

2.2.9 Bat call data recorded on detectors during these surveys were analysed manually by ecologists with experience in bat call analysis. Where both surveyors on a vantage point survey detected and/or recorded a bat species at the same time, this was recorded as a single individual to prevent duplication.

2.2.10 During this analysis, all call files (including noise files) were manually checked for barbastelle and *Myotis* species. The times of calls were recorded and compared with surveyor notes on bats seen/heard to produce a document of

barbastelle and *Myotis* species call times and observed activity on each survey occasion.

2.2.11 In addition to this, the thermal imaging camera footage was analysed by ecologists. The footage was checked at the times when barbastelle or *Myotis* species were recorded by surveyors or by the detectors in order to pick up the behaviour of these bats (e.g. commuting/foraging, direction of flight and flight height, if not recorded).

2.2.12 The sound files were subject to a quality assurance (QA) process. This involved analysing all calls from 10% of the surveys completed (i.e. 16 vantage point surveys were completed in 2022, therefore, two of these surveys were subject to QA checks in full).

2.2.13 Where bats were observed crossing the A1067, the flight height was used to determine whether it was a safe crossing. A safe crossing is defined as being greater than 5m above the road surface (Berthinussen & Altringham, 2015). The maximum height for heavy goods vehicles in the UK is 4.95m, therefore bats crossing below 5m are at risk of collision.

Table 2.1 – Summary of bat vantage point survey locations (relating Figure A-1)

Reference	Location	Feature	Surveyor setup	Survey objective
Vantage point 9 (south of the original Vantage Point 1)	Track running north to south through the eastern edge of The Nursery at the junction to Rose Carr	Woodland ride	Two surveyors (or pairs of surveyors) located at either end of the track facing each other, one facing north, and the other facing south.	To ensure a robust baseline and determine whether bat activity is similar to that previously recorded at VP1 which was located along the previous alignment just to the north within the Nursery. This survey data will inform mitigation design in this location.
Vantage point 10	A1067	A hedgerow south of the A1067 running parallel to the road and a line of trees north of the A1067, running perpendicular to the road.	Two pairs of surveyors on the north side of the road, one located in the field and the other located on the track, both facing the road.	To determine whether bats are using the features either side of the A1067 to cross, as well as the height and direction of this flight. This survey data will inform mitigation design in this location, if required.
Vantage point 11	A1067	A hedgerow south of the A1067 running parallel to the road and a parcel of woodland to the north of the road	Two pairs of surveyors on the north side of the road, located either side of the woodland.	To determine whether bats are using the features either side of the A1067 to cross, as well as the height and direction of this flight. This survey data will inform mitigation design in this location, if required.
Vantage point 12	A1067	A hedgerow south of the A1067 running parallel to the road and a line of trees north of the A1067, running perpendicular to the road.	May and July surveys - two pairs of surveyors, one on the north side of the road and the other south of the road. August surveys – two pairs of surveyors on the north side of the road, located approximately 35m either side of the line of trees.	To determine whether bats are using the features either side of the A1067 to cross, as well as the height and direction of this flight. This survey data will inform mitigation design in this location, if required.

2.3 Automated Detector Deployments

Surveys

2.3.1 Radio-tracking completed during 2021 identified patterns of barbastelle movement across the A1067 to the north of the Scheme (WSP UK Ltd, 2022b). Therefore, additional automated detector surveys were proposed in 2022 in order to fully establish the extent and seasonality of barbastelle activity in relation to the A1067, as well as determine key commuting routes/features.

2.3.2 Previous automated detector surveys had been undertaken across the Scheme during summer 2019, 2020 and 2021 and winter 2020/2021 to build a baseline about bat activity as reported in the 2021 Bat Activity Report (WSP UK Ltd., 2022a). In addition to this, during 2022 automated detector surveys were carried out at targeted locations along the A1067.

2.3.3 c, as described in Table 2.2 and shown on Figure B-1.

2.3.4 Song Meter 4 (SM4) (© Wildlife Acoustics, Inc) detectors were placed within habitat features considered likely to be used by commuting or foraging bats within proximity of the A1067 (such as woodland edges and within areas of woodland and hedgerows). The microphones used were multi-directional, however, they were placed pointing along the feature under survey, at a height between 1.5 and 2m. The automated detectors were set to commence recording at least 30 minutes before sunset and cease recording 30 minutes after sunrise. Full details of deployments are provided in Appendix B.

Table 2.2 – Summary of automated detector locations

Location in Relation to the A1067	Total Number	Detector Locations
North	5	C82, C84, C85, C88, C89.
South	4	C83, C86, C87, C90.

2.3.5 Calls registered by the automated detectors were recorded for later analysis using the specialist computer software Kaleidoscope Pro, as detailed below.

Data Analysis

2.3.6 Once triggered by ultrasound, the SM4 (© Wildlife acoustics) detectors were programmed to record sound files with a duration of 15 seconds, which may contain a number of individual bat calls (or passes), or discrete groups of ultrasound 'pulses'. The assessment of relative bat activity is based on the relative abundance of recorded bat calls of each species within each survey period.

2.3.7 It should be recognised that a series of separate sound files may represent a number of different bats commuting within the range of an automated detector, or a smaller number of bats repeatedly triggering the detector (e.g. bats making repeated foraging passes within the range of a detector).

2.3.8 Where possible, bat calls were identified to species level. However, species of the genus *Myotis* were only identified to genus level as their calls are similar in structure and have overlapping call parameters, making species identification difficult (Russ, 2012). Given the Scheme is outside the current known range of grey long-eared bat *Plecotus austriacus*, each long-eared bat pass has been identified as brown long-eared bat *Plecotus auratus (JNCC, 2018)*.

2.3.9 Identification of the genus *Nyctalus* (noctule *Nyctalus noctula* and Leisler's bat *Nyctalus leisleri*) was based on the following parameters (Russ, 2012):

- Noctule <20 KHz;
- *Nyctalus spp.* (noctule or Leisler's bat) >20 KHz.

2.3.10 The following parameters were used to manually identify *Pipistrellus* species (Russ, 2012):

- Common pipistrelle *Pipistrellus pipistrellus* ≥40 and ≤49KHz;
- Soprano pipistrelle *Pipistrellus pygmaeus* >51KHz;
- *Pipistrellus* species ≥49 and <51KHz;
- Nathusius' pipistrelle *Pipistrellus nathusii* ≤39KHz.

2.3.11 The process for bat call analysis is summarised below:

- Bat calls were run through Kaleidoscope-Pro (© Wildlife acoustics) using the 'Auto-ID' function, which enables identification of species or species groups based on call parameters.
- All bat calls (other than common and soprano pipistrelles for which Auto-ID has a high accuracy (Brabant, Laurent, Dolap, Degraer, & Poerink, 2018) were manually checked by ecologists competent in analysing bat calls and experienced in the use of Kaleidoscope software. Where the Auto-ID label was incorrect, the correct species label was attributed to the call.
- Each file may contain calls of multiple bat species; however, the Auto-ID function is only capable of labelling one species. This was corrected during manual checks by duplicating the file and labelling each species separately.
- All files labelled as common or soprano pipistrelle in the Auto-ID process that were below a confidence interval of 0.6 were manually checked. A minimum of 50 common and soprano calls were manually checked per Auto ID file (*i.e.* 40 calls with a confidence interval of <0.6

- and then 10 additional calls starting with those at a confidence interval of 0.60 and above).

2.3.12 To allow standardisation and comparison of automated detector survey results the number of bat passes recorded per night (ppn) was calculated for each location, as explained below in Figure

Figure 2-1 - Bat passes per night calculation

$$Bat\ ppn = \frac{Total\ bat\ passes\ recorded\ at\ a\ SM4\ location}{Number\ of\ nights\ SM4\ Surveyed}$$

2.3.13 As the aim of the automated detector survey was to record a representative sample of bat activity and not a population assessment; no noise files were checked as part of the manual ID process. Noise files consist of any sound which has triggered the detector, which has not been recognised as a bat call, such as crickets or rustling vegetation etc. Occasional bat calls may be present with these, although these are usually short sections of calls from bats which are likely to have been further away from the detector and therefore less relevant to the habitat feature under survey. Although slightly higher numbers of calls of all species may be recorded if the noise files were analysed, this would not alter the results in terms of habitat features with highest/lowest levels of bat activity.

2.3.14 The analysed sound files were subject to a QA process. Ten percent of sound files which were identified as common or soprano pipistrelle and 10% of each non-pipistrelle label were randomly selected for QA checks by a suitably competent analyst experienced in using Kaleidoscope software (© Wildlife acoustics). A minimum of 10 files were subject to QA, if there were less than 10 files analysed in total, then all files were subject to QA.

Survey Area. Results from these surveys are reported in the 2021 Bat Roost Survey Report (WSP UK Ltd., 2022c).

2.4.2 In 2022, all trees within 25m of the Site Boundary (as refined) and/or 100m from the Scheme Alignment (as refined) which fell outside previous Survey Areas were subject to GLTA survey as shown in Figure C-1, in Appendix C. All GLTA surveys were completed by ecologists competent in recognising features suitable for use by tree roosting bats.

2.4.3 In reference to the good practice guidelines and industry standards (Collins, 2016), a visual inspection of the trees from ground level using binoculars and a high-powered torch was undertaken to search for features which provide potential roosting opportunities for bats such as:

- woodpecker holes;
- rot holes;
- hazard beams;
- cracks and splits (e.g. frost cracks);
- knot holes;
- cankers;
- dense ivy; and
- lifting/peeling bark.

2.4.4 Where potential roost features were identified, their location and a brief description were recorded, in order to aid further survey work as required. Where possible, each feature was visually inspected for evidence of use by roosting bats, including:

- bat droppings in, around or below the potential roost feature;
- urine staining below the potential roost feature;
- scratch marks; and,

- characteristic staining (from fur oils).

2.4.5 If features were present at a height possible for a ground-level inspection to be safely completed (e.g., 2m high), then this was completed by a Level 2 licensed or accredited bat surveyor using high powered torches and/or an endoscope. Trees were categorised in line with the descriptions in Table 2.3. Trees categorised as having negligible suitability to support roosting bats are not discussed further in this report, beyond those which were downgraded to negligible suitability following further inspection.

Table 2.3 – Tree bat roost suitability classification (Collins, 2016)

Bat roosting suitability	**Description of roosting behaviour**
Confirmed	A tree with features confirmed to be used by roosting bats either by historic records or evidence recorded during survey.
High	A tree with one or more potential roost sites that are obviously suitable for use by larger numbers of bats on a more regular basis and potentially for longer periods of time due to their size, shelter, protection, conditions and surrounding habitat.
Moderate	A tree with one or more potential roost sites that could be used by bats due to their size, shelter, protection, conditions and surrounding habitat but unlikely to support a roost of high conservation status (with respect to roost type only – the assessments in this table are made irrespective of species conservation status, which is established after presence is confirmed).
Low	A tree of sufficient size and age to contain potential roosting features but with none seen from the ground or features with only very limited roosting potential.
Negligible	A tree with features of negligible value to tree-roosting bats.

2.4.6 For trees assessed as being of low, moderate or high suitability, information on species, approximate height in metres, and age class was collected. Additionally, a ten-figure grid reference and photographs were collected for all trees assessed as low, moderate or high suitability.

2.5 Further Roost Surveys

2.5.1 Any trees identified as being of moderate or high suitability for tree-roosting bats (or a confirmed roost) have been subject to a follow-up presence/likely absence survey, either comprising aerial inspection surveys or dusk emergence/dawn re-entry surveys as described in this section.

2.5.2 Negligible and low suitability trees did not receive a follow-up presence/likely absence survey in accordance with best practice survey guidance (Collins, 2016). Low suitability trees have been recorded on a plan and will be considered as part of the bat mitigation strategy for the Scheme.

2.5.3 Trees which could not be safely climbed were subject to dusk emergence/dawn re-entry surveys to determine the presence or likely absence of roosting bats, in addition some trees on further inspection were subject to a combination of aerial inspection and dusk emergence and/or dawn re-entry surveys to ensure robust results were obtained.

2.5.4 Methods used for each approach are detailed below.

Aerial Inspections of Trees

2.5.5 Aerial inspection surveys were undertaken by qualified tree-climbers with a Level 2 Natural England bat licence or accredited under one.

2.5.6 Surveyors undertook inspections with high powered torches, endoscopes and mirrors. Information about the features were noted, for example, dimensions and exposure to cold, rain and light. After inspection, the suitability of the potential roost feature was re-evaluated depending on the suitability of the feature to support roosting bats, and re-categorised as appropriate (as low, moderate or high).

2.5.7 The number of aerial inspections conducted for each tree was proportional to the level of bat roosting suitability assigned. Two aerial inspections were completed for trees with moderate suitability, and three separate aerial inspections were completed for trees with high suitability or trees with

confirmed roosting status. Each separate aerial inspection was considered as a separate survey visit.

Dusk Emergence and Dawn Re-Entry Surveys of Trees

2.5.8 Dusk emergence/dawn re-entry surveys were undertaken by surveyors experienced in completing emergence/re-entry surveys for trees and structures.

2.5.9 Surveyors noted features on the tree or structure from which bats were observed emerging or returning. Surveyors recorded the species and time of activity, as well as noting any flight lines and comments on activity (i.e. commuting or foraging).

2.5.10 For emergence/re-entry surveys, the number of survey visits completed was proportional to the level of assigned bat roosting suitability as show in Table 2.4 below. This is in line with current best practice guidance (Collins, 2016).

Table 2.4 – Recommended number of presence/likely absence based on Collins (2016)

Roost suitability	**Recommended minimum number of survey visits for trees**
Low	No further survey required. Tree will be subject to suitable mitigation and assessment prior to felling.
Moderate	Two separate survey visits.
High	Three separate survey visits

2.5.11 Surveyors positioned themselves in order to achieve optimal visibility of the tree and any potential roosting features. In most cases one surveyor could survey the tree adequately, however, in some cases where there was restricted visibility or many features, a second surveyor was required.

2.5.12 Dusk emergence surveys began 15 minutes before sunset and continued for 1.5 hours after sunset. The dawn re-entry surveys began 1.5 hours before sunrise and continued until 15 minutes after sunrise.

2.5.13 Surveyors used EMT (© Wildlife acoustics) bat detectors to listen to and record bat echolocation calls. On every survey occasion, surveyors were

aided by either an infra-red or thermal imaging camera to enable visibility of the tree in darkness.

2.6 Dates of Survey and Personnel

2.6.1 The dates of the surveys completed and details on the relevant personnel are provided below in Table 2.5.

Table 2.5 – Dates of survey and personnel used

Survey type	Dates of survey	Personnel
Vantage point surveys	Various dates ranging between May – September 2022. For a full list of dates see Table A in Appendix A.	Vantage point surveys were undertaken by surveyors with experience in conducting such surveys.
Automated detector surveys	Various dates ranging between May – August 2022.	Automated detector surveys were undertaken by surveyors with experience in conducting such surveys.
Ground level tree assessment	30 and 31 March 2022.	GLTAs were completed by ecologists competent in recognising potential bat roosting features. Any inspection of features at ground level (e.g. using an endoscope) were coordinated and undertaken by a licenced bat ecologist or accredited bat surveyor.
Aerial inspection	12, 13, 16, 17, 18, 19 May 2022. 2, 3, 31 August 2022.	Aerial inspections were coordinated and undertaken by teams of two ecologists (at least one holding a Level 2 Natural England class licence for bats or accredited under one) qualified in tree climbing and aerial rescue.
Dusk emergence / dawn re-entry	25 May 2022, 15 June 2022, 28 July 2022, 24 August 2022.	Tree emergence/re-entry surveys were undertaken by surveyors with experience in conducting such surveys.

2.7 Notes and Limitations

General

2.7.1 Best practice indicates that survey data is generally considered valid for up to 18 months (CIEEM, 2019). The data presented in this report enables an evaluation of bat activity and bat roost availability within the respective Survey Areas, which in combination with other surveys is intended to inform an Environmental Impact Assessment of the Scheme. Should the planning submission be delayed, further surveys may be required to verify the baseline data remains representative.

2.7.2 In some cases, due to issues such as poor weather conditions, health and safety reasons or access restrictions, the data was not collected in the targeted month. Where this happened, the data was generally collected as early as possible in the following month, and a gap of at least two weeks left before data collection in that month.

Vantage Point Surveys

2.7.3 Due to the limited field of view of thermal imaging cameras, bats were frequently recorded by bat detectors but not observed by surveyors or recorded by the thermal imaging cameras. Given that the camera had a view of the feature under survey, it is assumed that these bats were not using the linear feature or habitat subject to the surveys and therefore data collected is still considered valid and not a limitation to the survey.

2.7.4 Due to the speed of flight of bats under observation, an estimation of flight height was not possible on all occasions. However, flight heights were able to be estimated for the majority of observations and therefore the data collected is still considered valid and not a limitation to the survey. Where the flight height could not be estimated when bats were observed crossing the A1067, it was assumed that the bats were crossing at an unsafe height on a precautionary basis. This was only the case for two bat passes.

2.7.5 Due to health and safety reasons, the June survey for VP11 was abandoned early and the June surveys for both VP11 and VP12 had to be rescheduled.

The replacement survey for VP11 took place in September and for VP12 took place in late August. This is not considered a limitation as both surveys took place within the optimal bat surveying season, with a sufficient gap between the rescheduled surveys and vantage point surveys taking place in the remaining months.

2.7.6 During the following three surveys there were errors during the bat detector recording:

- VP9 May – southern surveyor location.
- VP11 August – surveyor location east of the parcel of woodland (for the first 30 minutes).
- VP12 August – surveyor location east of the line of trees (for the first 30 minutes).

2.7.7 This meant that bat call analysis could not be completed at the times when the bat detector recordings were missing. The other surveyor locations still provided good coverage of the area therefore, it is considered that this limitation does not affect the value of the overall dataset.

2.7.8 The survey set-up for the VP 12 August surveys changed due to health and safety reasons. This meant that both pairs of surveyors were positioned on the north side of the road resulting in a more limited field of view. During these surveys, both barbastelle and *Myotis* species were still observed crossing the road and overall, this is not considered to be a significant limitation.

Automated Detector Surveys

2.7.9 Noise files were not analysed as part of the bat activity call analysis process for automated detector surveys. The reasons for this are explained in paragraph 2.3.11. Although it is inevitable that some bat calls (incorrectly labelled as noise files) will have not been assessed and included as a result of this, these are likely to have been calls from bats a further distance from the detector and therefore less relevant to the habitat feature under survey. Additionally, the bat activity surveys were designed to provide representative

data and not to record every pass possible. Therefore, this has been achieved utilising the existing methods and is not considered a limitation to this assessment.

2.7.10 A high level of background noise was recorded occasionally at a number of automated detector locations. This loud background noise can reduce detectability of echolocation calls, especially quieter bats such as barbastelle and brown long-eared bat. The dataset collected however is still considered representative and valid, given that a large number of automated detectors were deployed along the A1067.

2.7.11 Due to an error during deployment, location C84 was not deployed in July. As there were detector locations in the surrounding vicinity to the west and south of the affected detector, it is determined there was good coverage of the area. This detector has been given special consideration when drawing comparisons through averages and has been discussed as such in the results. Therefore, it is considered that this limitation does not limit the value of the overall dataset.

Roosting Bats

2.7.12 Dusk emergence and dawn re-entry surveys are unlikely to provide a complete measure of incidental bat activity due to the tendency for *Plecotus* species to use low intensity calls which are rarely detected unless passing within 5m of a detector. Even then, *Plecotus* species do not always echolocate when foraging. However, this is not expected to affect the findings of the roosting status of trees recorded for the Scheme, as additional equipment was utilised e.g. infra-red or thermal cameras, where practical, to enhance the findings of the survey results.

2.7.13 Tree 457 was subject to two dusk emergence surveys instead of one dusk emergence and one dawn re-entry survey as recommended following guidelines (Collins, 2016). This was required due to health and safety reasons and is not considered a limitation.

3 Vantage point survey results

3.1.1 The dates and meteorological data of these surveys are provided in Appendix A, Table A.1. The vantage point locations are shown in Figure A-1 and are described in Table 2.1 (previous section). The results of vantage point surveys are summarised below and indicative flight lines are shown in Figures A-2 - A-8. The results of vantage point surveys per month are summarised in Appendix A, Table A.2.

3.2 Vantage Point 9 (Woodland Ride)

3.2.1 The results of vantage point 9 are summarised in Table 3.1 below.

Table 3.1 – Summary of results of vantage point 9

Species	Total recorded passes	% Passes observed	Average height m (height range)	% Passes observed foraging	% Passes observed commuting	% Passes observed commuting and foraging
Barbastelle	196	58.7	4.0 (1-8)	20.9	36.7	1.0
Myotis sp.	121	43.0	2.7 (1-5)	19.8	23.1	0

Barbastelle

3.2.2 A total of 196 barbastelle passes were recorded at VP9. Of these passes, 36.7% (72 passes) were observed by surveyors using this feature, a woodland ride, for commuting. A further 1% (2 passes) were observed using the feature for commuting and foraging and 20.9% (41 passes) for foraging.

3.2.3 Barbastelle passes were recorded and observed by surveyors or captured by the thermal imaging cameras across all months surveyed.

3.2.4 Flight lines observed during the surveys are shown on Figure A-2 and summarised below:

- Individual bats were observed commuting along the woodland ride at 1 to 7m, from the north (on 34 occasions) and the south (on 38 occasions).
- An individual bat was observed commuting east out of the woodland and following the ride south.
- An individual bat was observed commuting east out of the woodland and following the ride north.

Myotis Species

3.2.5 A total of 121 *Myotis* species passes were recorded at VP9. Of these passes, 23.1% (28 passes) were observed by surveyors using this feature, a woodland ride, for commuting. A further 19.8% (24 passes) were observed using the feature for foraging.

3.2.6 *Myotis* species were recorded and observed by surveyors or captured by the thermal imaging cameras across all months.

3.2.7 Flight lines observed during the surveys are shown on Figure A-3 and summarised below:

- Individual bats were observed commuting along the woodland ride at 1 to 5m, from the north (on eight occasions) and the south (on 15 occasions) and flying back and forth along the ride (on one occasion).

- An individual bat was observed commuting north along the track and then west into the woodland.
- Two bats were observed commuting east out of the woodland and following the ride south.
- One bat was observed commuting across the woodland ride from west to east.

3.3 Vantage Point 10 (A1067)

3.3.1 The results of vantage point 10 are summarised in Table 3.2 below.

Table 3.2 – Summary of results of vantage point 10

Species	Total recorded passes	% Passes observed	Average height m (height range)	% Passes observed foraging	% Passes observed commuting	% Passes observed commuting and foraging	Total observed crossing road	% Observed crossing at safe height
Barbastelle	23	34.8	5.3 (3-10)	0	34.8	0	8	62.5
Myotis	37	51.4	3.9 (2-7)	2.7	43.2	5.4	19	26.3

Barbastelle

3.3.2 A total of 23 barbastelle passes were recorded at VP10. Of these passes, 34.8% (8 passes) were observed by surveyors commuting across the road. Of the bats observed crossing the road, 62.5% (five passes) crossed the road at a safe height.

3.3.3 Barbastelle passes were recorded in all months, however, no passes were observed by surveyors or captured by thermal imaging cameras during the July survey.

3.3.4 Flight lines observed during the surveys are shown on Figure A-4 and summarised below:

- Individual bats were observed commuting across the road at 3 to 10m, from the north (on five occasions) and the south (on three occasions).

Myotis Species

3.3.5 A total of 37 *Myotis* species passes were recorded at VP10. Of these passes, 43.2% (16 passes) were observed by surveyors commuting across the road. A further 5.4% (two passes) were observed by surveyors commuting and foraging across the road and 2.7% (one pass) foraging across the road. Of the bats observed crossing the road, 26.3% (five passes) crossed the road at a safe height.

3.3.6 *Myotis* species passes were recorded in all months, however, no passes were observed by surveyors or captured by thermal imaging cameras during the May survey.

3.3.7 Flight lines observed during the surveys are shown on Figure A-5 and summarised below:

- Individual bats were observed commuting across the road at 2 to 7m, from the north (on 14 occasions) and the south (on four occasions).

3.4 Vantage Point 11 (A1067)

3.4.1 The results of vantage point 11 are summarised in Table 3.3 below.

Table 3.3 – Summary of results of vantage point 11

Species	Total recorded passes	% Passes observed	Average height m (height range)	% Passes observed foraging	% Passes observed commuting	% Passes observed commuting and foraging	Total observed crossing road	% Observed crossing at safe height
Barbastelle	1	0	Not applicable	0	0	0	0	0
Myotis	11	54.6	8 (5-10)	0	45.5	9.1	6	83.3

Barbastelle

3.4.2 A total of one barbastelle was recorded at VP11, which was not observed by surveyors or captured by thermal imaging cameras. This pass was recorded during the August survey.

Myotis

3.4.3 A total of 11 *Myotis* species passes were recorded at VP11. Of these passes, 45.5% (5 passes) were observed by surveyors commuting across the road. A further 9.1% (one pass) were observed by surveyors commuting and foraging across the road. Of the bats observed crossing the road, 83.3% (five passes) crossed the road at a safe height.

3.4.4 *Myotis* species passes were recorded in all months, however, no passes were observed by surveyors or captured by thermal imaging cameras during the August survey.

3.4.5 Flight lines observed during the surveys are shown on Figure A-6 and summarised below:

- Individual bats were observed commuting across the road, from the north (on five occasions) and the south (on one occasion).

3.5 Vantage Point 12 (A1067)

3.5.1 The results of vantage point 12 are summarised in Table 3.4 below.

Table 3.4 – Summary of results of vantage point 12

Species	Total recorded passes	% Passes observed	Average height m (height range)	% Passes observed foraging	% Passes observed commuting	Total observed crossing road	% Observed crossing safely at safe height
Barbastelle	41	29.3	6.3 (4-10)	17.1	12.2	6	50
Myotis	47	21.3	7.3 (2-15)	8.5	12.8	7	85.7

4 Automated detector survey results

4.1 Survey Results – Overview

4.1.1 At least eight bat species were recorded using habitats within the Survey Area during the automated bat detector surveys. The following species and species groups were confirmed and will be discussed as follows:

- Barbastelle;
- Common pipistrelle;
- Soprano pipistrelle;
- Nathusius' pipistrelle;
- *Myotis* species;
- Noctule;
- Unidentified *Nyctalus* species (noctule or Leisler's Bat);
- Brown long-eared bat; and
- Serotine.

4.1.2 The passes per night recorded during the automated detector surveys each month are summarised in Table B.1, Appendix B.

4.1.3 A total of 51,201 call registrations were recorded across the deployment period. Of these calls the most commonly registered species was common pipistrelle accounting for 45.70% of the total bat passes. The least commonly registered species was Nathusius' pipistrelle, accounting for only 0.04% of the total bat passes.

4.1.4 A total of 33,944 call registrations were recorded at the locations situated north of A1067 throughout the deployment, accounting for 66.30% of total call registrations. This was expected as the locations north of A1067 were near a

large area of woodland, whereas the locations south of A1067 were mainly surrounded by grassland.

4.1.5 Locations C85, C82 and C87 saw the highest number of call registrations, accounting for 26.19%, 23.70% and 16.53% respectively. The location with the lowest total call registrations for all species was C83, accounting for 2.72% of total calls.

4.1.6 July was the most active month, with a total call registration of 18,243 accounting for 35.63% of the call registrations across the period. The month with the least call registrations was August with 9,470 passes, accounting for 18.50% of total call registrations.

4.2 Barbastelle

4.2.1 Barbastelle activity across the deployment period at all locations within the Survey Area was an average of 7.8ppn, with a peak of activity in May recording an average of 13.1ppn. Activity was noticeably lower in the remaining months, ranging from an average of 4.8ppn in June to 7.0ppn in July.

4.2.2 The graph showing average barbastelle ppn per location is shown on Figure 4.1 and the graph showing average barbastelle ppn per location per month is shown on Figure 4.2.

Figure 4.1 – Average passes per night for barbastelle per location

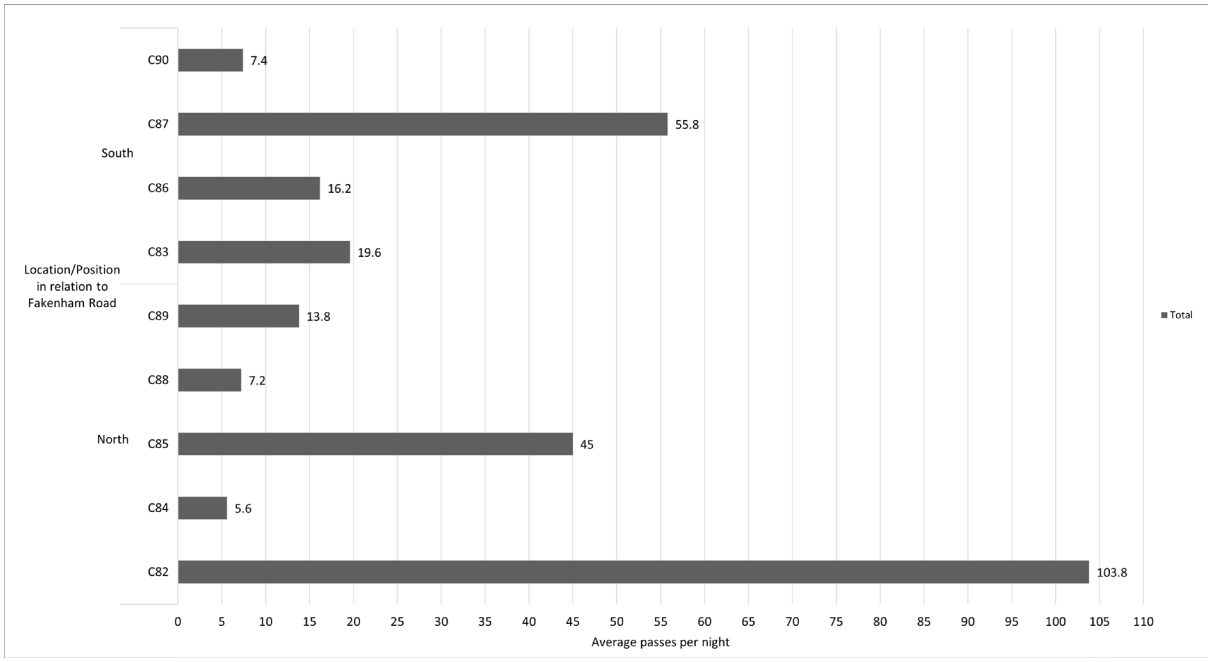
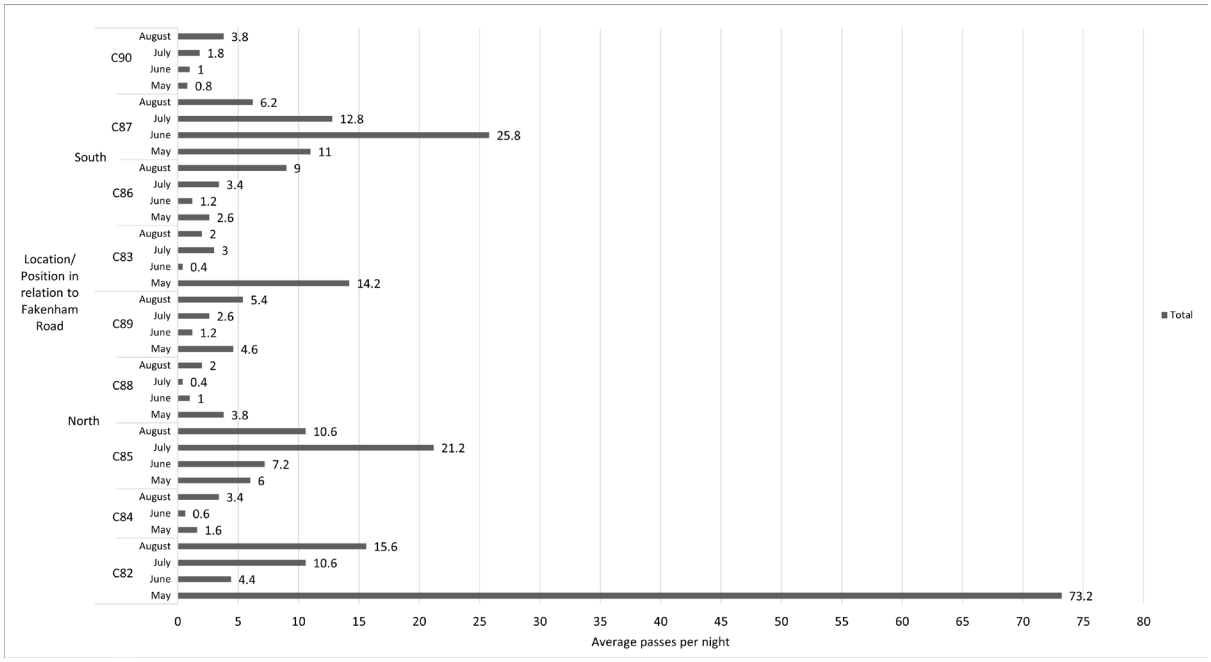


Figure 4.2 – Average passes per night for barbastelle per location per month



4.2.3 The highest activity levels across the Survey Area were recorded at location C82, with an average 26.0ppn across the deployment period. The peak activity was recorded in May, recording an average 73.2ppn. Activity over the

remaining months of the deployment period was noticeably lower and ranged from an average 4.4ppn in June to 15.6ppn in August.

4.2.4 The next highest levels of activity across the Survey Area were recorded at locations C87 and C85, which recorded similar activity levels, with an average of 14.0ppn and 11.3ppn throughout the deployment period respectively. The levels of activity recorded each month at these locations fluctuated less than those recorded at location C82. Location C87 recorded a peak activity in June of an average 25.8ppn and the remaining months ranged from 12.8ppn in July to 6.2ppn in August. Location C85 recorded a peak activity in July of an average 21.2ppn and the remaining months ranged from 10.6ppn in August to 6ppn in May.

4.2.5 The lowest activity levels across the Survey Area were recorded at locations C84, C88 and C90, which all recorded similar levels of activity, with an average of 1.9ppn, 1.8ppn and 1.9ppn throughout the deployment period respectively. Activity levels throughout all of the months were consistently low and activity levels were not recorded above an average of 3.8ppn.

4.2.6 Barbastelle activity at the remaining locations across the Survey Area was an average of 3.5ppn (C89), 4.9ppn (C83) and 4.1ppn (C86) across the deployment period. Overall, these locations did not record above an average 5.4ppn, with the exception of location C83 recording 14.2ppn in May and location C86 recording 9ppn in August.

4.3 Common Pipistrelle

4.3.1 Common pipistrelle activity across the deployment period at all locations within the Survey Area was an average of 133.7ppn, with a peak of activity in July recording an average of 285.8ppn. Activity was noticeably lower in the remaining months, ranging from an average of 72.2ppn in August to 108.1ppn in May.

4.3.2 The graph showing average common pipistrelle ppn per location is shown on Figure 4.3 and the graph showing average common pipistrelle ppn per location per month is shown on Figure 4.4.

Figure 4.3 – Average passes per night for common pipistrelle per location

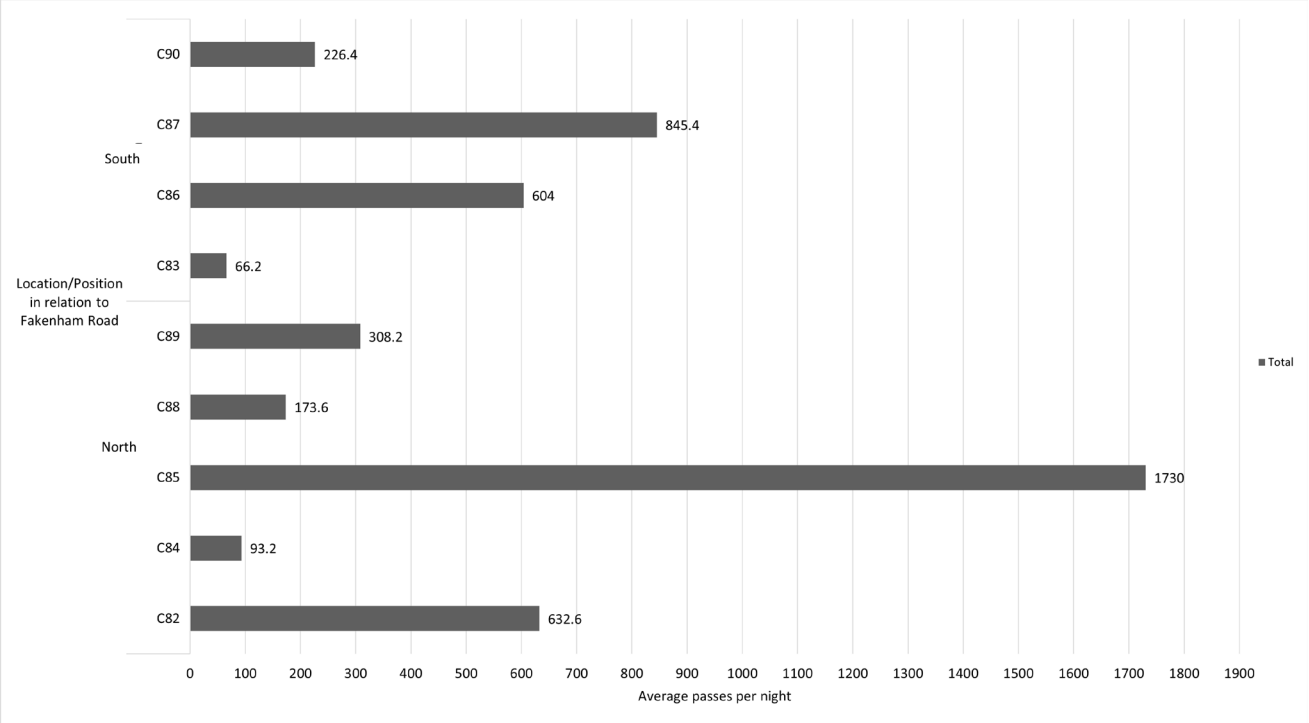
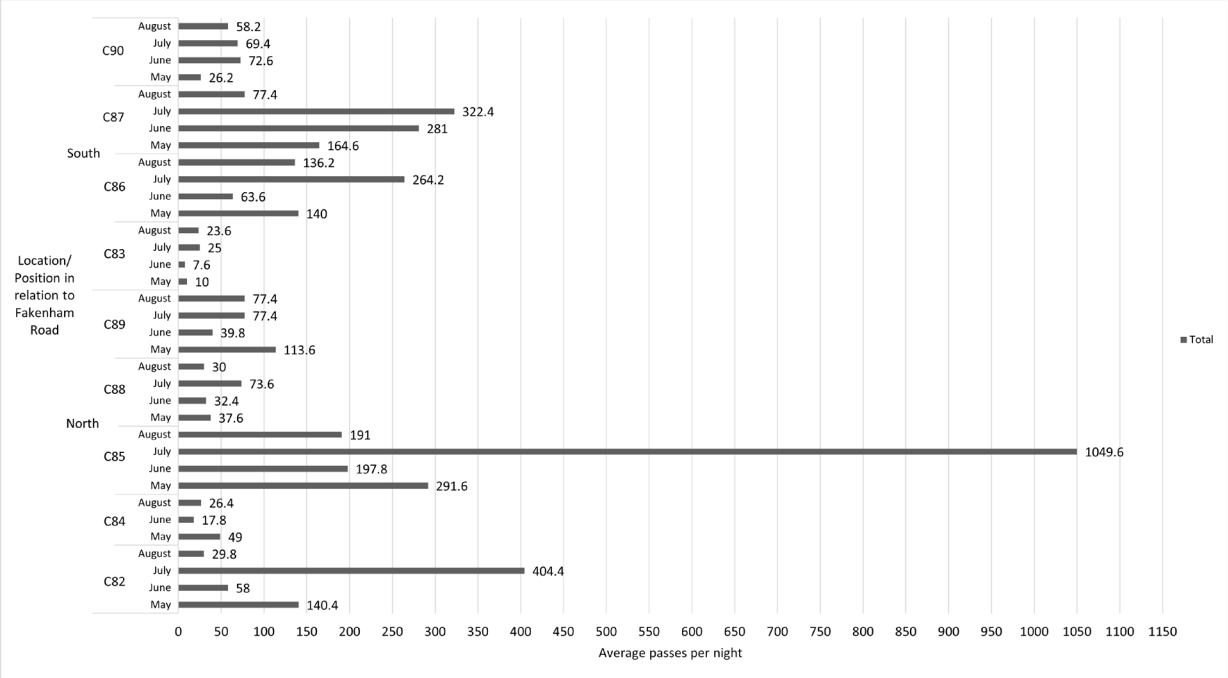


Figure 4.4 – Average passes per night for common pipistrelle per location per month



4.3.3 The highest activity levels across the Survey Area were recorded at location C85, with an average 432.5ppn across the deployment period. The peak activity was recorded in July, recording an average 1049.6ppn. Activity over the remaining months of the deployment period was noticeably lower and ranged from an average 191ppn in August to 291.6ppn in May.

4.3.4 The next highest level of activity across the Survey Area was recorded at location C87, with an average of 211.4ppn throughout the deployment period. The levels of activity recorded each month at this location fluctuated less than those recorded at location C85. The peak was recorded in July, recording an average 322.4ppn, with May and June also recording high levels of activity, an average of 164.6ppn and 281ppn, respectively. Levels of activity were noticeably lower in August which recorded an average of 77.4ppn.

4.3.5 Activity levels at locations C82 and C86 were also relatively high and recorded similar levels of activity, with location C82 recording an average of 158.2ppn and location C86 151ppn over the deployment period. Location C82 recorded the overall second highest monthly peak in activity in July, recording

an average 404.4ppn. The remaining months recorded noticeably lower activity levels which ranged from an average 29.8ppn in August to 140.4ppn in May. The levels of activity recorded at location C86 fluctuated less, recording a peak activity in July of an average 264.2ppn and the remaining months recording from 140ppn in May to 63.6ppn in June.

4.3.6 Location C83 recorded activity levels noticeably lower than the other locations, with an average of 16.6ppn over the deployment period. Activity levels were consistently low throughout all of the months and ranged from an average 7.6ppn in June to 25ppn in July.

4.3.7 Common pipistrelle activity at the remaining locations across the Survey Area was an average 31.1ppn (C84), 43.4ppn (C88), 77.1ppn (C89) and 56.6ppn (C90) across the deployment period. Overall, these locations did not record above an average 80.00ppn, with the exception of C89 recording 113.6ppn in May.

4.4 Soprano Pipistrelle

4.4.1 Soprano pipistrelle activity across the deployment period at all locations within the Survey Area was an average of 107.9ppn, with a peak activity in May recording an average of 131.3ppn. Activity levels remained high in July and June, with averages of 112.4ppn and 103.3ppn respectively. In August activity levels dropped further, however still recorded a high level of activity at an average of 85.1ppn.

4.4.2 The graph showing average Soprano Pipistrelle ppn per location is shown on Figure 4.5 and the graph showing average Soprano Pipistrelle ppn per location per month is shown on Figure 4.6.

Figure 4.5 – Average passes per night for soprano pipistrelle per location

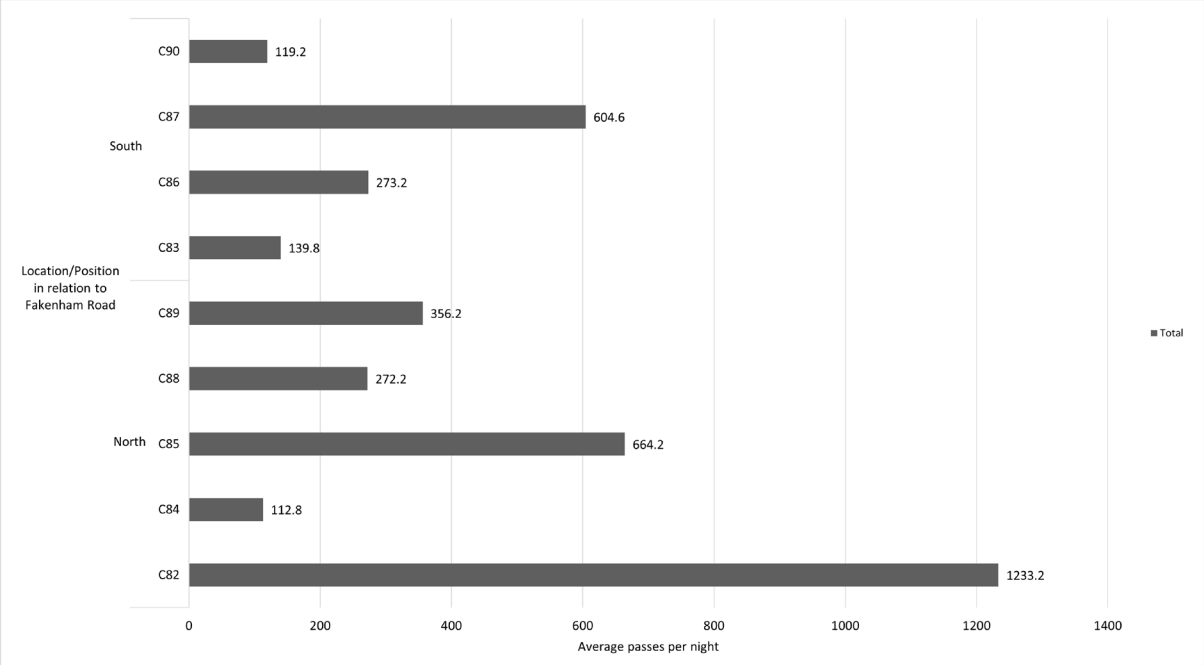
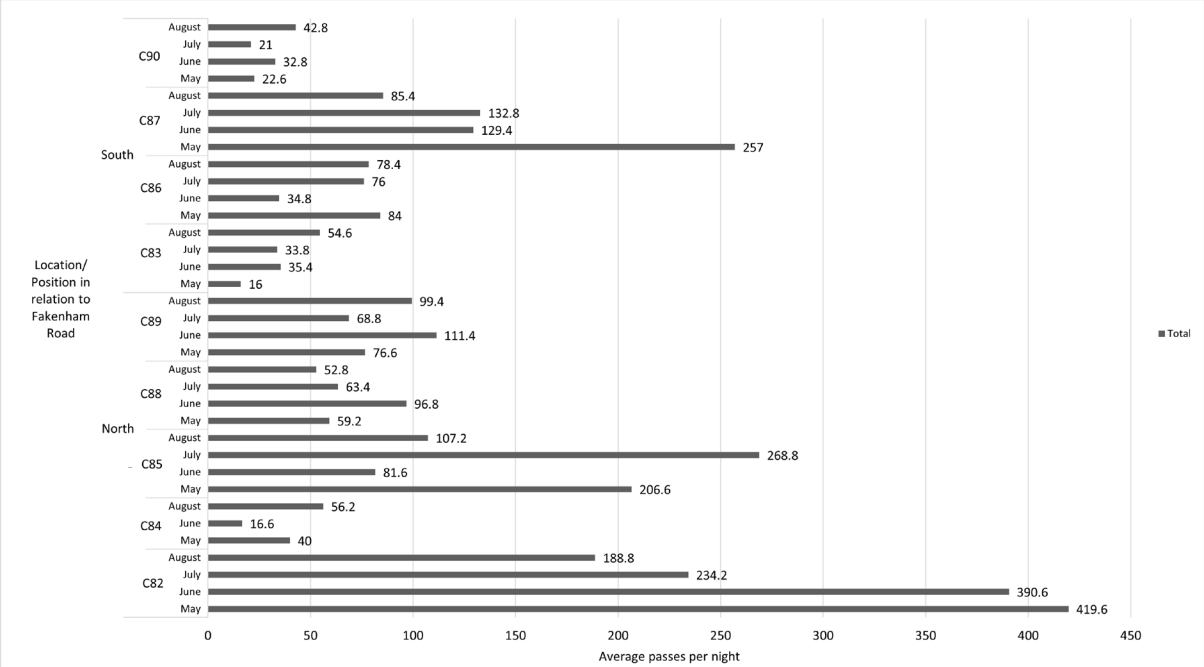


Figure 4.6 – Average passes per night for soprano pipistrelle per location per month



4.4.3 The highest activity levels across the Survey Area were recorded at location C82 and were noticeably higher than the other locations, with an average 308.3ppn across the deployment period. The peak activity was recorded in May, recording an average 419.6ppn. Activity over the remaining months of the deployment period was consistently high and ranged from an average 188.8ppn in August to 390.6ppn in June. Location C82 recorded the highest activity across the Survey Area in May, June and August.

4.4.4 The next highest level of activity across the Survey Area was recorded at location C85, with an average 166.1ppn throughout the deployment period. The activity levels fluctuated more than those recorded at C82. Location C85 recorded a peak activity in July of an average 268.8ppn, with the remaining months ranging from 81.6ppn in June to 206.6ppn in May.

4.4.5 Activity levels recorded at location C87 were similar to those recorded at location C85, with an average 151.2ppn recorded throughout the deployment period. The peak activity was recorded in May, recording an average 257ppn. Activity over the remaining months was noticeably lower and ranged from an average 85.4ppn in August to 132.8ppn in July.

4.4.6 The lowest activity levels across the Survey Area were recorded at location C90, with an average 29.8ppn throughout the deployment period. Location C90 recorded a peak activity in August of 42.8ppn and the remaining months ranged from 21ppn in July to 32.8ppn in June.

4.4.7 Soprano pipistrelle activity at the remaining locations across the Survey Area was an average 37.6ppn (C84), 68.1ppn (C88), 89.1 (C89), 35.0ppn (C83) and 68.3ppn (C86) across the deployment period. Overall, these locations did not record above an average 100.00ppn, with the exception of location C89 recording 111.4ppn in June.

4.5 Nathusius' Pipistrelle

4.5.1 Nathusius' pipistrelle activity was low across all detectors in all months. Activity across the deployment period at all locations within the Survey Area was an average of 0.1ppn. Activity levels ranged from an average of 0.2ppn and 01.ppn from May to July with no activity recorded in August.

4.5.2 The graph showing average Nathusius' pipistrelle ppn per location is shown on Figure 4.7 and the graph showing average Nathusius' pipistrelle ppn per location per month is shown on Figure 4.8.

Figure 4.7 – Average passes per night for Nathusius' pipistrelle per location

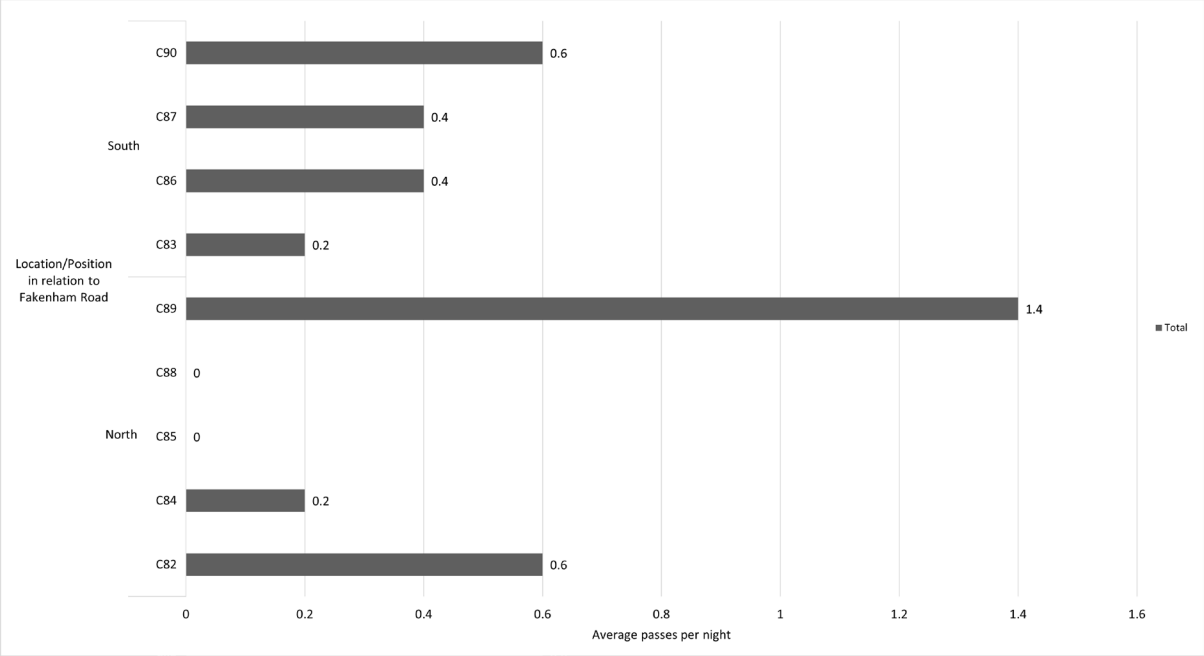
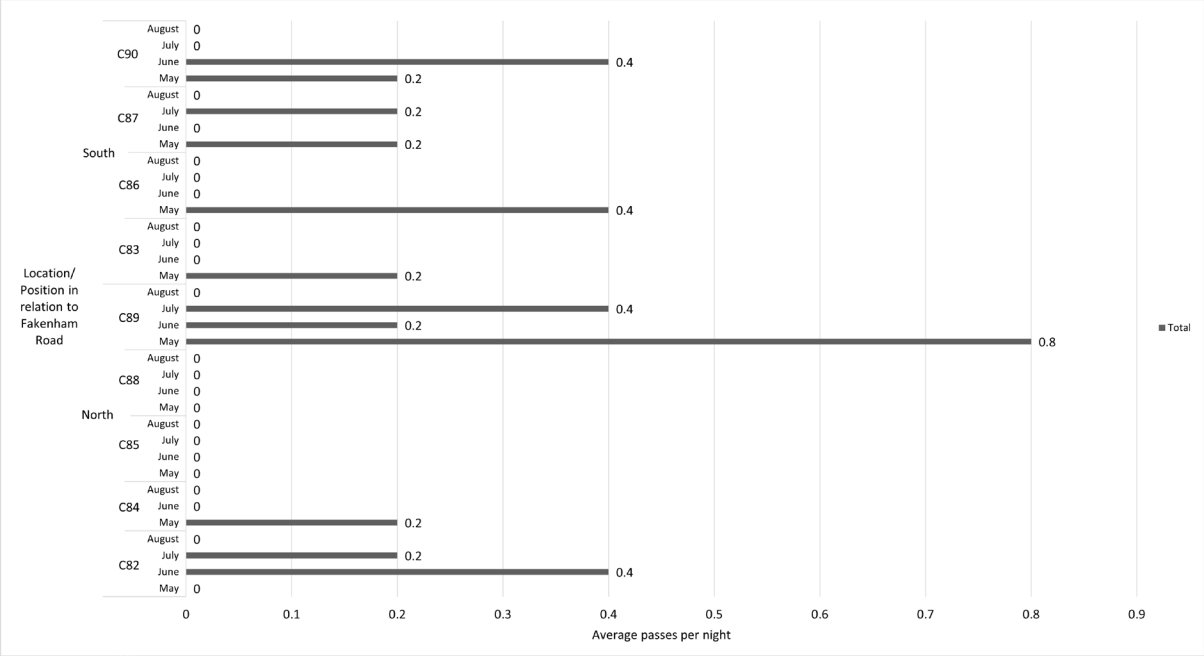


Figure 4.8 – Average passes per night for Nathusius' pipistrelle per location per month



4.5.3 Locations C85 and C88 did not record any activity throughout the whole deployment period. The remaining locations did not record any activity exceeding an average 0.8ppn in any given month.

4.6 *Myotis* Species

4.6.1 *Myotis* species activity across the deployment period at all locations within the Survey Area was an average of 15.9ppn, with a peak of activity in July recording an average of 21.4ppn. Activity was slightly lower in the remaining months, which all recorded similar activity, ranging from an average of 13.7ppn in August to 14.9ppn in May.

4.6.2 The graph showing average *Myotis* species ppn per location is shown on Figure 4.9 and the graph showing average *Myotis* species ppn per location per month is shown on Figure 4.10.

Figure 4.9 – Average passes per night for *Myotis* species per location

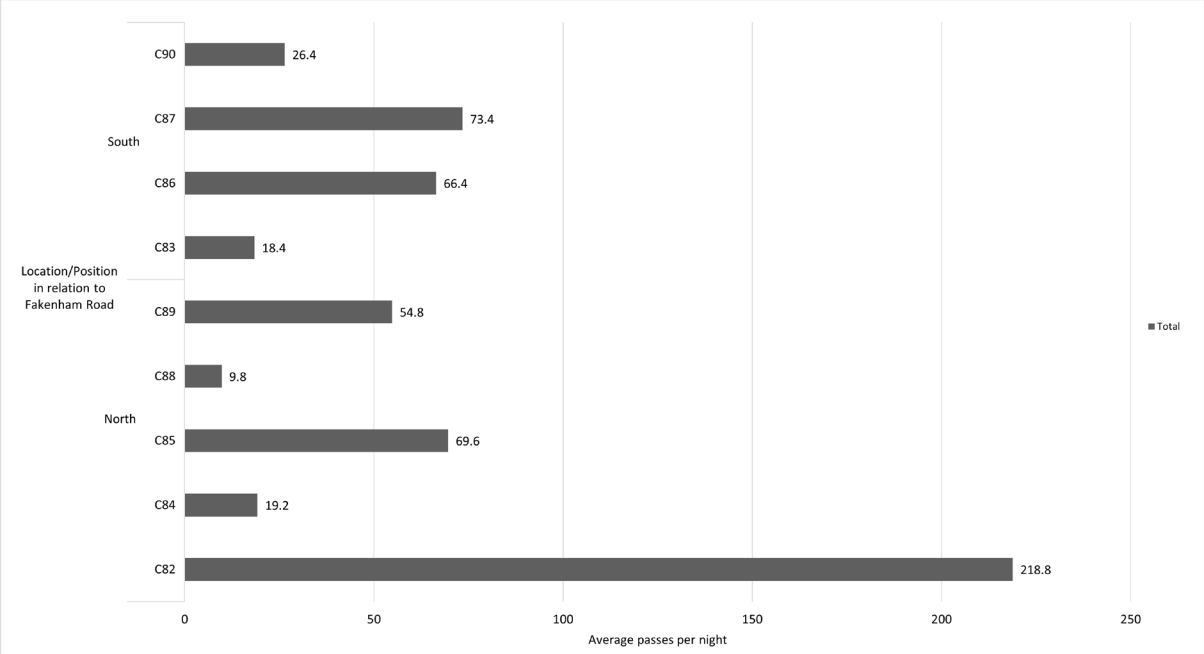
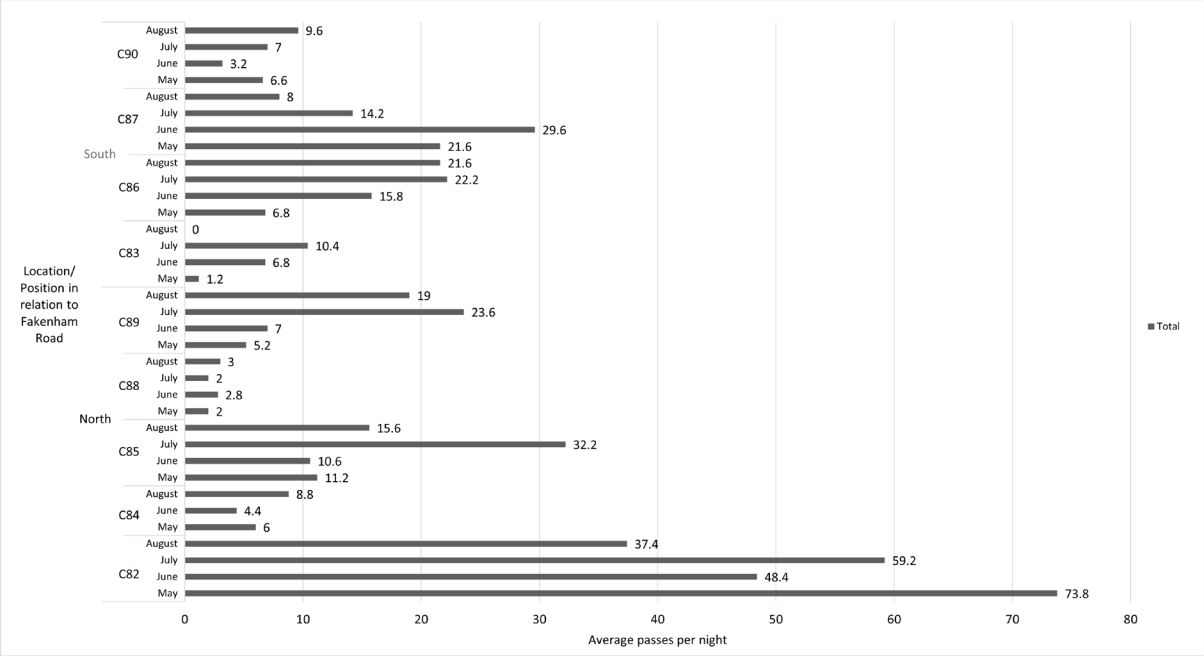


Figure 4.10 – Average passes per night for *Myotis* species per location per month



4.6.3 The highest activity levels across the Survey Area were recorded at C82, which were noticeably higher than the activity levels at the other locations, with an average 54.7ppn across the deployment period. The peak activity was recorded in May, recording an average 73.8ppn. Activity over the remaining months of the deployment period was also high and ranged from an average 37.4ppn in August to 59.2ppn in July.

4.6.4 The next highest levels of activity were recorded at location C87, with an average 18.4ppn across the deployment period. Locations C85, C89 and C86 recorded similar activity levels, with an average 17.4ppn, 13.7ppn and 16.6ppn across the deployment period respectively. Overall, these locations did not record above an average 24ppn, with the exception of C85 in July (32.2ppn) and C87 in June (29.6ppn).

4.6.5 The lowest activity levels across the Survey Area were recorded at location C88, with an average of 2.5ppn across the deployment period. Activity levels throughout the deployment period were consistently low and activity levels were not recorded above an average 3ppn.

4.6.6 *Myotis* species activity at the remaining locations across the Survey Area was an average 6.4ppn (C84), 4.6ppn (C83) and 6.6ppn (C90) across the deployment period. Overall, these locations did not record above an average 10.4ppn.

4.7 *Nyctalus S*pecies (noctule, Leisler's bat and unidentified Nyctalus species)

4.7.1 *Nyctalus* species activity across the deployment period at all locations within the Survey Area was an average of 18.6ppn, with a peak of activity in June recording an average 25.7ppn. Activity levels remained high in July and August which recorded an average of 21.3ppn and 21.4ppn respectively. Activity levels were noticeably lower in May with an average of 6.5ppn.

4.7.2 The graph showing average *Nyctalus* species ppn per location is shown on Figure 4.11 and the graph showing average *Nyctalus* species ppn per location per month is shown on Figure 4.12.

Figure 4.11 – Average passes per night for *Nyctalus* species per location

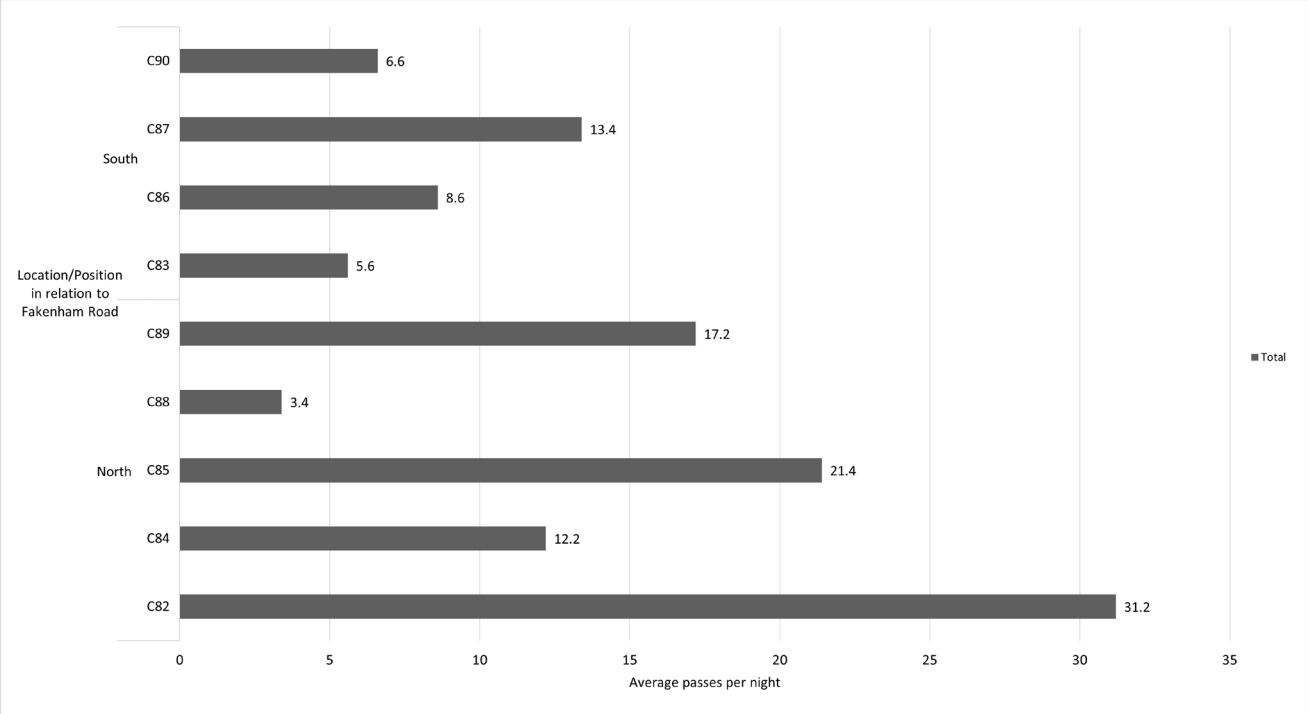
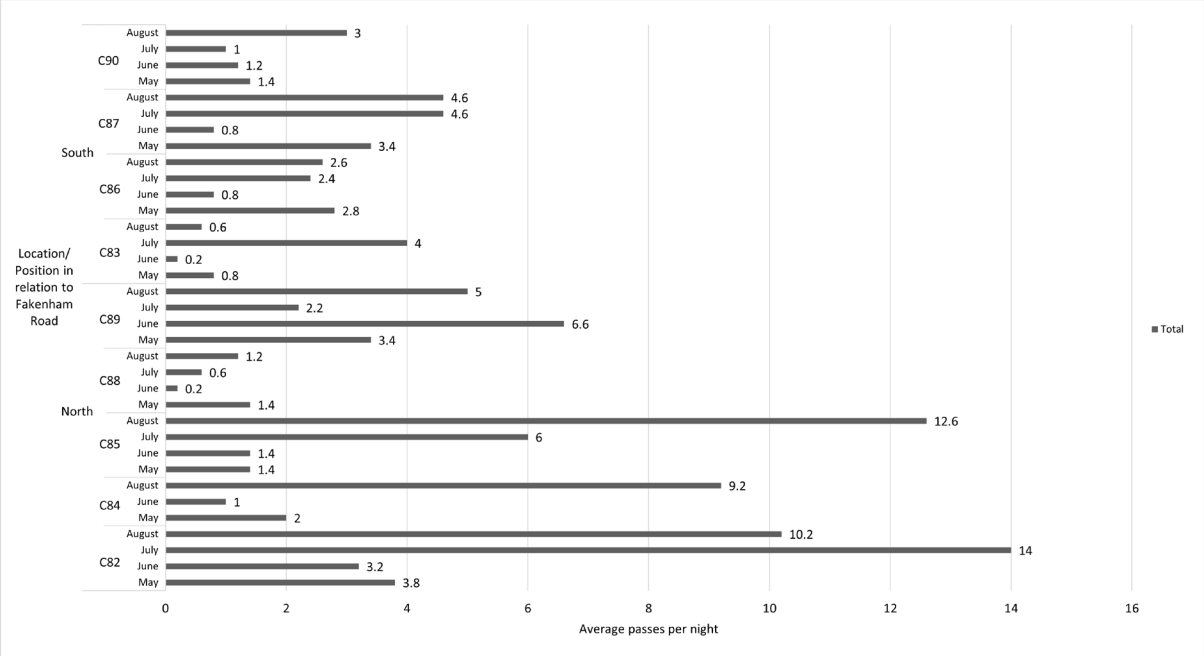


Figure 4.12 – Average passes per night for *Nyctalus* species per location per month



4.7.3 The highest level of activity across the Survey Area was recorded at location C82, with an average 38.2ppn across the deployment period. The peak activity was recorded in June, recording an average 69.4ppn. Although noticeably less, July and August still recorded high levels of activity, with an average 41ppn and 33.4ppn recorded respectively. Activity in May was noticeably lower than the other months of the deployment period, only recording an average 8.8ppn.

4.7.4 The next highest level of activity recorded across the Survey Area was recorded at location C85, which recorded similar activity levels to location C82, with an average 35.9ppn across the deployment period. The peak activity was recorded in July, with an average 54ppn. June and August also recorded high levels of activity, with an average 42.2ppn and 40.8ppn respectively. Similarly, to location C82, activity in May was noticeably lower than the other months of the deployment period, only recording an average 6.6ppn.

4.7.5 The lowest activity level across the Survey Area was recorded at location C83, with an average 6.0ppn across the deployment period. The peak activity

was recorded in June, recording an average 10.8ppn and the remaining months ranged from 1ppn in August to 8.6ppn in July.

4.7.6 *Nyctalus* species activity at the remaining locations across the Survey Area was an average 16.4ppn (C84), 12.3ppn (C88), 17ppn (C89), 12.2ppn (C86), 17.6ppn (C87), 11.8ppn (C90) across the deployment period. Overall, the activity in these locations ranged from 25.8ppn to 4.2ppn, with the exception of C89 in June recording a peak of 30.8ppn.

4.8 Brown Long-Eared Bat

4.8.1 Brown long-eared bat activity across the deployment period at all locations within the Survey Area was an average of 6.7ppn, with a peak of activity in August recording an average of 9.6ppn. Similar activity levels were also recorded in July, with an average of 7.1ppn. Activity was slightly lower in May and June, recording an average of 4.6ppn and 5.6ppn, respectively.

4.8.2 The graph showing average brown long-eared bat ppn per location is shown on Figure 4.13 and the graph showing average brown long-eared bat ppn per location per month is shown on Figure 4.14.

Figure 4.13 - Average passes per night for brown long-eared bat species per location

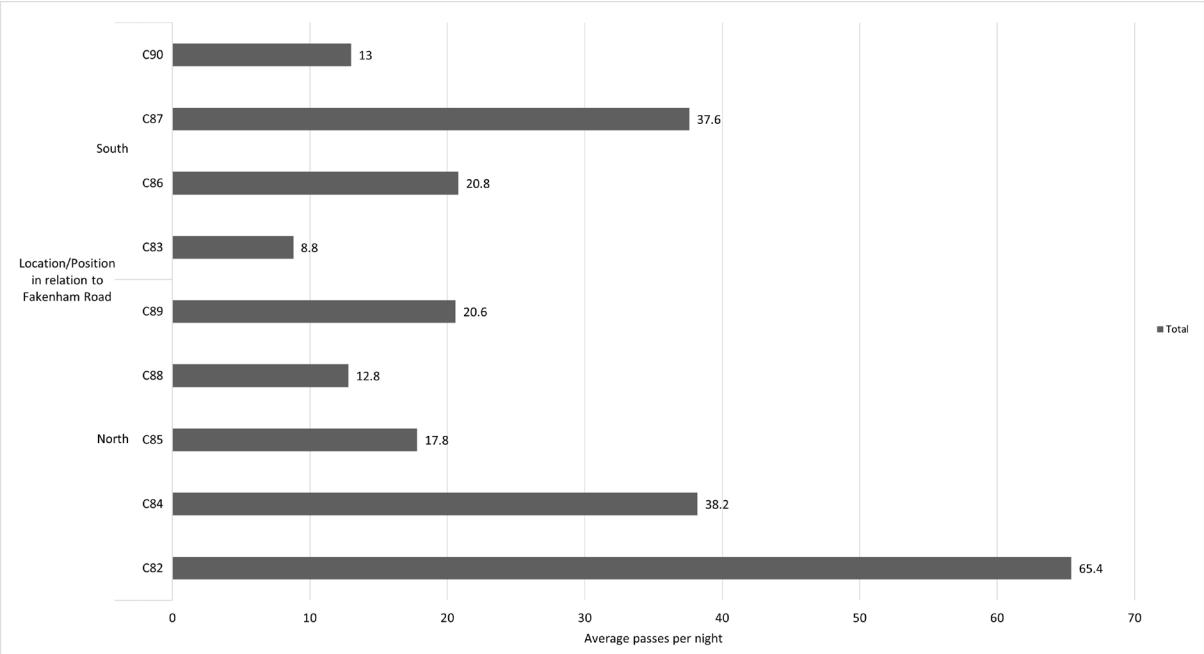
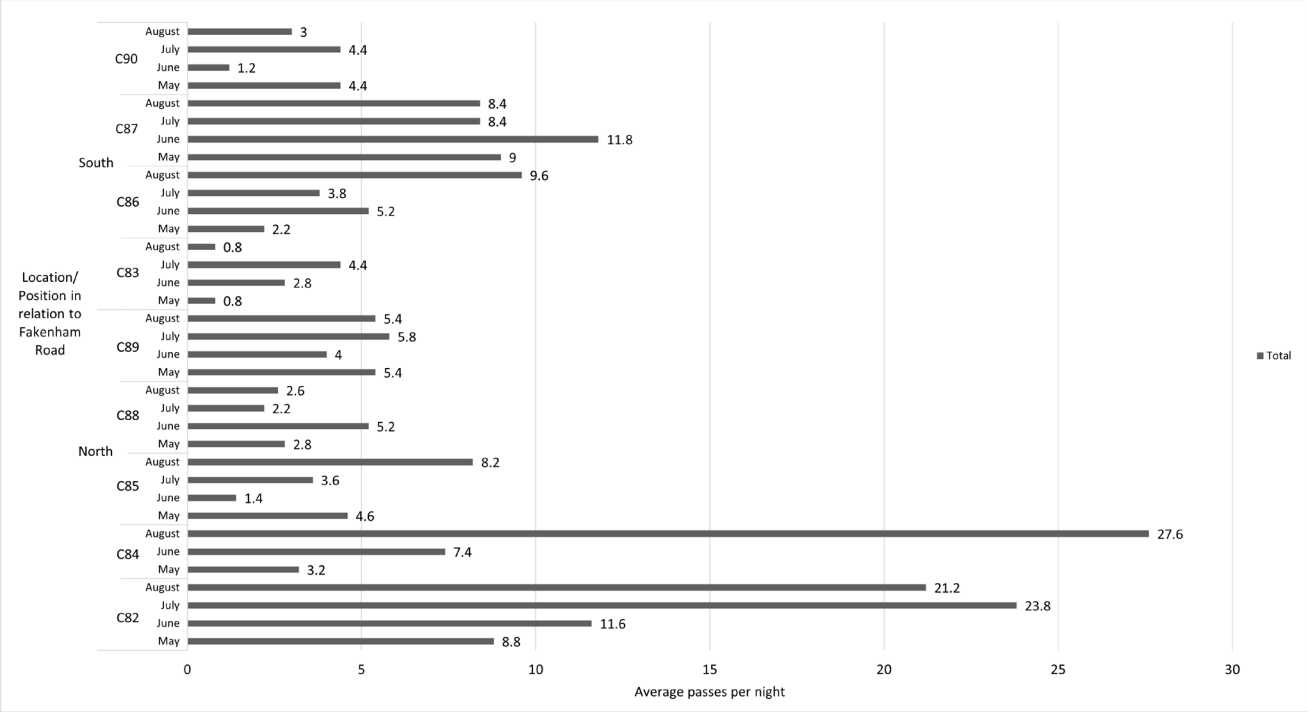


Figure 4.14 - Average passes per night for brown long-eared bat species per location per month



4.8.3 The highest activity level across the Survey Area was recorded at location C82, with an average 16.4ppn across the deployment period. The peak activity was recorded in July, recording an average 23.8ppn. In August, the level of activity remained high at an average 21.2ppn, whereas in May and June the activity recorded was noticeably lower, with 8.8ppn and 11.6ppn recorded respectively.

4.8.4 The next highest activity levels across the Survey Area were recorded at location C84, which recorded similar activity levels to location C82, with an average 12.7ppn across the deployment period. The peak activity was recorded in August, recording an average 27.6ppn, which was also the highest monthly activity out of all the locations. The remaining months recorded noticeably lower levels of activity, with May only recording an average 3.2ppn and June only 7.4ppn.

4.8.5 The activity level at location C87 was also higher than the majority of the other locations, with an average 9.4ppn across the deployment period. Peak activity was recorded in July, recording an average 11.8ppn. The remaining months

recorded fairly consistent activity, ranging from an average 9ppn in May to 8.4ppn in both July and August.

4.8.6 Brown long-eared bat activity at the remaining locations across the Survey Area was an average of 4.5ppn (C85), 3.2ppn (C88), 5.2ppn (C89), 2.2ppn (C83), 5.2ppn (C86) and 3.3ppn (C90) across the deployment period. Overall, these locations did not record above an average 6.0ppn, with the exception of location C85 in August recording an average 8.2ppn and location C86 recording 9.6ppn in August.

4.9 Serotine

4.9.1 Serotine activity across the deployment at all locations within the Survey area was an average of 1.8ppn. All months recorded similar low average activity levels, varying between an average of 2.1ppn in May to 1.2ppn in July.

4.9.2 The graph showing average serotine ppn per location are shown on Figure 4.15 and the graph showing average serotine ppn per location per month are shown on Figure 4.16.

Figure 4.15 – Average passes per night for serotine species per location

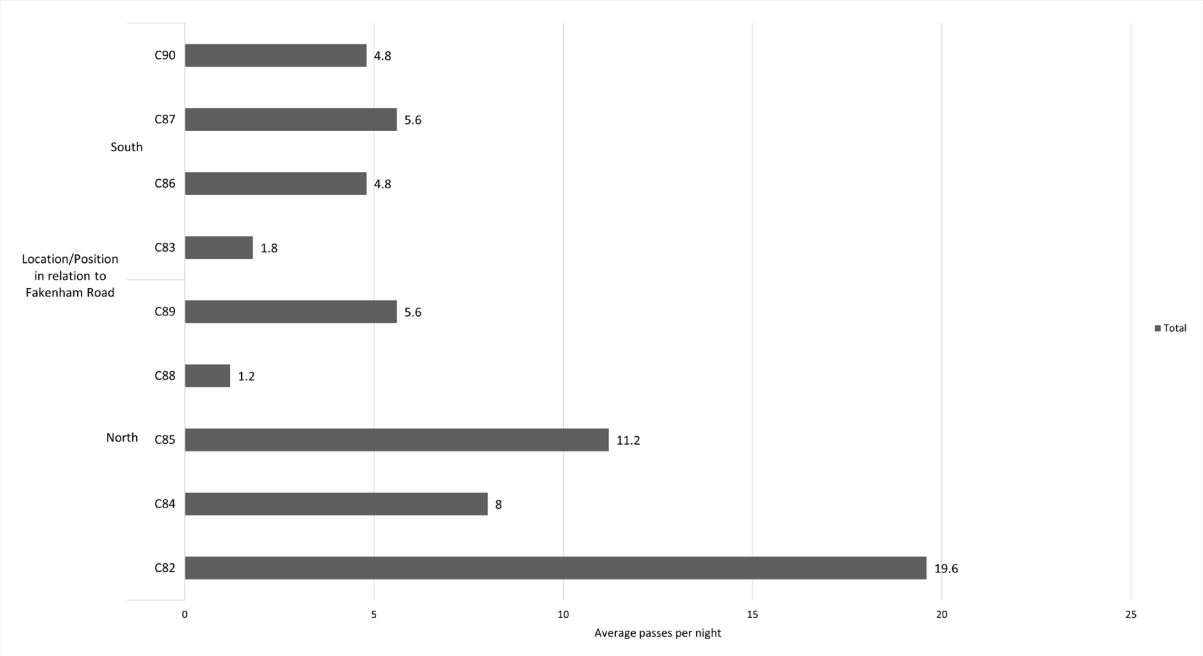
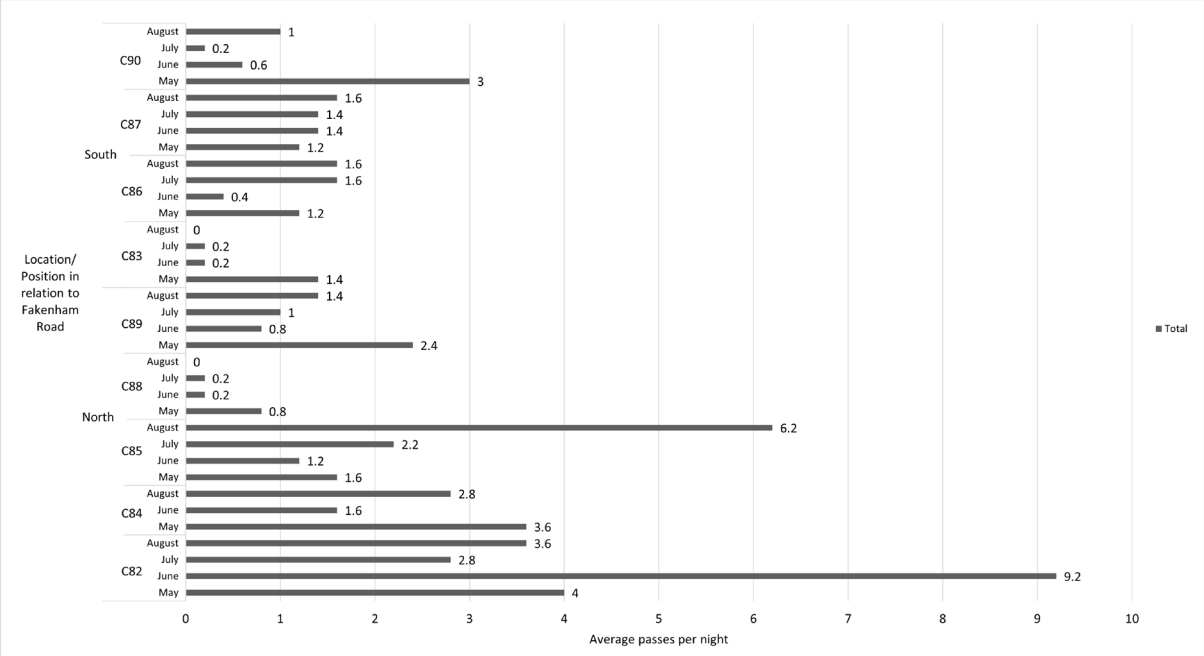


Figure 4.16 – Average passes per night for serotine species per location per month



4.9.3 The highest activity level across the Survey Area was recorded at location C82, with an average 4.9ppn across the deployment. The peak activity was recorded in June, recording an average 9.2ppn. Activity over the remaining months of the deployment period was noticeably lower and ranged from 2.8ppn in July to 4ppn in May.

4.9.4 Serotine activity at the remaining locations across the Survey Area was generally relatively low. The remaining locations did not record any activity exceeding an average 3.6ppn in any given month, with the exception of C85 in August recording an average 6.2ppn.

5 Bat Roost Results

5.1 Ground Level Tree Assessments

5.1.1 A total of 34 trees were identified within the Survey Area as having bat roost suitability, in addition to the previously surveyed trees. The total number of trees which fall under each category following the GLTA surveys are as follows:

- Low roosting suitability: 7 trees
- Moderate roosting suitability: 25 trees
- High roosting suitability: 2 trees

5.1.2 None of the trees surveyed were found to support roosting bats at the time of the GLTA survey.

5.1.3 The results of the GLTA surveys undertaken are presented in Appendix C, including a table of suitability results and survey dates (Table C.1) and drawings showing the location of the trees (Figure C-1).

5.2 Further Survey

5.2.1 Of the 27 trees subject to further surveys, 24 were subject to aerial and ground level inspection and one was subject to dusk emergence surveys. A further two trees were subject to a combination of aerial inspections and dusk emergence and/or dawn re-entry surveys.

5.2.2 An additional two trees with bat roost suitability were discovered during the aerial inspections which were recommended for further survey and subject to aerial inspections.

Aerial and Ground Level Inspection Surveys

5.2.3 No roosts or evidence of bats were identified during the aerial surveys.

5.2.4 Of the 28 trees subject to aerial and ground inspection surveys in 2022; 16 trees were downgraded in suitability and two trees were upgraded in suitability. The suitability of the remaining ten trees remained the same after further survey was undertaken. A summary of the reclassified trees is provided in Table C-1 in Appendix C.

Emergence Re-Entry Surveys

5.2.5 No roosts were identified during these surveys.

Final bat roost suitability

5.2.6 Of the 36 trees suitable to support bat roosts in the Survey Area, the number of trees which fall under each category following further surveys are as follows:

- Negligible roosting suitability: 7 trees;
- Low roosting suitability: 16 trees;
- Moderate roosting suitability: 8 trees;
- High roosting suitability: 5 trees.

5.2.7 The final bat roost suitability of all trees is shown Table C.1, in Appendix C.

5.3 Roosting Summary

5.3.1 A summary of GLTA and further survey results of all trees is shown in Table 5.1 below.

Table 5.1 – Summary of GLTA and further survey results

Tree reference	GLTA suitability	Aerial survey results	Dusk/dawn survey results	Final suitability
438	High	No evidence of bats and remained high suitability	N/A	High
439	Moderate	No evidence of bats and remained moderate suitability	N/A	Moderate
440	Low	No evidence of bats and remained low suitability	N/A	Low
441	Moderate	No evidence of bats and downgraded to low suitability	N/A	Low
442	Moderate	No evidence of bats and remained moderate suitability	N/A	Moderate
443	Moderate	No evidence of bats and upgraded to high suitability	N/A	High
444	Moderate	No evidence of bats and remained moderate suitability	N/A	Moderate
445	Moderate	No evidence of bats and downgraded to low suitability	N/A	Low
446	Moderate	No evidence of bats and downgraded to low suitability	N/A	Low
447	Moderate	No evidence of bats and downgraded to negligible suitability	N/A	Negligible
448	Moderate	No evidence of bats and downgraded to negligible suitability	N/A	Negligible
449	Moderate	No evidence of bats and remained moderate suitability	N/A	Moderate
450	Moderate	No evidence of bats and downgraded to negligible suitability	N/A	Negligible
451	Moderate	No evidence of bats and downgraded to negligible suitability	N/A	Negligible
452	Moderate	No evidence of bats and upgraded to high suitability	N/A	High
453	Low	No evidence of bats and remained low suitability	N/A	Low
454	Moderate	No evidence of bats and downgraded to low suitability	N/A	Low
455	Moderate	No evidence of bats and downgraded to low suitability	N/A	Low
456	Moderate	No evidence of bats and downgraded to low suitability	N/A	Low
457	Moderate	Not safe to climb	No emergence	Moderate

Tree reference	GLTA suitability	Aerial survey results	Dusk/dawn survey results	Final suitability
458	Moderate	No evidence of bats and downgraded to negligible suitability	N/A	Negligible
459	Low	No evidence of bats and remained low suitability	N/A	Low
460	Moderate	No evidence of bats and downgraded to low suitability	N/A	Low
461	Moderate	No evidence of bats and downgraded to negligible suitability	N/A	Negligible
462	Moderate	No evidence of bats and downgraded to negligible suitability	N/A	Negligible
463	Moderate	No evidence of bats and downgraded to low suitability	N/A	Low
464	Moderate	No evidence of bats and remained moderate suitability	N/A	Moderate
465	High	No evidence of bats and remained high suitability	N/A	High
466	Low	No evidence of bats and remained low suitability	N/A	Low
467	Low	No evidence of bats and remained low suitability	N/A	Low
468	Low	No evidence of bats and remained low suitability	N/A	Low
469	Low	No evidence of bats and remained low suitability	N/A	Low
470	Moderate	No evidence of bats and upgraded to high suitability	No emergence	High
471	Moderate	No evidence of bats and downgraded to low suitability	No emergence	Low
472	N/A	No evidence of bats and moderate suitability	N/A	Moderate
473	N/A	No evidence of bats and moderate suitability	N/A	Moderate

5.4 Incidental Records

5.4.1 Bats were incidentally recorded emerging from Tree 300 during the VP12 survey undertaken on 10 August 2022. A total of 35+ soprano pipistrelle were observed emerging from Tree 300 then commuting south across the A1067 at 10 to 1m. A soprano pipistrelle maternity roost was confirmed.

5.4.2 The location of Tree 300 is shown in Figure C-1. Although Tree 300 is not within the 2022 Survey Area, it was within the previous Survey Area and an emergence had not previously been observed.

6 References

6.1 Project References

- WSP UK Ltd. (2022a) Bat Activity Report 2021. Cambridge.
- WSP UK Ltd. (2022b) Bat Radio Tracking Report 2021. Cambridge
- WSP UK Ltd. (2022c) Bat Roost Survey Report 2021. Cambridge.
- WSP UK Ltd. (2021) Interim Bat Survey Report. Cambridge.
- Norwich Western Link Update Minutes of cabinet meeting 4th July 2022

6.2 Technical References

- Berthinussen, A., & Altringham, J. (2015). Development Of A Cost Effective Method For Monitoring The Effectiveness Of Mitigation For Bats Crossing Linear Transport Infrastructure. *University of Leeds/DEFRA*.
- Brabant, R., Laurent, Y., Dolap, U., Degraer, S., & Poerink, B. J. (2018). Comparing the results of four widely used automated bat identification software programs to identify nine bat species in coastal Western Europe. *Belgian Journal of Zoology*, 148(2): 119-128.
- CIEEM. (2019). *Advice Note on the Lifespan of Ecological Reports and Surveys.* Hampshire: Chartered Institute of Ecology and Environmental Management.
- Collins, J. (2016). *Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd edn).* London: Bat Conservation Trust.

- Collins, J. (2016). *Bat Surveys for Professional Ecologists:Good Practice Guidlines (3rd edn).* London: Bat Conservation Trust.
- JNCC. (2018). *European Community Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora (92/43/EEC) (4th edition) S1329 – Grey long-eared bat (Plecotus austriacus).* Peterborough: Joint Nature Conservation Committee.
- Russ, J. (2012). *British Bat Calls: A Guide to Species Identification.* Pelagic Publishing.