
Kirkby Valley Golf Club

Bat Transect & Automated Survey Report

Compiled by Ecology Services Ltd.

on behalf of

L32 Trading Ltd.

January 2020 (updated January 2021 and August 2021)



1 Church Row Chambers
Longton
Preston
Lancashire
PR4 5PN

Ref. number: 19051
Written by: CW
Checked: SO'N/SB
Approved: SB

tel: 01772 614932
fax: 01772 614930
email: info@ecologyservices.co.uk
web: www.ecologyservices.co.uk

Contents

1.0	Introduction	2
2.0	Planning Policy and Legislation	3
3.0	Methodology	4
4.0	Results and Evaluation	8
5.0	Impact Assessment	23
6.0	Conclusion	27
7.0	References	28

Tables

Table 1: Ecological Desktop Study Results and Record Centres Consulted

Table 2: Guidelines on the number of bat activity surveys recommended to achieve a reasonable survey effort in relation to habitat suitability (Table 8.3)

Table 3: Bat recordings per transect & point count.

Table 4: Summary of the transect activity surveys, see Figures 3-14 for result summaries.

Table 5: Status of bat species. Detail of conservation status at a local, county and regional level.

Table 6: Foraging habitat preferences & foraging strategies of different UK species (taken from BCT (2016) 3rd edition).

Figures

Figure 1: Transect Survey 1 – Transect Route, Listening Points and Automated Detector Location Plan

Figure 2: Transect Surveys 2-12 – Transect Route, Listening Points and Automated Detector Location Plan

Figure 3: Transect Survey 1 – Results Summary Plan

Figure 4: Transect Survey 2 – Results Summary Plan

Figure 5: Transect Survey 3 – Results Summary Plan

Figure 6: Transect Survey 4 – Results Summary Plan

Figure 7: Transect Survey 5 – Results Summary Plan

Figure 8: Transect Survey 6 – Results Summary Plan

Figure 9: Transect Survey 7 – Results Summary Plan

Figure 10: Transect Survey 8 – Results Summary Plan

Figure 11: Transect Survey 9 – Results Summary Plan

Figure 12: Transect Survey 10 – Results Summary Plan

Figure 13: Transect Survey 12 – Results Summary Plan

Figure 14: All Transect Surveys Combined – Results Summary Plan

Figure 15a: Automated Survey Period 1 – All species recordings per night

Figure 15b: Automated Survey Period 1- Species' recordings per night

Figure 16: Automated Survey Period 1 – Total recordings per hour

Figure 17a: Automated Survey Period 2 – All species recordings per night

Figure 17b: Automated Survey Period 2- Species' recordings per night

Figure 18: Automated Survey Period 2 – Total recordings per hour

Figure 19a: Automated Survey Period 3 – All species recordings per night

Figure 19b: Automated Survey Period 3- Species' recordings per night

Figure 20: Automated Survey Period 3 – Total recordings per hour

Figure 21a: Automated Survey Period 4 – All species recordings per night

Figure 21b: Automated Survey Period 4- Species' recordings per night

Figure 22: Automated Survey Period 4 – Total recordings per hour

Figure 23a: Automated Survey Period 5 – All species recordings per night

Figure 23b: Automated Survey Period 5- Species' recordings per night

Figure 24: Automated Survey Period 5 – Total recordings per hour

Figure 25a: Automated Survey Period 6 – All species recordings per night

Figure 25b: Automated Survey Period 6- Species' recordings per night

Figure 26: Automated Survey Period 6 – Total recordings per hour

Appendices

Appendix 1: Guidelines for assessing the potential suitability of proposed development sites for bats.

Appendix 2: Artificial bat roost provision.

1.0 Introduction

1.1 Ecology Services Ltd was commissioned by L32 Trading Ltd. in May 2019 to undertake bat habitat activity surveys of Kirkby Valley Golf Club, L32 4SS, hereinafter referred to as 'the site'. The centre of the site is located by National Grid Reference (NGR) 339582, 397944. The location and boundary of the site are shown on Figure 1.

1.2 The southern part of the site was subject to a walk over in August 2020 and the northern part in January 2021 by Ecology Services Limited. Habitats within the southern part of the site remain largely unchanged, however, works have been undertaken within the northern part of the site, mainly to the west of the R. Alt which has resulted in the loss of trees, tall ruderal and dense scrub habitats. While there have been changes in the northern part of the site, these have resulted in a reduction, not increase or improvement of potential foraging habitat. If anything, there may have been a reduction in bat activity in parts of the site. Therefore, the results of the 2019 bat habitat activity surveys are considered to remain representative of bat activity within the site. While the surveys based on the proposals at the time, did not cover the north eastern part of the site, habitats present within that area are similar to those elsewhere within the golf course and it is anticipated that there would be similar use of that part of the site as observed within the remainder of the golf course.

Site Description

1.3 The site includes sections of Kirkby Valley Golf Club containing amenity grassland, scattered trees and waterbodies to the north, east and west, plus an area of disused land containing unmanaged grassland, hedgerows and scrub with scattered trees to the south. The River Alt dissects the site. Overall, the site is bound by the A506 Valley Road to the south and B5194 Aintree Lane to the west, the M57 to the east and the Fazakerley Junction railway line to the north.

Proposals

1.4 Four parcels of land within the site, collectively referred to as the 'development area', are proposed for (re)development as shown on Figure 2 including:

- Reconfiguration and other improvement works across the entire golf course including the reshaping of tees / greens / bunkers and erection of a footbridge over the River Alt to provide both an improved 18 hole course and a new 9 hole course.
- New and improved irrigation / drainage works (including irrigation lake), extensive tree and shrub planting, and ecological mitigation measures across the course.
- The erection of a new 2 storey Clubhouse;
- Retention, alteration and extension of the existing clubhouse and its change of use to form a golf-related / grounds maintenance training academy (existing access and car park retained / unchanged).
- A new greenkeeper's compound with associated building and security fencing.
- Provision of an adventure golf course and practice putting green; and provision of a golf driving range with an associated 2 storey building and external lighting and safety netting.
- 6 synthetic outdoor 5-a-side football pitches, 5 synthetic outdoor tennis courts, 1 external bowling green with associated timber players' hut plus associated lighting and means of enclosure.
- Car and cycle parking spaces to serve all of the above facilities with two new vehicular accesses created onto Valley Road.
- Formation of a new gated access via Aintree Lane for the use of construction traffic and (upon completion of development works) for the sole use of course operatives for the purposes of course management / maintenance.

- 1.5 Two lakes are also proposed to assist with course irrigation and ecological mitigation at the site.

Background

- 1.6 An ecological appraisal of the site, undertaken in May 2019 by Ecology Services Ltd. identified the potential for the proposed development to affect suitable foraging and commuting habitat for bats within the site. In order to advise appropriate avoidance, mitigation and compensation measures, bat habitat activity surveys in the form of transect and automated detector surveys were recommended.
- 1.7 This report details the findings of the bat habitat activity surveys carried out to inform an assessment of the importance of habitats within the site for foraging and commuting bats.
- 1.8 The bat habitat activity surveys are undertaken in the form of walked transect surveys and automated static detector surveys, which aim to observe:
- The assemblages of bat species using the site;
 - The relative frequency with which the site is used by different bat species;
 - The locations and distribution of activity for different species within the site;
 - The nature of activity for different bat species, i.e. foraging, commuting etc.
- 1.9 The results from the habitat activity surveys detailed in this report will be used to inform any mitigation and or compensation requirements with regard to the proposed development works affecting habitats within the site.

2.0 Planning Policy and Legislation

- 2.1 This section provides a brief overview of planning policy and legislation relevant to bats in the UK. Further information is provided in Appendix 1.

Planning Policy

- 2.2 The National Planning Policy Framework (NPPF, July 2021) places a clear responsibility on Local Planning Authorities (LPAs) to contribute to conserving and protecting the natural and local environment. LPAs should promote the conservation, restoration and enhancement of priority habitats, ecological networks and the protection and recovery of priority species (e.g. Species of Principal importance, Local Biodiversity Action Plan species); and identify and pursue opportunities for securing measurable net gains for biodiversity. In accordance with the NPPF, local planning policy and guidance, development proposals should seek to maintain and enhance opportunities for bats at the site.
- 2.3 Protected species within the UK, such as bats, are a 'material consideration' in the determination of a planning application. Therefore, an LPA is unlikely to determine an application until all relevant information relating to protected species or habitats is submitted to fully inform the application. Relevant information includes adequate surveys and, where required, mitigation strategies, which will need to be submitted to inform a planning application.
- 2.4 The local planning authority (LPA) has a duty to ensure that protected and priority species (e.g. Species of Principal Importance, Biodiversity Action Plan species) are fully considered in a planning decision. Therefore, up to date survey information and, where required, mitigation strategies adequate to assess the impacts of the proposals and to demonstrate that opportunities for species using the site can be maintained, must be provided in support of a planning application.

Legislation

- 2.5 All bats and their roosts receive strict protection under the Wildlife & Countryside Act 1981 (as amended) and the Conservation of Habitats & Species Regulations 2017 (as amended)¹, which implements the EC Habitats Directive in the UK. In brief, this legislation makes it an offence to: kill, injure or capture a bat; to destroy, damage or obstruct access to a bat roost; or to disturb a bat occupying a roost. A Local Authority is a 'competent authority' within the context of Regulation 7 of the Conservation of Habitats & Species Regulations 2017 (as amended) when dealing with planning applications where a European Protected Species (EPS) (all bat species) may be affected. Therefore, planning decisions should only be made when European Protected Species and their habitats are fully taken into account.
- 2.6 Where proposed works are likely to contravene the legislation protecting bats, a Natural England licence must be applied for, and approved, before works can proceed.
- 2.7 Section 40 of the Natural Environmental and Rural Communities (NERC) Act 2006 places a statutory duty on public authorities, in exercising their functions, to conserve biodiversity in England. Species of Principal Importance for the conservation of biodiversity in England, identified by the Secretary of State in consultation with Natural England, are listed Section 41 of the NERC Act. The Local Planning Authority and government bodies (e.g. Natural England) will expect the overall design of the development to have regard for the conservation of these species. Seven bat species are listed as 'Species of Principal Importance' under Section 41 of the Natural Environmental and Rural Communities (NERC) Act 2006:
- Noctule (*Nyctalus noctula*)
 - Soprano pipistrelle (*Pipistrellus pygmaeus*)
 - Lesser horseshoe (*Rhinolophus hipposideros*)
 - Greater horseshoe (*Rhinolophus ferrumequinum*)
 - Barbastelle (*Barbastella barbastellus*)
 - Bechstein's (*Myotis bechsteinii*)
 - Brown long-eared (*Plecotus auritus*)

3.0 Methodology

Ecological Desktop Study

- 3.1 Ecological data and historic record searches were undertaken, up to 2km from the site, by contacting the following sources; listed in Table 1 below.

Table 1: Ecological Desktop Study Results and Record Centres Consulted

Source of information	Information supplied
North Merseyside Local Biodiversity Action Plan (NMBAP)	Identification of LBAP species and habitats known to occur in the region.
Multi Agency Geographical Information Centre (MAGIC)	To identify any statutory protected nature conservation sites with bats qualifying as criteria for their designation within 5km of the site.
Merseyside Biobank	To identify locally protected sites and records of protected and notable species within 2km of the site.
Natural Environment and Rural Communities (NERC) Act 2006	Review of Species of Principal Importance known to occur in the region.

¹ The Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019 continue the same provision for European protected species, licensing requirements and protected areas after Brexit.

- 3.2 The desktop study was undertaken on 15th January 2021. As part of the desktop study, a review of habitats was completed using on line aerial mapping.

Habitat Activity Survey Methodology

- 3.3 In order to understand how bats may be using the site, walked transect surveys and automated surveys were undertaken following standard methodologies set out in the Bat Conservation Trust's Bat Surveys for Professional Ecologists: Good Practice Guidelines (2016).
- 3.4 The site was classified in line with 'Guidelines for assessing the potential suitability of proposed development sites for bats, based on the presence of habitat features within the landscape, to be applied using professional judgement' (see Appendix 1: Table 4.1).

The Bat Conservation Trust's, Bat Surveys for Professional Ecologists: Good Practice Guidelines (2016) sets out guidance in relation to the number of surveys recommended in relation to the potential habitat suitability, as shown in Table 2 below.

Table 2: 'Guidelines on the number of bat activity surveys recommended to achieve a reasonable survey effort in relation to habitat suitability' (Table 8.3).

Survey Type	Low suitability habitat for bats ^a	Moderate suitability habitat for bats	High suitability habitat for bats
Transect/spot count/timed search surveys	One survey visit ^b per season (spring - April/May, summer - June/July/August, autumn - September/October) ^c in appropriate weather conditions for bats Further surveys may be required if these survey visits reveal higher levels of bat activity than predicted by habitat.	One survey visit ^b per month (April to October) ^c in appropriate weather conditions for bats. At least one of the surveys should comprise dusk and pre-dawn (or dusk to dawn) within one 24-hour period.	Up to two survey visits ^b per month (April to October) ^c in appropriate weather conditions for bats. At least one of the surveys should comprise dusk and pre-dawn (or dusk to dawn) within one 24-hour period.
AND			
Automated/static bat detectors surveys ^d	One location per transect, data to be collected on five consecutive nights per season (spring - April/May, summer - June/July/August, Autumn - September/October) in appropriate weather conditions for bats.	Two locations per transect, data to be collected on five consecutive nights per month (April to October) in appropriate weather conditions for bats.	Three locations per transect, data to be collected on five consecutive nights per month (April to October) in appropriate weather conditions for bats.

^a If the habitat has been classified as having low suitability for bats, an ecologist should make a professional judgement on how to proceed based on all of the evidence available. It may or may not be appropriate or bat activity surveys to be carried out in low suitability habitats. However, caution should be exercised in fringe areas where 'low suitability habitat for bats' may be extremely important to local bat populations due to the relative scarcity of better habitats. In such situation, bats are likely to also be more widely dispersed and may use a larger number of sites, therefore survey effort may actually need to be increased to detect use on the proposed site in question.

^b A survey visits should aim to cover all habitats represented in the survey are that could be impacted by the proposed activities. This may consist of a single transect carried out on a single night for small sites (e.g. small housing developments) with low habitat diversity but could range up to multiple transects carried out over one or several nights (depending on number of ecologists) on a larger site (e.g. Road schemes) with greater habitat diversity.

^c April, September and October surveys are both weather - and location-dependent. Conditions may become more unsuitable on these months, particularly in Scotland, which may reduce the length of the survey season.

^d Detector locations should be assigned to cover all habitats represented in the survey area that could be impacted by the proposed activities. This could mean a single detector location at a small site with only one habitat represented but could range to many detector locations on larger sites. Automated/static surveys are particularly useful when assessing collision risk, e.g. Detectors can be placed at crossing points on proposed roads or railways.

Note: Multiple survey visits should be separated by at least two weeks, preferably longer, to observed temporal changes in activity.

- 3.5 In general terms, the site comprises an unmanaged field of rough grassland with dense scrub hedgerows and scattered trees to the south, the golf club to the north, east and west containing amenity grassland with scattered trees and waterbodies and the River Alt running through the eastern areas of the site. The site is bordered by the A506 Valley Road to the south, M57 to the east, the B5194 Aintree Lane to the west and a railway line to the north.
- 3.6 Overall the site provides a mix of habitats for bat species when considering the lower suitability amenity grassland areas within the golf course compared to the higher quality habitats of rough grassland, hedgerows and scattered trees and the River Alt. The site may also provide links between other areas of higher quality habitat wider survey area. In combination, the habitats within the site are considered to provide 'high' quality habitat for foraging and commuting bats.

Transect Surveys

- 3.7 Twelve transect survey visits have been undertaken, two each month between May and October 2019 inclusive. The surveys consisted of walked transect surveys with a series of static listening points and were conducted by two surveyors at any one time. The recommended time and duration of walked transect surveys is to start at sunset and end between 2 to 3 hours after sunset (for dusk surveys) or to start 2 hours before sunrise and end at sunrise (for dawn surveys).
- 3.8 The walked transect surveys were aided with the use of heterodyne and frequency division bat detectors with calls recorded using AnaBat SD2 detectors. The transects were walked at a constant speed where possible; regular listening point (LP) counts were undertaken for a period of 3 minutes each along the route to record the number of passes, activity and species of bats. Bat passes were also recorded on the transit between the static point counts. The recorded echolocation calls were then analysed with computer software (AnaLookW) to verify the field results.

Automated Surveys

- 3.9 Automated surveys were designed following the Bat Conservation Trust's (BCT, 2016) guidance.
- 3.10 Automated surveys to record bat echolocation calls were undertaken at three locations within the site; one on a tree within the unmanaged field in the south west of the site; one on a tree adjacent to the River Alt; and one on a tree within the golf course (see Figure 1 for the automated detector locations). The automated detectors were deployed six times for a minimum of five consecutive nights at each location during each month between May and October 2019 inclusive.
- 3.11 Automated detectors deployed comprised of AnaBat Express and AnaBat Swift detectors for all six periods. The zero crossing recordings from the AnaBat Express detector were analysed using AnaLookW and AnaBat Insight software.
- 3.12 Both transect and automated surveys provide a record of activity within the site for those specific periods and locations.

- 3.13 The frequency that bats are encountered during activity surveys depend upon several factors, including:
- Number of roosts within or in close proximity to the site and the number of individuals in the roost;
 - The quality of foraging habitat within site and its surrounds and the distance at which it is located from a roost;
 - The quantity and diversity of invertebrates; and
 - The extent of the survey, in terms of distance for transect surveys and duration in terms of automated surveys.

Habitat Assessment

- 3.14 In addition to the bat habitat activity surveys, a detailed habitat appraisal has been undertaken bringing together the survey results, the habitats assessment and considering the specific requirements of each bat species recorded. The assessment has been based upon experience and knowledge of the species identified at the site.

Timing

Transects

- 3.15 A total of twelve walked transect surveys have been undertaken to date at the site between May and October 2019 inclusive. The survey visits were undertaken on the; 20th and 30th May; 10th and 24th June; 12th and 23rd July; 8th and 26th August; 11th and 25th September and the 8th and 23rd October 2019.
- 3.16 Ten transect surveys were undertaken at dusk, starting at sunset and finishing up to three hours after sunset. Two transect surveys were undertaken at dawn, starting between 3 hours and 2 and a half hours before sunrise and finishing at sunrise.

Automated Surveys

- 3.17 A total of six automated surveys have been undertaken at the site, each with three detectors being deployed for a minimum of five consecutive nights each month between May and October 2019 inclusive. The surveys were conducted on the following dates; 16th to 21st May, 24th to 30th June, 24th to 31st July, 27th August to the 2nd September, 25th September to 1st October and 23rd to 29th October.
- 3.18 During the nights in each period, weather suitable for recording bat activity generally prevailed (no heavy rain, no strong winds and temperatures at sunset >9°C). For any periods where the weather was not considered suitable the static detectors were deployed for longer than the recommended 5 nights.
- 3.19 The Anabat Express detectors were set to the 'night only' recording mode. This recording mode will automatically turn on the detector 30 minutes before sunset and off 30 minutes after sunrise on each night. This recording mode determines the correct sunset and sunrise times using the inbuilt GPS.

Personnel

- 3.20 The walked transect surveys were completed by two surveyors on each visit for safety reasons. The transect surveys were conducted by: senior consultant ecologist Mr. S. Booth who holds a Natural England Bat Class Licence (Level 2) (Registration number 2016-27296-CLS-CLS); Senior Consultant Ecologist Ms. L. Redgrave, experienced consultant ecologists Mr. A. Leishman who holds a Natural England Bat Class Licence (Level 2) (Registration number 2017-29436-CLS-CLS), Mr. C. Smith, Mr. M. Barnes, Mr. B. Meadows, Miss. C. Wood and Miss. N. Burdin. All surveyors are experienced at undertaking bat habitat and activity surveys.

- 3.21 Analysis of bat calls was undertaken by consultant ecologists Mr. B. Meadows and Miss. C. Wood and senior consultant ecologist Mrs S. O'Neill who holds a Natural England Bat Class Licence (Level 2) (Registration number 2015-13768-CLS-CLS).

Constraints

- 3.22 The habitat activity surveys provide a snapshot of habitat usage at the time that each visit was undertaken and the habitats present may be used by bats species for different purposes at different times of the year.
- 3.23 The BCT Bat Surveys for Professional Ecologists: Good Practice Guidelines (2016) requires surveys for sites classed as containing high habitats to have two survey visits per month between April and September. In view of the later instruction of the surveys, two survey visits per month were undertaken between May and October, this is not considered a significant constraint.
- 3.24 Inclement weather was recorded over some evenings of the automated survey periods. Automated detectors were left in position for further nights to ensure that five nights of optimal weather conditions were achieved. Dates in which survey data was omitted include; the dusk/ dawn of June 27th/28th, dusk of July 27th to the dawn of the 29th July, the dusk/ dawn of the 28th/ 29th August; the 28th/ 29th September and the 26th/ 27th of October. As the automated survey periods were extended to enable five optimal survey nights of data to be recorded it is not considered a constraint to the survey data collected.
- 3.25 No bats were recorded over the transect survey conducted on the 8th of October 2019. No known constraints were present. Weather conditions were suitable to undertake such a survey with no rain, a light air wind scale and temperatures ranging between 7.8°C and 10.5°C during the survey.
- 3.26 For some species, the call parameters are very similar, overlapping considerably in different environments. This is particularly the case for species in the *Myotis* genus, and therefore species in the genus have not been separated to species level. In addition, species in the *Pipistrellus* can also have similar call parameters and cannot always be distinguishable. In these cases, they were not identified to species level.
- 3.27 The call of the brown long-eared bat is very quiet which often leads to this species being under recorded by bat detectors, particularly where there are high levels of activity by louder species (e.g. *Pipistrellus* spp.). This has been considered when estimating the abundance of brown long-eared bats using the site.

4.0 Results and Evaluation

Desktop Study

Species of Principal Importance

- 4.1 Section 41 of the Natural Environmental and Rural Communities Act 2006 (NERC) lists several bat species as Species of Principal Importance, as follows:
- Noctule (*Nyctalus noctula*)
 - Soprano pipistrelle (*Pipistrellus pygmaeus*)
 - Brown long-eared (*Plecotus auritus*)
 - Lesser horseshoe (*Rhinolophus hipposideros*)
 - Greater horseshoe (*Rhinolophus ferrumequinum*)
 - Barbastelle (*Barbastella barbastellus*)
 - Bechstein's (*Myotis bechsteinii*)

National Status

- 4.2 There are 18 species of bat that are native to the United Kingdom. Little is known about the status of most species although the available evidence suggests a general decline in populations nationally (Harris, S. et al. 1995). The commonest species of bats in the UK are the pipistrelle genus (*Pipistrellus* spp.), although these are also estimated to have declined in numbers by around 70% between 1978 and 1993.

Regional Status

- 4.3 The north-west of England appears to be a stronghold for whiskered and Brandt's bats, both of which are reasonably rare in southern England.

Local Biodiversity Action Plan

- 4.4 North Merseyside Biodiversity Action Plans (LBAP) list eight bat species as being present in North Merseyside, these are as follows:

- Brown long-eared
- Whiskered (*Myotis mystacinus*)
- Brandt's (*Myotis brandtii*)
- Daubenton's (*Myotis daubentonii*)
- Noctule
- Common pipistrelle (*Pipistrellus pipistrellus*)
- Soprano pipistrelle
- Natterer's (*Myotis nattereri*)

Local Status

- 4.5 Populations of bats in many parts of North Merseyside are comparable in size and importance to some of the best areas in the country and their size and changes are believed to mirror national trends.
- 4.6 Pipistrelle bats occur in all four of the Merseyside districts and are widely distributed in North Merseyside, being the most encountered bats roosting within built structures and foraging in urban areas.
- 4.7 Brown long-eared and noctule bats are found throughout North Merseyside but are less common.
- 4.8 The distribution of Daubenton's bat, which feeds predominantly over water, is localised with records from Sefton, Liverpool and St Helens.
- 4.9 Whiskered/Brandt's and Natterer's bats are rare locally, whiskered being recorded in Sefton and St. Helens and Natterer's only recorded in St. Helens so far.

Data Search Results

- 4.10 The data search identified 239 records of bats within approximately 2km of the site including records of common pipistrelle, soprano pipistrelle, Nathusius' pipistrelle, pipistrelle species, noctule, *Nyctalus bat species*, Natterer's, brown long-eared and unidentified bat species. The nearest records to the site were common pipistrelle and soprano pipistrelle bats recorded just to the east of the M57/A506 motorway junction, approximately 500m east of the surveyed buildings. The majority of other records provided by Merseyside Biobank pertain to a waste water treatment works located approximately 1.5km south-west of the buildings.
- 4.11 MAGIC Map identified one record of a European Protected Species Licence pertaining to common pipistrelle, dating from 2010, located approximately 1.3km to the south of the site.

Transect Survey Results

- 4.12 Table 3 below shows the total bat recordings per transect on each night and the average recordings per hour during each transect.

Table 3: Bat recordings per transect & point count.

Month	May	June	July	August	September	October
Total bat recordings per month	298	221	275	225	239	31
Total bat recordings per hour	50.22	43.05	48.10	43.69	48.12	6.39

- 4.13 During the twelve transect surveys undertaken, up to five bat species were encountered:
- Common pipistrelle – Detected during all transects.
 - Soprano pipistrelle – Detected during all transects.
 - Nathusius pipistrelle – Detected during one of the transects.
 - Noctule – Detected during nine of the transects.
 - *Myotis* spp. – Detected during three of the transects.
- 4.14 Common pipistrelle accounted for the vast majority (almost 84%) of bat activity recorded during the transect surveys and was recorded throughout all areas of the site. Soprano pipistrelle and noctule were the next most common species (between 8.84% and 6.52% respectively). Nathusius pipistrelle was recorded on the third survey and *Myotis* spp. were recorded on the first, second and sixth survey, both species of which were recorded in low numbers and of less than 1% of the overall total.
- 4.15 A summary of the data from the transect activity surveys is provided in Table 4 overleaf. Figures 1 and 2 show the transect routes and the static point count locations. Figures 3-13 show a summary of the results of each transect survey, with Figure 14 providing a combined summary of the twelve transect surveys. The eleventh transect survey has been omitted from the figures as there were no bats seen or heard during the survey.

Table 4: Summary of the transect activity surveys, see Figures 3-14 for results summaries.

Survey details	Summary of bat activity
Survey 1 - 20th May 2019 21:14 – 00:10 (Sunset 21:14)	(Start to LP1 - LP10 to Finish) Activity by up to four species Common pipistrelle: • Activity recorded from 21:38 onwards. • 37 bat registrations recorded foraging, feeding or commuting across the whole site. • The highest concentrations of bats were recorded in the north west of the site (near to LP3 & 4) and adjacent to the river and along the tree line on the northern boundary of the site. Soprano pipistrelle: • Activity recorded from 22:32 • Approximately 3 bats recorded foraging and feeding around LP6 and the boundary between the golf course and the field. Noctule: • Activity recorded from 21:36 onwards. • One record of an individual bat passing over the site near to LP2. <i>Myotis</i> spp.: • A single recording at 23:59 of an individual was identified during sound analysis but was not seen or heard during the transect survey.
Survey 2 - 30th May 2019 21:25 – 00:25 (Sunset 21:25)	(Start to LP1 - LP10 to Finish) Activity by four species Common pipistrelle: • Activity recorded from 21:41 onwards. • Approximately 49 bat registrations were recorded across the whole site comprising foraging, feeding and commuting activity with the highest concentrations of bats recorded in the northern area of the site. Soprano pipistrelle: • Activity recorded from 22:31. • 4 bat registrations recorded foraging, feeding and commuting across the site. Noctule: • Activity recorded from 21:31 onwards. • 15 bat registrations recorded foraging, feeding and commuting from across the site. <i>Myotis</i> spp. • A brief recording at 22:01 was identified during sound analysis but was not seen or heard during the transect survey.
Survey 3 - 10th June 2019 21:39 – 00:20 (Sunset 21:39)	(Start to LP1 - LP10 to Finish) Activity by four species Common pipistrelle: • Activity recorded from 21:40 onwards. • 84 bat registrations were recorded across the whole site foraging, feeding and commuting, mainly concentrated around the north of the site near to LP4. Soprano pipistrelle: • Activity recorded from 22:20. • Approximately 4 bats were recorded foraging, feeding and commuting across the site. Nathusius Pipistrelle: • Two recordings of a Nathusius pipistrelle were confirmed during sound analysis. The bat(s) was identified as foraging at LP4 on the transect survey. Noctule • Activity recorded from 21:47. • 12 bat registrations recorded foraging, feeding and commuting across the site. The majority of activity was identified in the north of the site.

Survey details	Summary of bat activity
Survey 4 - 24th June 2019 21:45-00:12 (Sunset 21:45)	(Start to LP6-LP10 then LP5-LP1 to Finish) Activity by three species. Common pipistrelle: - Activity recorded from 21:45 onwards. 86 bat registrations were recorded feeding, foraging and commuting across the site. - The majority of the activity was concentrated in the southern portion of the site with very little being recorded on the golf course. Soprano pipistrelle: - Activity recorded from 22:14 onwards. 25 bat registrations were recorded foraging, feeding and commuting across the site. - The majority of the activity was concentrated in the southern portion of the site with very little being recorded on the golf course. Noctule: - Activity recorded from 21:45. - Approximately 4 bats were recorded foraging, feeding and commuting. The majority were located between LP6 and LP7.
Survey 5 - 12th July 2019 02:00-04:45 (Sunrise 04:58)	(Start to LP1-LP10 to Finish) Activity by three species. Common pipistrelle: - Activity recorded from 02:01 onwards. 86 bat registrations recorded foraging, feeding and commuting across the site. Soprano pipistrelle: - Activity recorded from 02:36 onwards. - Approximately 3 bats were recorded foraging, feeding and commuting across the site. Noctule: - Activity recorded from 04:23 onwards. - Approximately 3 bats were recorded commuting across the site between LP10 and the Finish.
Survey 6 - 23rd July 2019 21:27-00:25 (Sunset 21:27)	(Start to LP10-LP1 to Finish) Activity by four species. Common pipistrelle: - Activity recorded from 21:58 onwards. 121 bat registrations recorded foraging, feeding and commuting across the site. Soprano pipistrelle: - Activity recorded from 22:08 onwards. 13 bat registrations recorded foraging, feeding and commuting across the site. Noctule: - Activity recorded from 21:35 onwards. - Approximately 8 bats were recorded foraging, feeding and commuting across the site. Myotis spp: - Activity recorded at 23:55. 1 bat observed foraging and feeding to the west of LP2.
Survey 7 - 8th August 2019 20:55-23:31 (Sunset 20:55)	(Start to LP6-LP10 then LP5-LP1 to Finish) Activity by three species. Common pipistrelle: - Activity recorded from 21:20 onwards. 126 bat registrations recorded foraging, feeding and commuting across the site. Soprano pipistrelle: - Activity recorded from 21:46 onwards. 6 bat registrations recorded foraging, feeding and commuting across the site. Noctule: - Activity recorded from 21:12 onwards. - Approximately 5 bats were recorded foraging, feeding and commuting across the site.

Survey details	Summary of bat activity
Survey 8 - 26th August 2019 20:16-22:49 (Sunset 21:16)	(Start to LP1-LP10 to Finish) Activity by three species. Common pipistrelle: • Activity recorded from 20:45 onwards. • 82 bat registrations recorded foraging, feeding and commuting across the site. • The majority of the activity was recorded at the site boundaries and in association with the River Alt. Soprano pipistrelle: • Activity recorded from 20:52 onwards. • Approximately 4 bats were recorded foraging and commuting across the site. • The majority of the calls were recorded between LP8 and LP9 in the south of the site. Noctule: • Activity recorded from 20:35 onwards. • Three recordings of bats commuting across the site.
Survey 9 - 11th September 2019 19:38-22:02 (Sunset 19:38)	(Finish to LP10-LP1 to Start) Activity by two species. Common pipistrelle: • Activity recorded from 19:58 onwards. • 112 bat registrations recorded foraging, feeding and commuting across the site. • The majority of the activity was recorded in the south of the site concentrated on the western and southern boundary and the hedgerow near to the River Alt. Soprano pipistrelle: • Activity recorded from 20:51 onwards. • 13 bat registrations recorded foraging, feeding and commuting to the central area of the site.
Survey 10 - 25th September 2019 19:04-21:38 (Sunset 19:04)	(Start to LP1-LP10 to Finish) Activity by three species. Common pipistrelle: • Activity recorded from 19:28 onwards. • 94 bat registrations recorded foraging, feeding and commuting across the site. • The majority of activity was located between LP3, LP4 and LP5 along hedgerows and treelines. There was also foraging activity noted around the clubhouse building. Soprano pipistrelle: • Activity recorded at 19:40. • One bat was recorded foraging repeatedly along the hedgerow between LP3 and LP4. Noctule: • Activity recorded from 19:13 onwards. • Approximately 4 bats were recorded foraging, feeding and commuting across the site.
Survey 11 - 8th October 2019 05:02-07:32 (Sunrise 07:25)	(Finish to LP10-LP1 to Start) No bats were seen, heard or recorded during the survey.

Survey details	Summary of bat activity
Survey 12 - 23rd October 2019 17:58-20:19 (Sunset 17:58)	(Start to LP1-LP10-Finish) Activity by two species. Common pipistrelle: • Activity from 18:13 onwards. • 28 bat registrations recorded foraging, feeding and commuting across the site. • Activity was recorded close to the river near LP2 and between LP4 and LP5 and at LP6. Soprano pipistrelle: • Activity recorded at 19:10. • One bat was recorded foraging and feeding along the treeline near LP6.

- 4.16 In summary, a total of 1,289 recordings of bats were made across the twelve transect surveys. The majority of activity was recorded in May followed by July. The least amount of activity was recorded in October, during which one of the transects recorded no activity. Foraging and feeding activity was recorded over the entire survey area and commuting was more prevalent to the north of the surveyed area between LP4, LP3 and LP5 and between LP6 and LP7.
- 4.17 The majority of activity recorded during the transect surveys relates to common pipistrelle bats (83.94%), the majority of which were recorded foraging and feeding within the north of the site between LP4 and LP5. The next most common species were soprano pipistrelle (8.84%) and noctule (6.52%) with no significant difference between the numbers encountered on the site.
- 4.18 *Myotis* spp. were recorded on three of the surveys making up 0.54% of the calls and were located across the site. One on survey they were recorded on the southern boundary of the site, on another in the north of the site between LP3 and LP4 and on the final survey near the river at LP2.
- 4.19 There was one record of a *Nathusius* pipistrelle from the survey on the 10th June at LP4.

Automated Survey Results

- 4.20 Figure 1 shows the locations of the automated detectors and Figures 15a – 26 provide charts summarising the results from the automated detector surveys. In total, 27,792 bat recordings were made over five nights during six automated survey periods. The most active period was May (Period 1: 11,687 recordings) followed by July (Period 3: 6,368 recordings). The lowest levels of activity were recorded in October (Period 6: 101 recordings). All percentages below are rounded to 2 decimal places.
- 4.21 Overall, the following species/ genus groups were detected through data analysis:
- Common pipistrelle
 - Soprano pipistrelle
 - *Nathusius* pipistrelle
 - *Pipistrellus* spp.
 - Noctule
 - Serotine
 - Brown long-eared
 - *Myotis* spp.
- 4.22 Species recorded included a genus of bat (*Myotis* spp.) and species' (*Noctule*, *serotine* and *Leisler's*) which are difficult to separate into species due to the similarities of their calls and overlapping of call characteristics which can be difficult to determine to species level. Some *Pipistrellus* spp. calls were unable to be classified to species level due to the calls being social calls which are very similar.

- 4.23 Detectors were deployed at three locations within the site. One on a tree within the golf course (Location A), one on a tree adjacent to the River Alt (Location B) and one on a tree within the unmanaged field in the south west of the site (Location C). An analysis of bat activity recorded at these locations during each survey period is provided below.

Period 1

- 4.24 During Period 1 (16th to 21st May), at least seven bat species were detected, as detailed below:

- Common pipistrelle – 92.05% of total bat recordings over the period. Detected on all five nights at all locations.
- Soprano pipistrelle. – 6.73% of total bat recordings over the period. Detected on all five nights at Location A and B and on four nights at Location C.
- Nathusius pipistrelle – 0.06% of total bat recordings over the period. Detected on the last night at Location A and all but the fourth night at Location B with no records at Location C.
- *Pipistrellus* spp. – 0.08% of total bat recordings over the period. Detected on three nights; the second and fifth at Location B and the third night at Location C.
- Noctule – 0.9% of total bat recordings over the period. Detected on all five nights at Location C, the initial four nights at Location A and the second, third and fourth nights at Location B.
- Serotine - 0.12% of total bat recordings over the period. Detected on the second, fourth and fifth nights at Location B.
- Brown long-eared – 0.02% of total bat recordings over the period. Detected on two nights; second and fifth at Location A.
- *Myotis* spp. – 0.04% of total bat recordings over the period. Detected on the last night at Location A and nights one and two and the last night at Location B.

- 4.25 Bat activity was recorded on all nights over the survey period. Common pipistrelle was the most frequently recorded species on every night with, on average over 2000 registrations per night. The second most recorded species over the period was soprano pipistrelle, which was recorded 787 times over the period, with over 100 registrations on three of the nights. Noctule were recorded on every night, 105 times over the period. Nathusius pipistrelle were recorded 7 times over four nights. Undetermined *Pipistrellus* spp., Serotine and *Myotis* spp. bats were recorded on three nights and brown long-eared on two nights, all with low numbers of registrations on any one night (1-8). The recordings of the unidentified pipistrelle bats comprised of social calls and on balance of probability most likely relate common pipistrelle bats. Location B had the most recordings of bats throughout the period (10,147) followed by Location C (844) and Location A (696). (see Figures 15a and 15b)

- 4.26 Bat activity was recorded within most hours of every night between dusk and dawn over the period. The greatest levels of bat activity were recorded between the hours of 22:00 and 23:00 during each night, during the first 2 hours after sunset. There were also peaks at 02:00-03:00 during most nights before dawn (see Figure 16) with varying levels of activity between these times.

Period 2

- 4.27 During Period 2 (24th June to 30th June), at least six bat species were detected, as detailed below:

- Common pipistrelle – 90.56% of total bat recordings over the period. Detected on all five nights at all locations.
- Soprano pipistrelle – 4.74% of total bat recordings over the period. Detected on all five nights at Locations B & C and all nights except the fourth night at Location A.

- *Nathusius pipistrelle* – 0.04% of total bat recordings over the period. Detected on the first and third nights at Location B only.
- *Pipistrellus* spp. – 0.10% of total bat recordings over the period. Detected on two nights at Location C on the first and last night.
- Noctule – 3.62% of total bat recordings over the period. Detected on all five nights at all locations.
- Serotine – 0.58% of total bat recordings over the period. Detected on three nights; the second and third at Location A; and the fifth night at Location B.
- Noctule, Serotine or Leisler's – 0.02% of total bat recordings over the period. Detected on the third night at Location A.
- *Myotis* spp. – 0.35% of total bat recordings over the period. Detected on the third and fifth night at Location A, the second, third and fourth night at Location B and the fourth night at Location C.

4.28 Bat activity was recorded on all nights over the period. Common pipistrelle was the most frequently recorded species over the period as a whole and was the most recorded species on all except one night. Soprano pipistrelle were the second most common bat species recorded, with 245 registrations on all five nights over the period. Noctule were the third most recorded and were identified on all five nights. *Myotis* spp. were recorded 18 times over four of the nights. Serotine were recorded on three nights, with a peak of 27 registrations on the third night at Location A. Undetermined *Pipistrellus* spp. and *Nathusius* bats were recorded on only two nights. On the third night one registration was recorded of a bat that could not be separated between a noctule, serotine or Leisler's as the calls are very similar, however, given the distribution of Leisler's in the UK it is considered highly unlikely that this call would be from this species and is more likely to be a noctule or a serotine. Location B had the most recordings over the period (4055), followed by Location C (904) and Location A (213) (see Figures 17a and 17b).

4.29 Bat activity was recorded within most hours of every night between dusk and dawn over the period. The greatest levels of bat activity were generally recorded between the hours of 22:00 and 23:00 on all nights at Location C with a smaller peak between 01:00 and 03:00. Peak activity at Location B was between 01:00 and 03:00 on four of the nights, peaking at the earlier times of 22:00 to 00:00 on the fifth night. These peaks are generally during the first couple of hours after sunset and another peak just before dawn. Activity was more consistent at Location A with less discernible peaks being observed (see Figure 18).

Period 3

4.30 During Period 3 (24th to 31st July), at least seven bat species were detected, as detailed below:

- Common pipistrelle – 94.47% of total bat recordings over the period. Detected on all five nights at all locations.
- Soprano pipistrelle – 3.88% of total bat recordings over the period. Detected on all five nights at all locations.
- *Nathusius pipistrelle* – 0.09% of total bat recordings over the period. Detected at Location B on the second, third and fourth night.
- *Pipistrellus* spp. – 0.14% of total bat recordings over the period. Detected on the fourth and fifth night at Location C.
- Noctule – 1.21% of total bat recordings over the period. Detected on all five nights at Locations B and C and the first four nights at Location A.
- Serotine – 0.02% of total bat recordings over the period. Detected on the fifth night at Location B.
- Brown long-eared – 0.02% of total bat recordings over the period. Detected on the first night at Location B.

- *Myotis* spp. – 0.17% of total bat recordings over the period. Detected on the first and last night at Location A, the second, third and fourth nights at Location B and the third and last night at Location C.

- 4.31 Bat activity was recorded on all nights over the period. Common pipistrelle was the most frequently recorded overall with 6016 of the calls recorded over the period. Soprano pipistrelle was the second most recorded species overall, being recorded on every night and totalling 247 recordings. Noctule were the third most recorded species being recorded on all nights. *Myotis* spp. were recorded on all five nights although with low numbers of registrations (1-4). Nathusius pipistrelle were recorded on three of the nights, although again with low numbers of registrations (1-3). Undetermined *Pipistrellus* spp. bats were recorded on two nights at Location C. Brown long-eared and serotine had one registration recorded on one night each (the first and fifth respectively) at Location B. Overall Location B had the most recordings over the period (5,030) followed by Location C (973) and Location A (365). (see Figure 19a and 19b).
- 4.32 Bat activity was recorded within most hours of every night between dusk and dawn over the survey period. Overall activity peaked between 22:00 and 23:00 again between 02:00 and 04:00. Activity was less consistent and frequent at Location A with the greatest activity noted at Location B (see Figure 20).

Period 4

- 4.33 During Period 4 (27th August to 2nd September), at least six bat species were detected, as detailed below:
- Common pipistrelle – 91.8% of total bat recordings over the period. Detected on all five nights at all Locations.
 - Soprano pipistrelle – 6.05% of total bat recordings over the period. Detected on all five nights at Location A, the first, third, fourth and fifth nights at Location B and the first four nights at Location C.
 - *Pipistrellus* spp. – 0.75% of total bat recordings over the period. Detected at Location A on all but the fourth night and at Location B on all but the first night.
 - Noctule – 1.08% of total bat recordings over the period. Detected on all five nights at Locations A & B and on the first night only at Location C.
 - Serotine – 0.03% of total bat recordings over the period. Detected on the second night at Location B.
 - Brown long-eared – 0.06% of total bat recordings over the period. Detected on the third night at Location B.
 - *Myotis* spp. – 0.25% of total bat recordings over the period. Detected on the first two nights at Location A and the first, third and fourth nights at Location B.
- 4.34 Bat activity was recorded on all nights over the period. Common pipistrelle were the most frequently recorded species on all nights except at Location A on the first night where soprano pipistrelles were marginally greater in numbers. Soprano pipistrelle were the second most recorded species on all nights. Noctule and undetermined *Pipistrellus* spp. bats were the third and fourth most recorded species and were also recorded on all five nights. *Myotis* spp. were the fifth most recorded bats and were recorded on four nights, although with low numbers of registrations (1-4). Serotine and brown long-eared were only recorded on one night (second and third respectively) with two or less registrations. Location B had the most recordings over the period (2,791) followed by Location C (500) and Location A (331) (see Figures 21a and 21b).
- 4.35 Bat activity was recorded within most hours of every night between dusk and dawn over the period. Peaks in activity varied however, the peak of activity was between 21:00 and 22:00 on three of the nights (approximately 1-2 hours after sunset) with another slight peak between

02:00 and 03:00. Night two had relatively lower numbers of recordings compared to other nights with Location B pertaining to the greatest numbers of bat passes overall. (see Figure 22).

Period 5

4.36 During Period 5 (25th September to 1st October), at least four bat species/groups were detected, as detailed below:

- Common pipistrelle – 92.64% of total bat recordings over the period. Detected on all five nights at all Locations.
- Soprano pipistrelle – 3.68% of total bat recordings over the period. Detected on all five nights at Location A, on all but the third night at Location B and only the third night at Location C.
- *Pipistrellus* spp. – 0.48% of total bat recordings over the period. Detected on the first and fourth night at Location B.
- Noctule – 3.09% of total bat recordings over the period. Detected on the first to third night at Location A and the first two nights at Location B.
- *Myotis* spp. – 0.12% of total bat recordings over the period. Detected on the fifth night at Location B only.

4.37 Bat activity was recorded on all nights over the period. Common pipistrelle bats were the most frequently recorded overall on every night. Soprano pipistrelle was the second most recorded species overall, recorded on every night, although in significantly lower numbers than common pipistrelle. Noctule was the third most recorded across the period, recorded on three nights. Undetermined *Pipistrellus* spp. were recorded on two nights with low numbers of registrations (1-3) and *Myotis* spp. was only recorded once throughout the whole period on the fifth night. Location B had the most recordings over the period (493) followed by Location A (290) and Location C (59) (see Figures 23a and 23b).

4.38 Bat activity was intermittently recorded in low figures with no activity in some hours for each night and location. Overall peaks were evident between 19:00 and 20:00 hours and 02:00 to 04:00, with a peak at Location C on the third night at 22:00, tying in with dusk and pre-dawn timings over the survey period. The amount of bat activity was relatively low compared with the other periods, and therefore there is less of a noticeable trend in the results (see Figure 24).

Period 6

4.39 During Period 6 (23rd to 29th October), at least five bat species were detected, as detailed below:

- Common pipistrelle – 96.04% of total bat recordings over the period. Detected on all but the third night at Location B, on the second and third night at Location A and on the second night at Location C.
- Soprano pipistrelle – 0.99% of total bat recordings over the period. Detected on the second night at Location B.
- Nathusius pipistrelle. – 0.99% of total bat recordings over the period. Detected on the third night on Location A.
- Noctule – 0.99% of total bat recordings over the period. Detected on the second night at Location B.
- *Myotis* spp. – 0.99% of total bat recordings over the period. Detected on the fifth night at Location A.

4.40 Bat activity was recorded on four nights over the period. Common pipistrelle bats were the most frequently recorded overall with only one recording of each of the other species' over the period. Location B had the most recordings over the period (84) followed by Location A (13) and Location C (4) (see Figures 25a and 25b).

- 4.41 Bat activity was only recorded between the hours of 18:00 and 21:00 on each of the nights with the greater number of calls between 19:00 and 20:00. The amount of bat activity was very low compared with the other periods, and it is therefore difficult to determine a discernible trend in the results (see Figure 26).

Habitat Assessment Results

- 4.42 Habitats present within the site are considered suitable to support commuting, foraging and feeding bats. The golf course areas of the site are dominated by amenity grassland with stands of scattered trees, plantation woodland and occasional rough grassland, scrub, ponds and ditches. The south western area of the site comprises three fields of unmanaged rough grassland with scattered trees, tall ruderal vegetation, wet grassland and hedgerows along the field boundaries. The River Alt runs south to north through the centre of the site and a railway corridor borders the northern boundary.
- 4.43 The River Alt corridor, woodland strips around the golf course and hedgerows provide good links to other habitats in the wider surrounds, including extensive areas of riverside grassland to the south of Valley Road and woodland habitats along the railway corridor on the northern boundary of the site. Movement is, however, likely to be restricted to the east of the site by the M57 motorway.
- 4.44 In addition to areas of suitable foraging and commuting habitat nearby, there are a number of buildings and trees in the area that could provide suitable roosting habitat for bats within the adjacent habitats to the site. However, no bat roosts have been identified within the site during the suite of roost surveys carried out (see Protected Species Survey Report (Bats) dated August 2021).

Evaluation

- 4.45 The habitat activity surveys (transect and automated surveys) identified up to seven bat species/ genus groups at the site, as listed below:
- Common pipistrelle
 - Soprano pipistrelle
 - Nathusius pipistrelle
 - *Pipistrellus* spp.
 - Noctule
 - Serotine
 - Noctule/Serotine/Leisler's
 - Brown long-eared
 - *Myotis* spp.

Transect Surveys

- 4.46 During the twelve transect surveys up to five bat species/ species groups were encountered: In summary, a total of 1,289 registrations of bats were made across the twelve transect surveys. The majority of activity was recorded in May followed by July. The least amount of activity was recorded in October, during which one of the transects no activity was recorded. Activity was recorded across the whole of the site, with more concentrated activity identified around hedgerows/tree lines on the boundaries, at the River Alt and the ditch on the north western boundary and the larger areas of woodland on the golf course.
- 4.47 Foraging and feeding activity was recorded during the transect surveys throughout the survey area. Commuting activity was recorded on a number of occasions at LP3, LP4, LP5 and LP6 and LP7, although no perceptible commuting routes were noted.

Automated Surveys

- 4.48 In total, 27,792 bat recordings were made during six automated survey periods. The most active period was May (Period 1: 11,687 recordings) followed by July (Period 3: 6,368 recordings). The lowest levels of activity were recorded in October (Period 6: 101 recordings), which is to be expected for the time of year.
- 4.49 The majority of the automated survey recordings over all periods were recorded at Location B, adjacent to the River Alt, indicating that the river is an important feature for bats, both to commute and forage along.
- 4.50 The second most common location was Location C, on the southern boundary of the site. There was however a distinct difference in the distribution of species with the majority of the species recorded at Location C being common and soprano pipistrelle, followed by noctule. There were very few recordings of *Myotis* spp. at Location C and no recordings of serotine, Nathusius pipistrelle or brown long-eared bats. Studies have shown that *Myotis* spp. and brown long-eared bats generally avoid street lights and Location C is adjacent to the A506, which may explain the lower numbers of recordings. In contrast serotine have been shown to feed around white street lights, however none were recorded at Location C.
- 4.51 Location A had the least number of recordings across the surveys, possibly because this location is on the golf course which is a more open habitat with fewer commuting routes and foraging opportunities adjacent to the detector location point.
- 4.52 Multiple recordings of unidentified pipistrelle bats were made during all periods which comprised social calls, on balance of probability, these are considered most likely to relate to common pipistrelle bats in view of the dominance of this species recorded over all periods during the static and transect surveys. One recording of a bat during analysis could not be separated between noctule, serotine or Leisler's, as the calls are very similar, however, given the distribution of Leisler's in the UK it is considered highly unlikely that this call would be from this species of bat and is more likely to be a noctule or a serotine call.
- 4.53 Conservation status of the bat species identified at the site through surveys are detailed in Table 6 below.

Table 5: Status of bat species. Detail of conservation status at a local, county and regional level.

Species	Conservation status assessment		
	Local	County	Regional
Common pipistrelle	Common and widespread	Common and widespread.	Common and widespread. Considered to be widely distributed across the UK and one of the commonest bat species*.
Soprano pipistrelle	Common and widespread	Common and widespread.	Common and widespread. Considered to be widely distributed across the UK and one of the commonest bat species*.
Nathusius pipistrelle	Widespread but not common.	Widespread but not common.	Widespread but sparse in records, an increase in records may reflect sampling effort as opposed to expanding range*.
Noctule	Common and widespread	Common and widespread	Common and widespread. Considered to be widely distributed across the UK*.

Species	Conservation status assessment		
	Local	County	Regional
Serotine	Uncommon (sparsely recorded & largely restricted to south)	Uncommon (sparsely recorded & largely restricted to south)	Less common, localised to south of The Wash and South Wales.
Brown long-eared	Common and widespread	Common and widespread. Clusters of brown long-eared are known in the County.	Common and widespread. Considered to be found throughout the UK*.

*According to Bat Conservation Trust (BCT) data.

- 4.54 Serotine are a species that are not known to be present in Merseyside although a small number of records of their presence is known. It is noted that 100% confidence in species presence is not possible without a bat in the hand or DNA evidence. However, for the purpose of this evaluation it is taken that serotine are present at the site.
- 4.55 An evaluation of species identified from the transect and automated surveys undertaken at the site is provided below.
- 4.56 Common pipistrelle was the most frequently recorded species at the site over all automated and transect surveys, with 26,742 registrations. Overall activity by common pipistrelle was recorded throughout the site with preference noted around wooded areas, treelines around the site boundaries and at River Alt during the transect surveys. *Pipistrellus spp.* social calls were also recorded and due to the prominence of common pipistrelle registrations it is considered that the majority of these calls relate to common pipistrelle, although soprano pipistrelle and Nathusius pipistrelle were recorded in smaller numbers. A maximum of five common pipistrelle individuals were observed at any one time. In view of the frequency that this species was recorded during the transect and automated surveys, it is expected that the site is used by a number of common pipistrelle bats on a frequent and regular basis.
- 4.57 Soprano pipistrelle was the second most frequently recorded species at the site and detected during all periods and transects in low to moderate numbers, with 1,644 registrations. Activity was recorded throughout the site with preference noted around wooded areas, treelines around the site boundaries and at the River Alt during the transect surveys.
- 4.58 Noctule bats were the third most detected species during all periods on both the automated and transect surveys with 519 registrations. A maximum of two individuals were observed at any one time on the transect surveys. In view of the frequency that this species was recorded during the transect and automated surveys, it is expected that the site is used by very low to low numbers of noctule bats on a regular basis. Noctule bats have a large range, and it is therefore considered likely that the site and its surrounds form a very small part of a much wider foraging territory for individuals of this species.
- 4.59 *Myotis spp.* were the detected during all periods for the automated surveys and during May and July on the transect surveys at the site with 52 registrations. Activity was almost evenly split between both locations A and B on the automated surveys and only two bats were recorded on the transect surveys, one in the north of the site and one in the south west of the site. In view of the data it is considered that there are low numbers of *Myotis spp.* present which use the site.
- 4.60 Serotine had only 46 registrations on the automated surveys in periods 1 to 4 and were recorded at locations A and B only with no registrations recorded during the September of October period and 1 registration during the July and August period. It is considered that the site is being used seasonally by very low numbers of bats on an infrequent basis.

- 4.61 Nathusius pipistrelle had 18 registrations over one transect survey in June and periods 1, 2, 3 and 6 of the automated surveys. The majority of the registrations were recorded at Location B on the automated surveys. The recordings on the transect survey were identified during sound analysis. It is therefore expected that the site is used by very low numbers of bats on an infrequent and uncommon basis.
- 4.62 Brown long-eared bats were the lowest recorded species on the site with 5 registrations recorded on the automated surveys in period 1, 3 and 4. No recordings were detected during the transect surveys. Brown long-eared bats were the least recorded bats at the site however, it should be noted that brown long-eared bats have a very quiet echolocation call which often leads to this species being under recorded. It should therefore be considered that the site is used by low numbers of this species on an infrequent and uncommon basis.

Habitat Assessment

- 4.63 Habitats within the site and its immediate surrounds were assessed to assist in the determination of impacts. Table 5 reviews habitat preferences for the species identified during the surveys.

Table 5: Foraging habitat preferences and foraging strategies of different UK species (taken from BCT (2016) 3rd Edition except where otherwise stated).

Species	Habitat Preferences
Common pipistrelle	Shows preference to deciduous woodland but a generalist using a wide range of habitats.
Soprano pipistrelle	Tends to select riparian habitats over other habitat types available.
Nathusius' pipistrelle	Riparian habitats, broadleaved and mixed woodland and parkland, occasionally found in farmland but always near water (Harris and Yalden, 2008). Found over lakes and rivers (Vaughan et al., 1997). One study recorded males feeding over lake edge and managed gardens and fields around a lake (Hargreaves, 2012).
Noctule	Found in a range of habitats, forages out in the open, often over trees and with strong affinity to water. Reported as selecting broad-leaved woodland and pasture.
Serotine	Catto et al. (2006) and Robinson and Stebbings (1997) identified the following habitats as important for foraging: cattle pasture, playing fields, village greens, white streetlights, tree-lined hedgerows and woodland edge.
Brown long-eared	Strongly associated with tree cover, prefers woodland with cluttered under storey, including native species particularly deciduous woodland. Also forages in mixed woodland edge and among conifers. Use of hedgerows increases though the active season.

*Due to the diversity in requirements of *Myotis* spp. this genus is excluded from the above table.

- 4.64 The habitat activity surveys have identified main key habitat areas at the site;
- The River Alt and adjacent riparian habitat including clusters of activity around LP2, LP4, LP6 and LP7;
 - Higher general activity areas such as site boundaries, at LP5 and woodland edges;
 - Higher assemblage of species at LP3;
- 4.65 Other supporting habitats present at the site in the form of;
- The tree lines within the north and along the northern boundary of the site;
 - Hedgerows within the southern area of the site; and
 - LP8 to the west and in south western boundaries of the site.
- 4.66 Some of these areas have the potential to be directly affected by the proposals for the site. Other areas have the potential to be affected by indirect impacts such as artificial lighting.

5.0 Impact Assessment

5.1 The below paragraphs assess the effects of the proposals on bat activity identified at the site.

Roosting habitat

5.2 There are a number of buildings and trees in the area that could provide suitable roosting habitat for bats within the adjacent habitats to the site (see ESL Protected Species Survey Report (Bats: Buildings) dated August 2021 and Protected Species Survey Report (Bats: Trees) dated August 2021). A single, common pipistrelle bat was observed returning to roost within the existing clubhouse during one of the bat surveys undertaken. No confirmed tree roosts have been identified. Due to the loss of trees with potential roosting features within the site and to facilitate the proposals it is recommended that a bat box scheme is designed and implemented, which will increase the availability of roosting habitat within the site. Appendix 2 details a range of bat boxes suitable for a range of species and purposes suitable for use on trees and / or buildings.

5.3 Comprehensive engineering / reconfiguration / new and improved irrigation / drainage works and other improvement works in the wider golf course should seek to retain as much of the existing tree and scrub cover as possible. Where tree loss is unavoidable, two trees will be planted for any tree lost. Compensatory tree planting should include large standards to reduce the time required for the trees to reach maturity. Any trees to be affected in the wider golf course must first be subject to a Preliminary Roost Assessment for bats and any necessary further surveys undertaken to determine the presence or absence of bats.

5.4 If a bat roost/s is/are located during the survey work a Natural England Licence accompanied by an appropriate mitigation strategy will need to be applied for and granted to legally permit work to commence which would affect bats or their roost.

5.5 A Natural England licence can only be applied for once planning permission is gained, if planning permission is required. Natural England, the licensing authority, will require the species, numbers and use of a roost to be ascertained before granting a licence and there may be delays in obtaining a Licence and time constraints as to when mitigation can be undertaken.

Foraging habitat

5.6 Foraging habitat is available throughout the site but is more frequently used by bat species within supporting and key habitats such as at the River Alt, woodland, hedgerows and scrub interface habitats along the site boundaries. Overall activity within central grassland areas; such as the golf course and the adjacent grassland habitats including the hedgerows, is generally low although used on a relatively frequent basis.

5.7 Proposed loss of grassland and hedgerow habitats from within the site is considered unlikely to have a significant effect on the use of the site by foraging common pipistrelle, soprano pipistrelle and noctule bats, which have a wide range of habitat preferences.

5.8 It is expected that the trees along the boundaries of the site and a number of trees within the amenity grassland golf course and the rough grassland area will be lost to facilitate the development. However, the landscape plan indicates that there will be planting of trees to replace those lost which over the golf course area as a whole which will result in an increase of interface habitats. Compensatory tree planting must be provided on a two for one basis with two trees planted for any tree lost. Compensatory tree planting should include large standards to reduce the time required for the trees to reach maturity. The River Alt is not to be directly affected by the proposals at the site and foraging at this key habitat will be

retained. The landscape plan for the development area includes areas of semi-rough, rough and long rough, areas of wildflower seeding, woodland planting, infilling gaps in existing hedgerows and the creation of two lakes with marginal planting which will provide suitable foraging habitat for bats within the developed site.

- 5.9 During the January 2021 walkover, it was noted that works had been undertaken within the golf course and the vegetation largely removed along the banks of the River Alt in an area adjacent to the car park in the south of the site and in the north of the site. There had also been loss of trees, tall ruderal and dense scrub habitats, mainly in the north western part of the golf course. These works may have a temporary impact on the quality of the foraging habitat as the lack of vegetation may reduce the amount of prey in these areas. It is considered that the impact on the River Alt will be temporary and the vegetation including bankside grassland, scrub and tall ruderal will re-establish naturally over time. Works in the wider golf course should seek to retain as much of the existing tree and scrub cover as possible. Where tree loss is unavoidable, compensatory tree planting must be provided on a two for one basis with two trees planted for any mature tree lost. Compensatory tree planting should include large standards to reduce the time required for the trees to reach maturity. There is potential in the wider golf course to enhance habitats for bats through increasing the amount of semi-rough, rough and long rough and through enhancing out of play areas and waterbodies.
- 5.10 Overall, the development proposals should seek to maintain opportunities for bat species favouring wooded and scrub interface habitats such as pipistrelles, brown long-eared and some *Myotis* species. The lighting proposals should seek to minimise indirect effects of artificial light spill on foraging areas, the issues of which are discussed in the lighting section below.
- 5.11 The proposed netting in relation to the driving range will not conflict with the retained key habitat areas or other retained supporting habitats. To ensure that the netting does not cause a collision/ entanglement hazard to bats and other species it is recommended that a heavy gauge twine is used.

Commuting features

- 5.12 No perceptible commuting paths were noted during the transect surveys undertaken at the site however commuting activity was recorded on a number of occasions at LP3, LP4, LP5, LP6 and LP7. All of these locations are in close proximity to linear features such as water courses, both the River Alt and an adjacent ditch, woodland/ scrub edges and in particular LP4 which is also near to the railway north of the site. LP3, LP4 and LP5 may be affected by comprehensive engineering / reconfiguration / new and improved irrigation / drainage works and other improvement works within the wider golf course. The commuting noted at LP6 and LP7 is likely to be in association with the River Alt and whilst this is not to be directly affected by the proposal, assessment of the effect of lighting and potential artificial light spill will need to be considered.
- 5.13 In general, it is likely that bats use the site for commuting on an infrequent to frequent basis, in particular at tree lines and scrub along the boundaries of the development area and the River Alt and adjacent ditch area. Although tree and scrub loss are proposed at the site, in particular along the margins and up to the boundaries, development should seek to maximise retention of boundary trees and scrub in order to maintain linear vegetated corridors for commuting bats.
- 5.14 The loss of scrub and trees along the boundaries are expected to be partially compensated for by proposed tree planting within development close to the site boundaries. Provision of

native species-rich hedgerow, scrub and/ or further treeline planting along the boundaries of the development site is recommended to further enhance these linear habitats.

- 5.15 During the 2021 walkover, it was noted that works have been undertaken in the wider golf course and the vegetation largely removed along the banks of the River Alt in an area adjacent to the car park in the south of the site and in the north of the site. There had also been loss of trees, tall ruderal and dense scrub habitats, mainly in the north western part of the golf course. These works may have a temporary impact on the quality of the river as commuting habitat. However, it is considered that this impact will be temporary as the vegetation including bankside grassland, scrub and tall ruderal will re-establish naturally over time.
- 5.16 Comprehensive engineering / reconfiguration / new and improved irrigation / drainage works and other improvement works in the wider golf course will result in temporary habitat losses being reinstated to golf course following completion. It is envisaged that in the long term, the golf course will provide a similar range of habitats as currently present. Works in the wider golf course should seek to retain as much of the existing tree and scrub cover as possible. Where tree loss is unavoidable, compensatory tree planting must be provided on a minimum like for like basis with two trees planted for any mature tree lost. Compensatory tree planting should include large standards to reduce the time required for the trees to reach maturity. There is potential in the wider golf course to enhance habitats for bats through increasing the amount of semi-rough, rough and long rough and through enhancing out of play areas and waterbodies.
- 5.17 In order to maintain the suitability of retained and newly created habitat corridors for commuting bats, the proposals should seek to minimise indirect effects on all habitats from artificial light spill onto areas of semi-natural vegetation (see below).
- 5.18 As recommended in relation to foraging habitat, the proposed netting in relation to the driving range will not conflict with the retained key commuting habitat areas or other retained supporting habitats. It is recommended that netting with a heavy gauge twine is used to ensure that the netting does not cause a collision/ entanglement hazard to bats and other species.

Lighting

- 5.19 Development proposals should seek to maintain suitable opportunities for the seven species/ species groups of bats identified within the site. Key habitats noted such as the River Alt, woodland edges and at LP3 where species assemblages were higher are important habitats for foraging and commuting bats and should not therefore be subject to artificial light pollution. Other supporting habitats such as tree lines and the western and south western boundaries also provide suitable foraging and commuting habitat and minimal artificial light spill measures are recommended.
- 5.20 The proposals seek to construct a variety of buildings including a range building, clubhouse and maintenance building as well as sports facilities including an external driving range, bowling green, tennis courts, 5 aside football pitches, an adventure golf course, practice putting green and associated car parking spaces. Two new vehicular accesses will be created onto Valley Road and a new gated access formed via Aintree Lane for construction access and course operatives following completion of development works. The majority of the proposed buildings are located to the south of the development area adjacent to the A506 Valley Road which is an existing well-lit busy road. Other external sports facilities are also situated to the south of the development with the exception of the driving range that protrudes into the central development area to the west of the River Alt.

- 5.21 Flood lighting to the car park areas shall be installed on 6m columns and the optics shall be such that there is zero upward light. All fittings shall be selected to ensure light pollution and overspill from the lit area is minimised. The lighting at the perimeter of the site will be directed back onto the site rather than out towards the road. The car park lighting would be operated via photocells and ideally a time clock to knock off the lighting during the night when the site is not in use, subject to security requirements.
- 5.22 The lighting for the adventure course shall be a mixture of low-level bollard lighting and additional flood lighting around the perimeter to provide working illumination with buried uplighters providing accent lighting to features of the course. Flood lighting shall also be provided to the putting green to allow for its use during the same hours as the adventure golf. LED flood lighting is proposed for the tennis courts, football pitches and bowling green with a mounting height of 8m and will be designed to minimise upward light pollution. Spill calculations have been done to show that there will be no spill out past the site boundary. The lighting for the adventure golf course, putting green, tennis courts, football pitches and bowling green shall be switched via a photocell with a manual override switch so that the lighting can be switched off during the middle of the night when not operational.
- 5.23 Discrete over door LED lighting shall be used on the clubhouse and driving range buildings, which will direct the light down onto the pavement. Lighting to walkways alongside the building would be provided via wall mounted LED bulkheads, which come in an eyelet version to ensure light is thrown down at the path and not up into the air. External areas of the clubhouse would be flood lit with lights mounted to the soffit of the overhang to light the terrace area. Low level lighting shall be provided to the pedestrian bridge across the river.
- 5.24 Any lighting in the vicinity of the confirmed bat roost in the existing clubhouse would use motion detection to ensure lighting is not on when not required. Light spill from the windows will be minimised by selecting fittings with asymmetric distribution and siting fittings away from windows.
- 5.25 A BERM lighting system is proposed for the driving range, where the flood lighting is installed within the ground in built up mounds, with the lighting directed out across the targets. The lighting is installed along the length of the range to avoid high power flood lights around the entire perimeter.
- 5.26 To minimise potential light pollution, it is recommended that soft screening light buffers be planted along the River Alt, particularly at the end of the Driving Range and either side of the river near the Clubhouse. The soft screening light buffer, should ideally be slightly raised on a mound and then a planted buffer of trees and hedgerow to create a screen. Hedgerow species should be evergreen, ideally native species. More permanent screening fencing or walls could be used.
- 5.27 There are currently no proposals for additional lighting for the wider golf course and it is anticipated that similar lighting levels will be maintained following the comprehensive engineering / reconfiguration / new and improved irrigation / drainage works and other improvement works. Should any new lighting be proposed, this should be designed in consultation with a suitably experienced ecologist. Light pollution of key and supporting habitats (see paragraph 5.19) should be avoided/minimised.
- 5.28 In order to minimise potential effects of artificial lighting, both during construction and the operational phase upon completion of the proposed development, a detailed sensitive

lighting scheme should be designed and implemented in accordance with ILP (2018) to maintain the site as suitable for foraging and commuting bat species which are sensitive to light such as brown long-eared and *Myotis* spp. bats.

- 5.29 Lighting levels should be at the minimum required for health and safety, and avoided wherever possible. The following provides lighting parameters for the species and habitats found present at the site.
- 5.30 Lighting of key habitats should be avoided and typical clear full moon lux levels, between 0.25 to <1, and/ or 'complete darkness' in these areas should be adhered to. Supporting habitats should be subject to reduced lighting levels relating to the species identified at the site.
- 5.31 In this instance the presence of light-averse species has been identified albeit in low numbers for *Myotis* spp. at Location C and both *Myotis* spp. and brown long-eared identified at Locations A and B. Acceptable lux levels range from a typical average of <3 lux to a maximum of <5 lux.
- 5.32 Acceptable levels for light opportunistic species such as *Pipistrellus* spp., noctule and serotine are also required at the site in areas of supporting habitat for which acceptable lux levels should be <10 lux. However, if light-averse species are noted to be present in these areas then acceptable levels should reflect their presence, as noted in 5.31.
- 5.33 Furthermore, it is advised that where light-averse species are present at a site the LED light sources should be used that have minimal UV light; a warm colour temperature of 3000K or 2700K; and with a light source that peaks higher than 550nm.
- 5.34 The effects of lighting could be further reduced through the use of low-level lighting; the use of bollards with 100% downward directional lighting; placement and direction of the lighting; the use of switching or dimming triggers e.g. seasonal, time/light level based, movement and screening (both hard and soft) through bunds/ embankments or through vegetation.
- 5.35 The lighting strategy should be reviewed at an appropriate stage of design in relation to bat species and their requirements by a suitably experienced ecologist

Drinking areas

- 5.36 Artificial lighting, in particular by white light, has been shown to reduce drinking behaviour by fast flying species and to stop drinking behaviour by slow flying species. Therefore, indirect lighting of the proposed lakes should be avoided.

Habitat enhancement measures

- 5.37 Creation of additional broadleaved woodland, two lakes, infilling gaps in retained hedgerows, implementation of a bat box scheme and enhancing habitats in the wider golf course have the potential to enhance habitats for bats in the longer term.

6.0 Conclusion

- 6.1 The bat habitat activity surveys (transect and automated detector surveys) recorded seven bat species/ genus groups foraging and/ or commuting within the site.
- 6.2 Common pipistrelle made up the majority of activity recorded during the transect surveys with low numbers of individuals recorded on a frequent basis foraging around the site, mostly utilising interfaces between trees, scrub, grassland habitats and the site boundaries. Other

areas of the site with higher concentrations of recordings include the northern boundary treeline, the north western boundary near the ditch and along the River Alt.

- 6.3 The transect and automated surveys also recorded relatively large numbers of noctule and soprano pipistrelle foraging above the site on a regular basis. Other species recorded in low numbers at the site on an occasional basis included *Nathusius pipistrelle*, serotine, brown long-eared and *Myotis* spp. bats.
- 6.4 The surveys have highlighted key habitats and supporting habitats present at the site and identified the assemblage of species utilising the site.
- 6.5 Effects that are likely to occur due to the proposed development have been reviewed. Through the implementation of the above measures to maintain areas of good quality foraging and commuting habitat within the site for bats and minimising potential effects of artificial light spill associated with the proposals, it is considered that opportunities for foraging and commuting bat species recorded at the site can be maintained and potentially enhanced in the long-term.
- 6.6 Subject to the recommended measures being implemented and no further impacts arising, it is concluded unlikely that the proposed development of the site would result in a significant reduction in the interest of the site for foraging and commuting bats in the long-term.

7.0 References

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

Ecology Services Limited (2021) Protected Species Survey Report (Bats: Buildings)

Ecology Services Limited (2021) Protected Species Survey Report (Bats: Trees)

Google Maps (<https://www.google.com/maps>)

Guidance document on the strict protection of animal species of Community interest under the Habitats Directive 92-43-EEC (2007). Online - available from: http://ec.europa.eu/environment/nature/conservation/species/guidance/pdf/guidance_en.pdf [Accessed July 2021].

Harris, S. et al. (1995) A review of British mammals: population estimates and conservation status of British Mammals other than cetaceans. JNCC, Peterborough.

Individual Species Reports – Fourth Article 17 UK Habitats Directive Report (2019): Supporting Information (habitats & species). Online – available from <https://hub.jncc.gov.uk/assets/081db8a3-afa7-442b-bd0d-701aaf830bdc> [accessed July 2021].

Institution of Lighting Professionals (ILP) (2018) Bats and artificial lighting in the UK, ILP, Rugby, Warwickshire.

Marnell, F. & Presetnik, P. (2010) Protection of over ground roosts for bats (particularly roosts in buildings of cultural heritage importance). EUROBATS Publication Series No. 4 (English Version). UNEP/EUROBATS secretariat, Bonn, Germany.

Ministry of Housing, Communities & Local Government (February 2019). National Planning Policy Framework. Online - available from:

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/779771/NPPF_Feb_2019_print.pdf. [Accessed July 2021]

Mitchell-Jones, A.J. (2004). The Bat Workers Manual (3rd Edition) JNCC. The Bat Mitigation Guidelines (English Nature 2004)

Rowse, E.G., Lewanzik D., Stone, E.L., Harris, S. & Jones G. (2016) *Dark Matters: The Effects of Artificial Lighting on Bats*. In: Voigt C., Kingston T. (eds) *Bats in the Anthropocene: Conservation of Bats in a Changing World*. Springer, Cham

Species Factsheet, Bat Conservation Trust, Online – available from: <http://www.bats.org.uk/about-bats/what-are-bats/uk-bats> [Accessed July 2021].

Stone, E.L. (2013) Bats and lighting: Overview of current evidence and mitigation guidance

The Conservation of Habitats and Species Regulations 2017 (as amended).

The EEC Directive 1992 (European Legislation).

The Wildlife & Countryside Act 1981 (as amended)

UK Biodiversity Steering Group (1995) Biodiversity – the UK Steering Group Report. Volume 2: Action Plans. P89 SAP for Pipistrelle. London, HMSO.

Figure 1:
Transect Survey 1 –
Transect Route, Listening Points and Automated Detector Location Plan

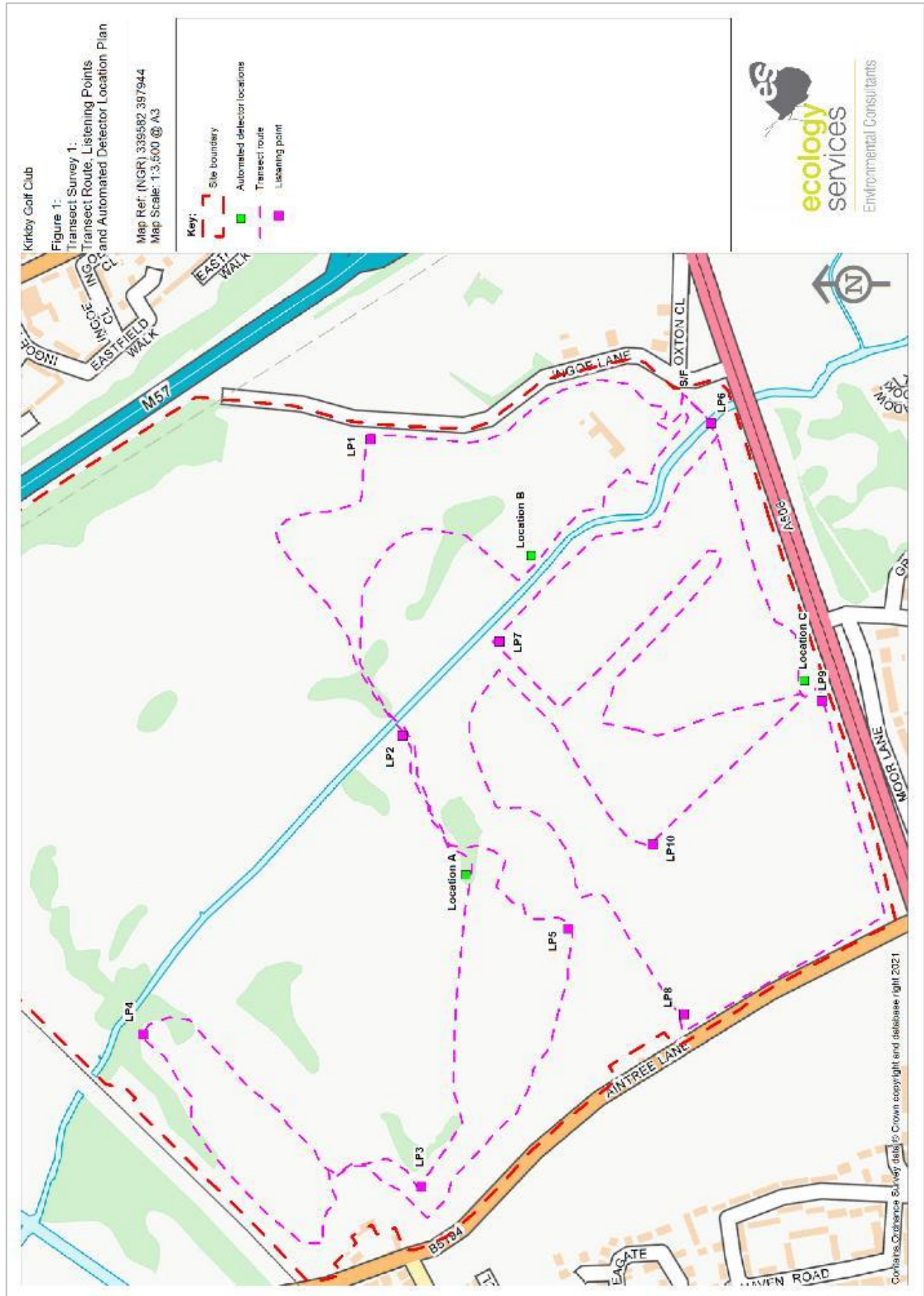


Figure 2:
Transect Survey 2-12 –
Transect Route, Listening Points and Automated Detector Location Plan

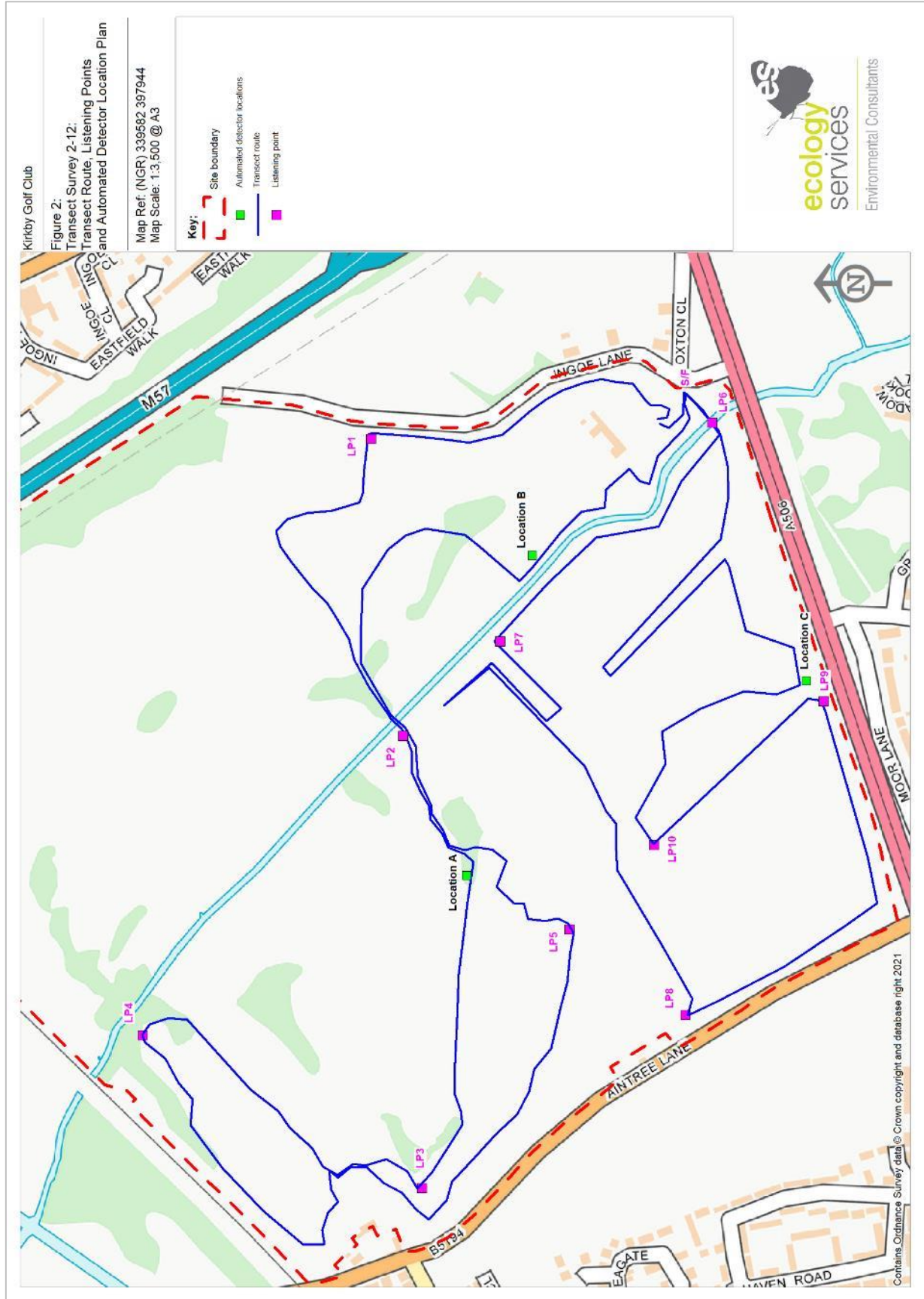


Figure 3:
Transect Survey 1 – Results Summary Plan

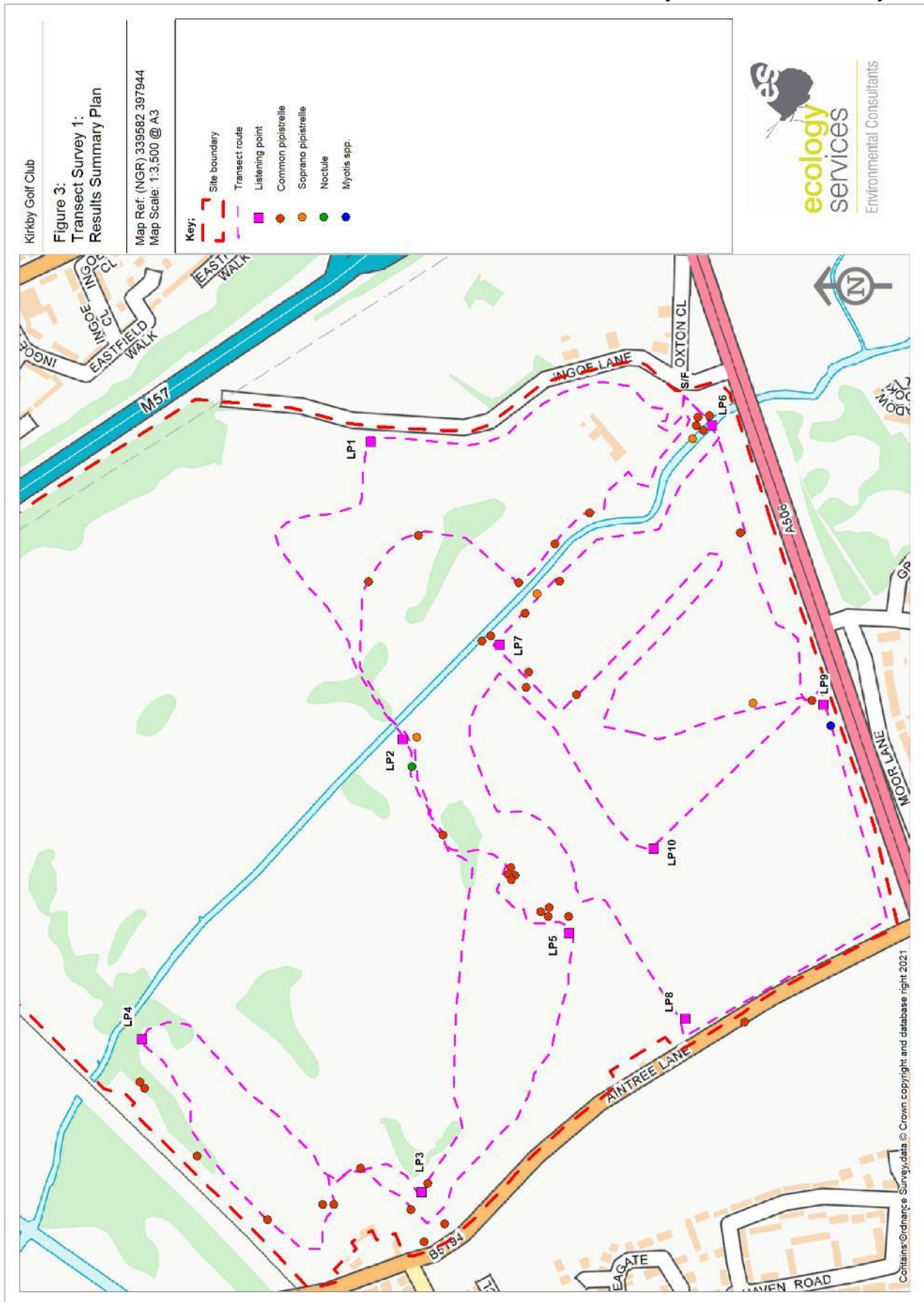


Figure 4:
Transect Survey 2 – Results Summary Plan

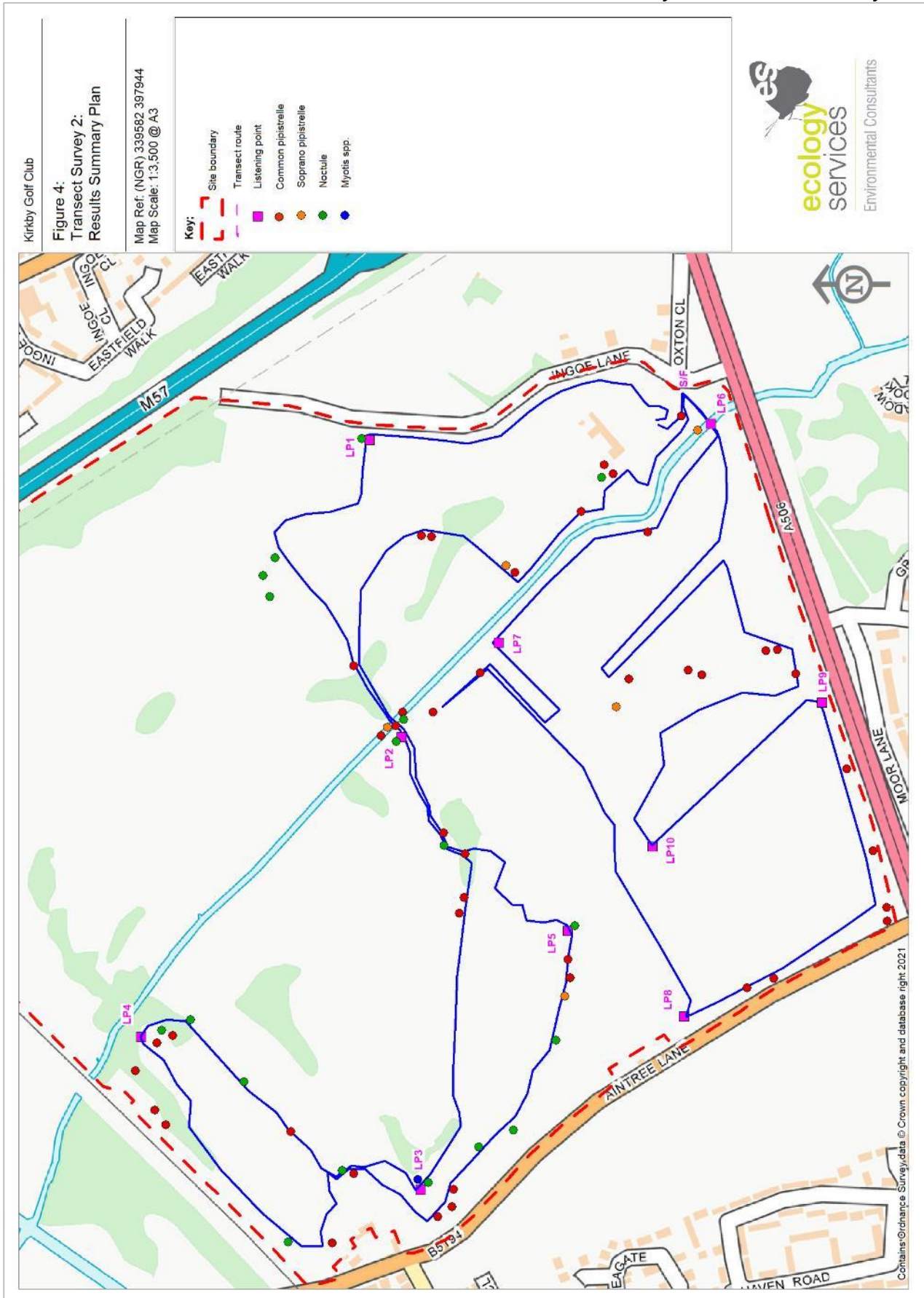


Figure 5:
Transect Survey 3 – Results Summary Plan



Figure 6:
Transect Survey 4 – Results Summary Plan



Figure 7:
Transect Survey 5 – Results Summary Plan



Figure 8:
Transect Survey 6 – Results Summary Plan

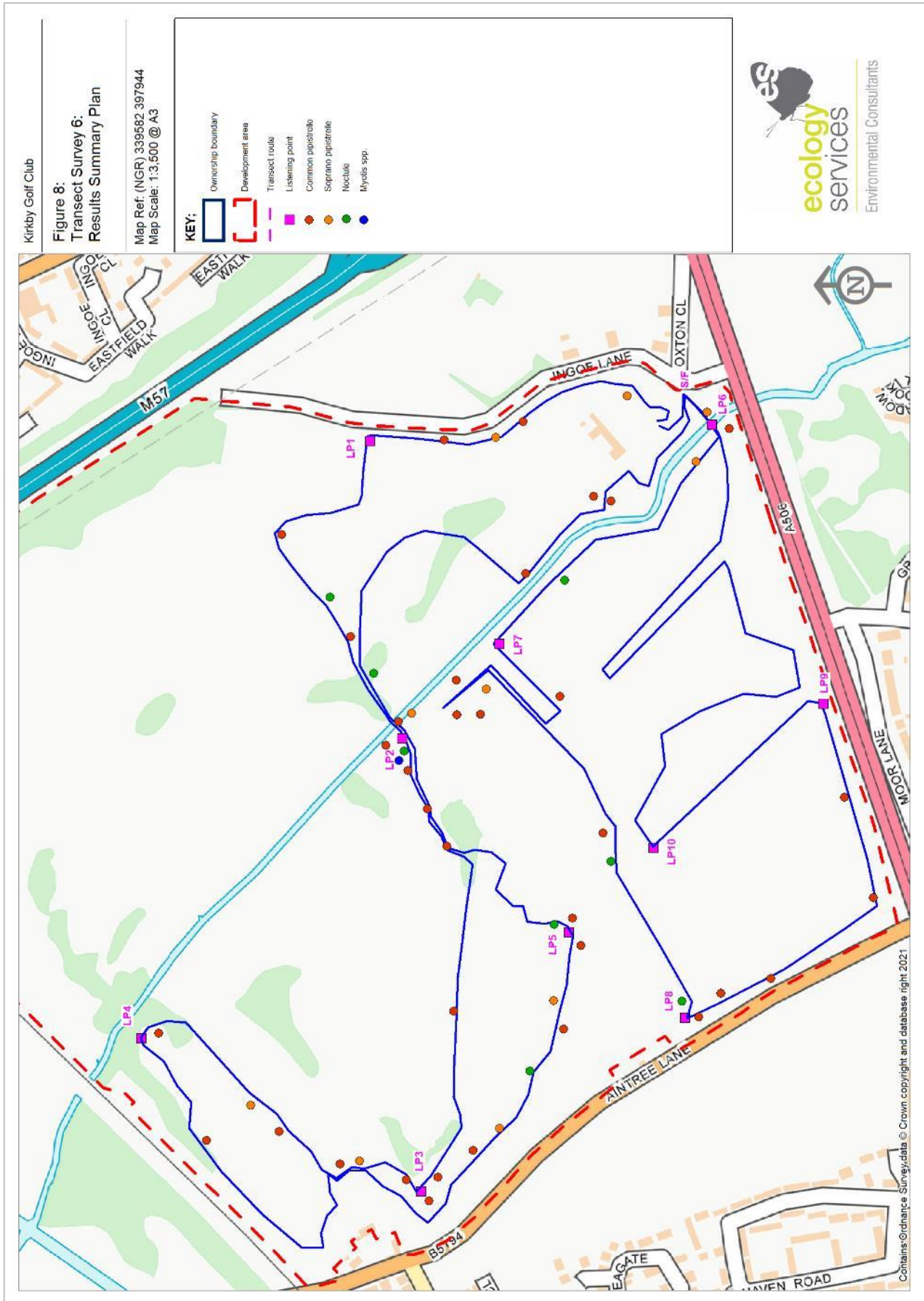


Figure 9:
Transect Survey 7 – Results Summary Plan

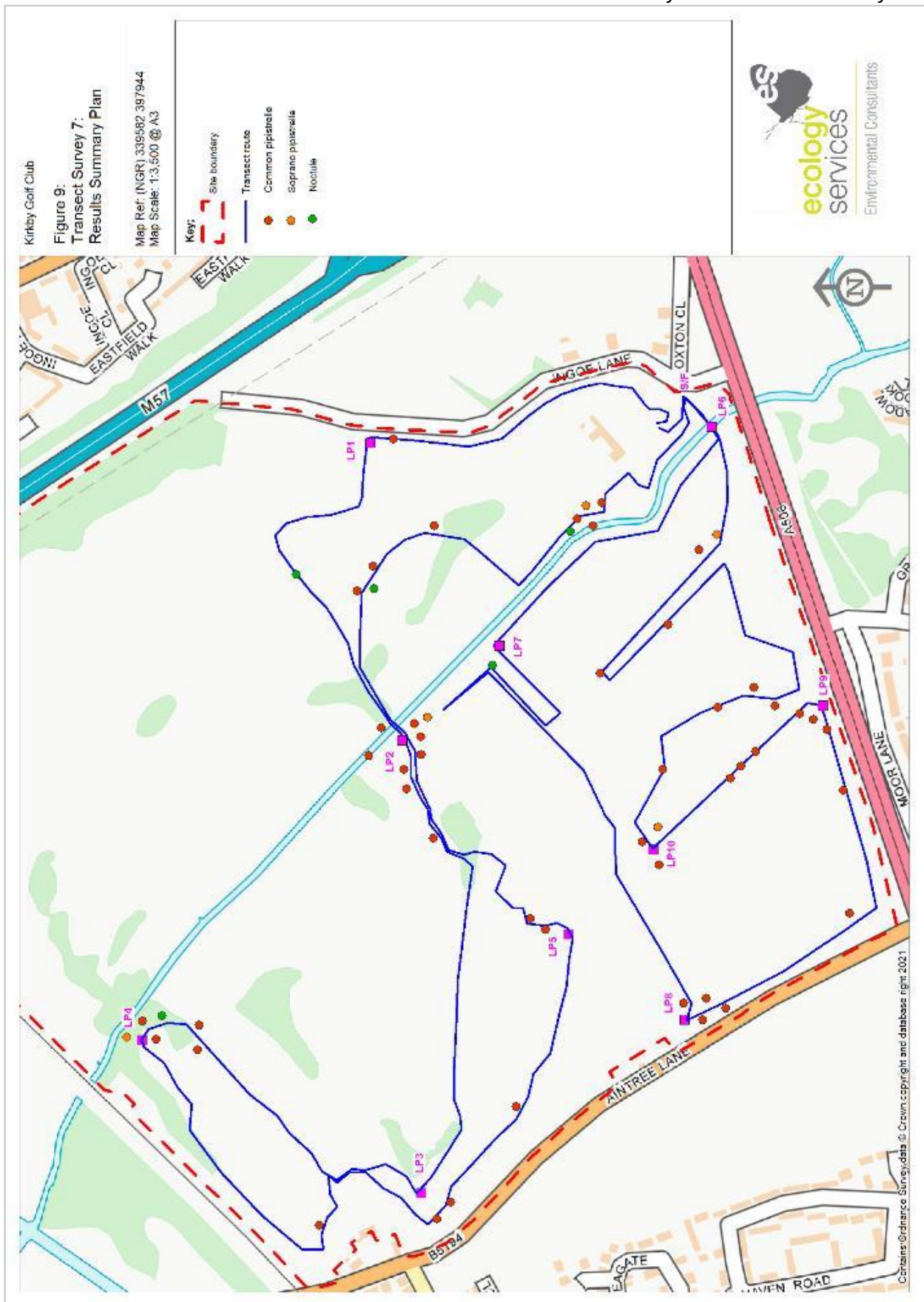


Figure 10:
Transect Survey 8 – Results Summary Plan



Figure 11:
Transect Survey 9 – Results Summary Plan

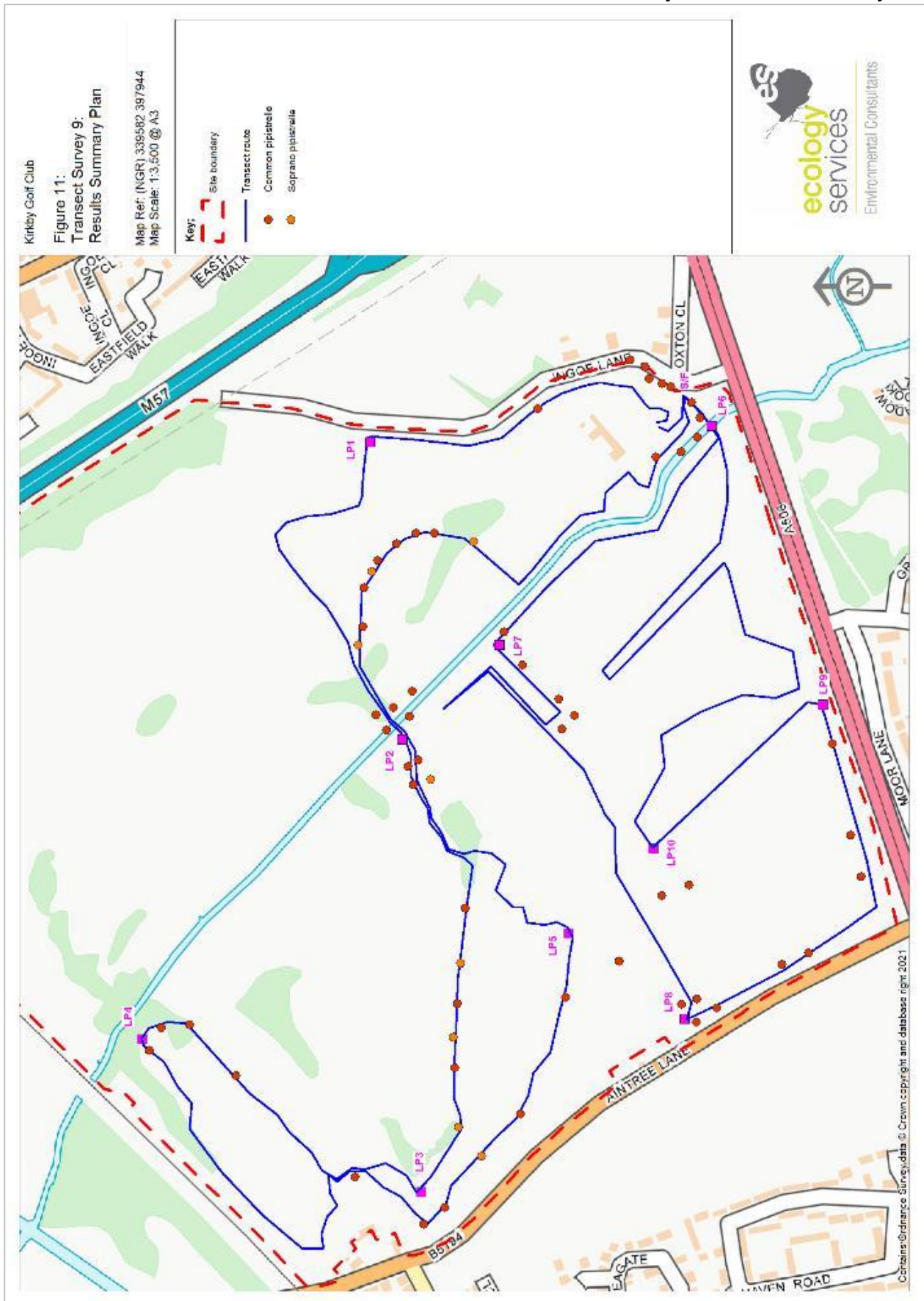


Figure 12:
Transect Survey 10 – Results Summary Plan

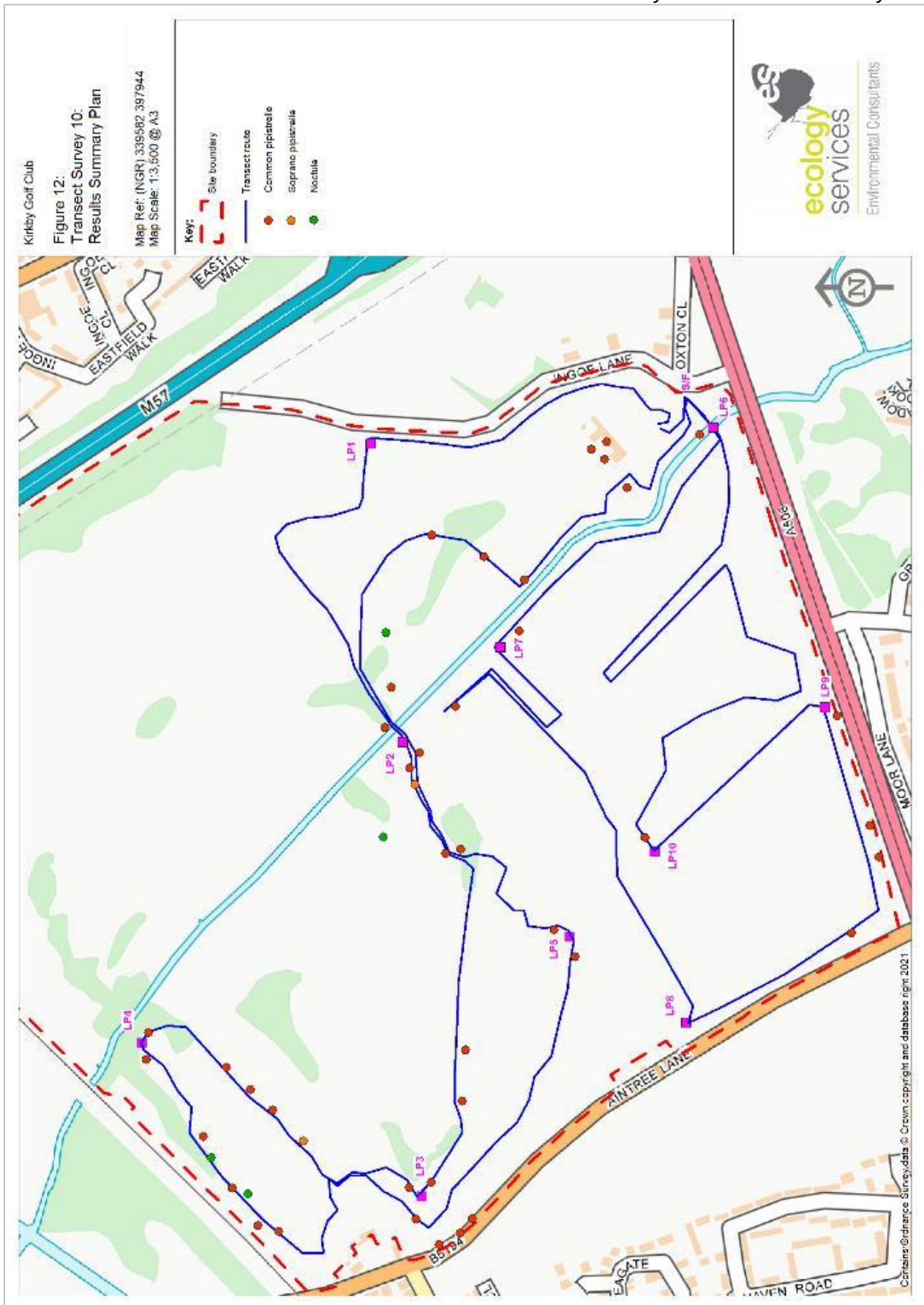


Figure 13:
Transect Survey 12 – Results Summary Plan

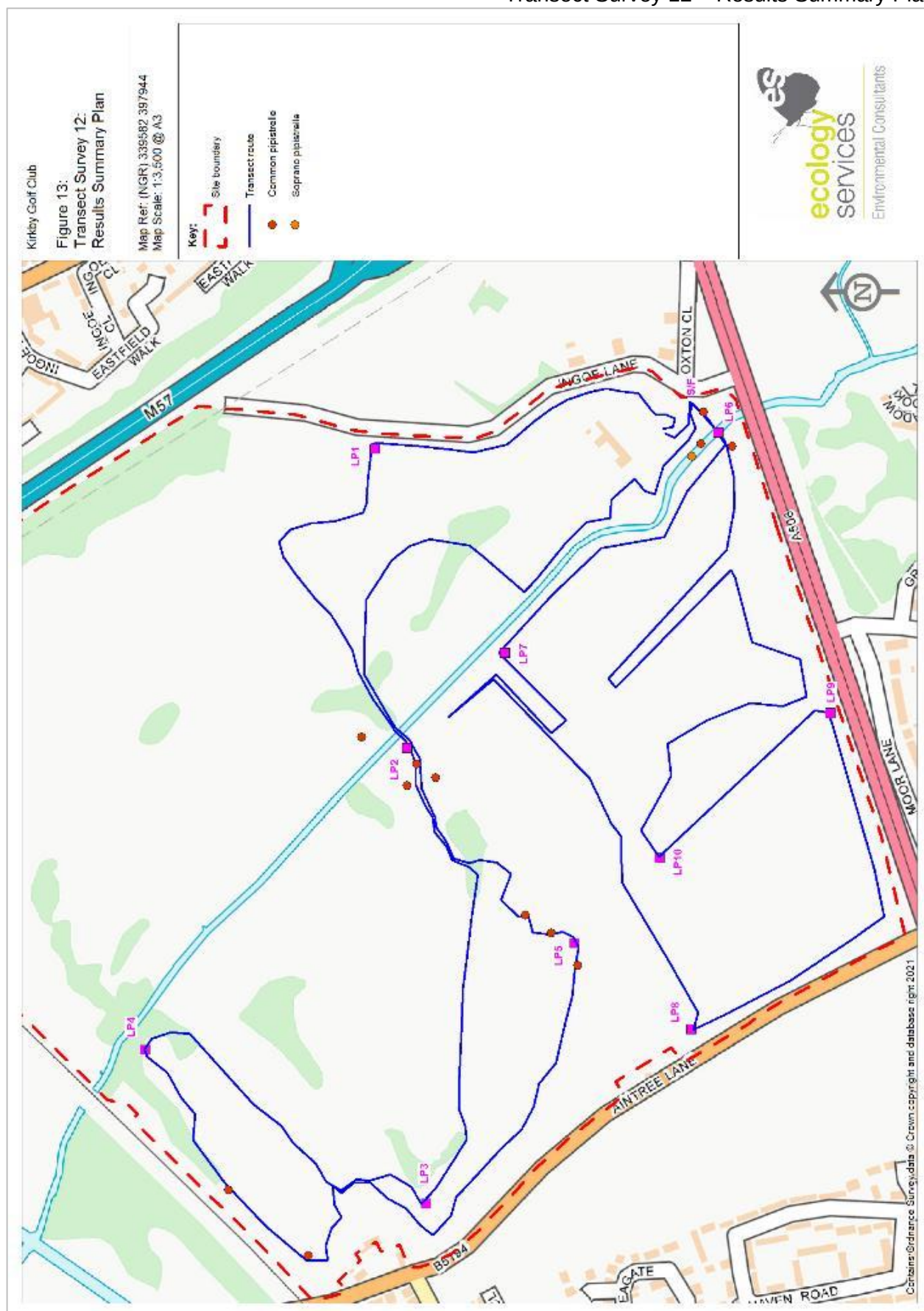


Figure 14:
All Transect Surveys Combined – Results Summary Plan

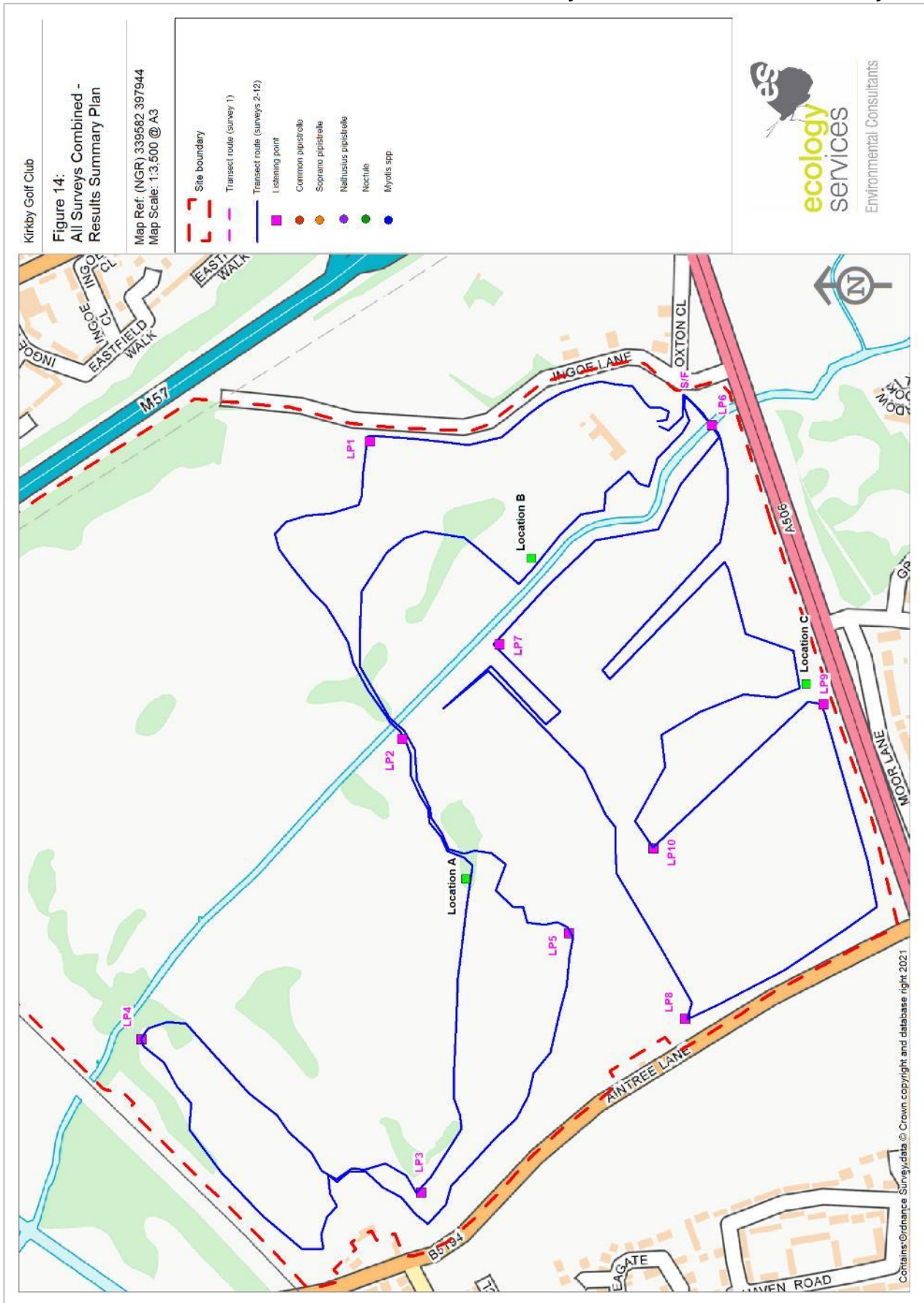


Figure 15a:
Automated Survey Period 1 – All species recordings per night

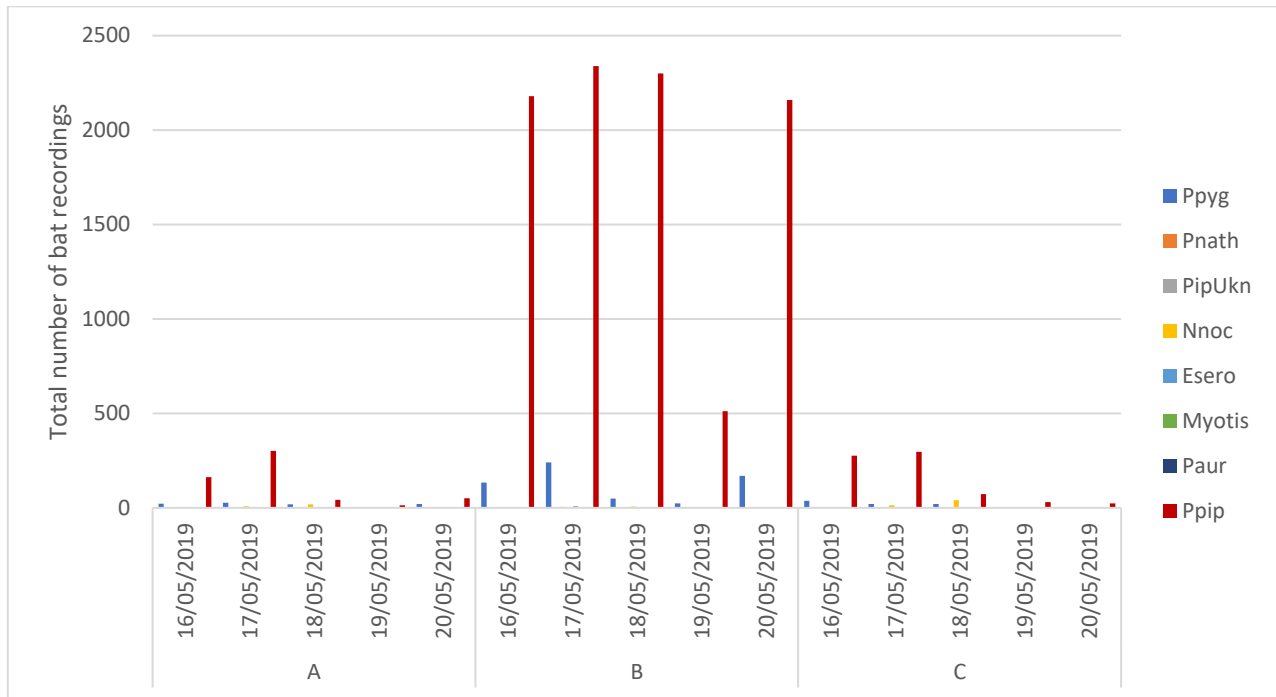
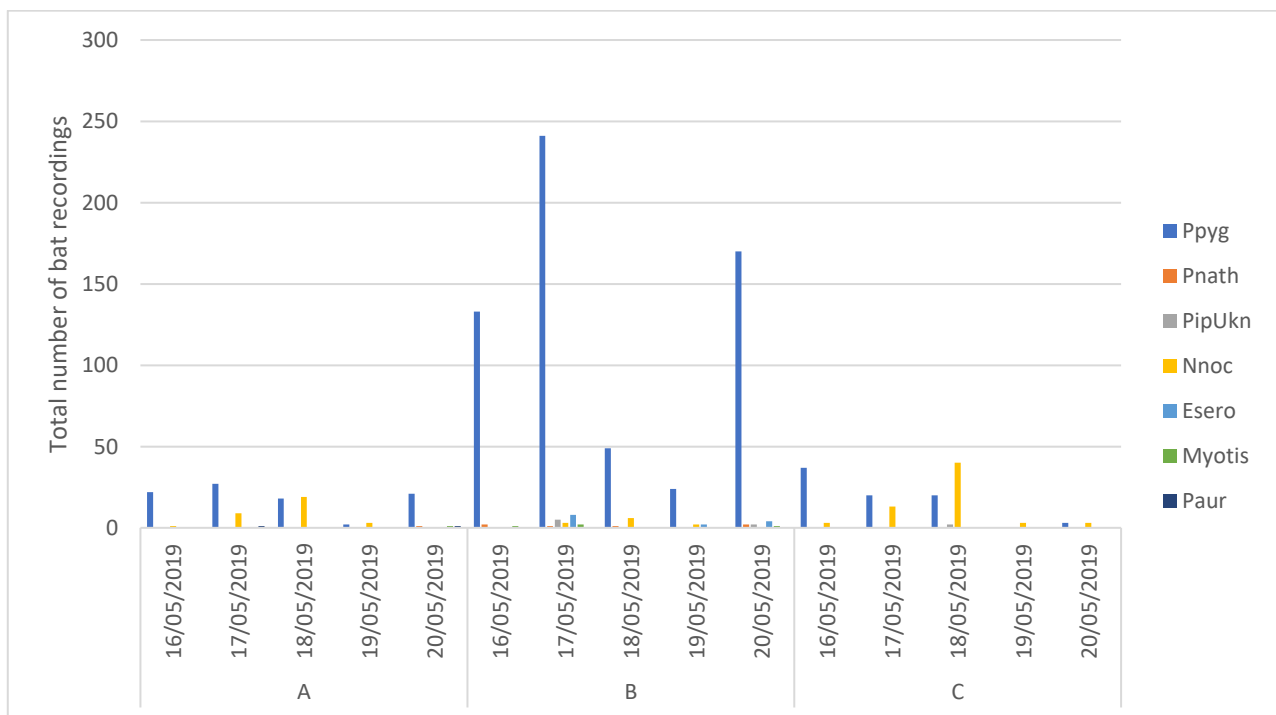


Figure 15b:
Automated Survey Period 1 – Species recordings per night*



*excluding Common Pipistrelle (Ppip).

Ppyg = Soprano pipistrelle (*Pipistrellus pygmaeus*), Pnath = Nathusius pipistrelle (*Pipistrellus nathusii*), PipUkn = *Pipistrellus* spp. (common, soprano or Nathusius pipistrelle), Nnoc = Noctule (*Nyctalus noctula*), Esero = Serotine (*Eptesicus serotinus*), Myotis = *Myotis* spp., Paur = Brown long-eared (*Plecotus auritus*), Ppip = Common pipistrelle (*Pipistrellus pipistrellus*).

Figure 16:
Automated Survey Period 1 – Total recordings per hour

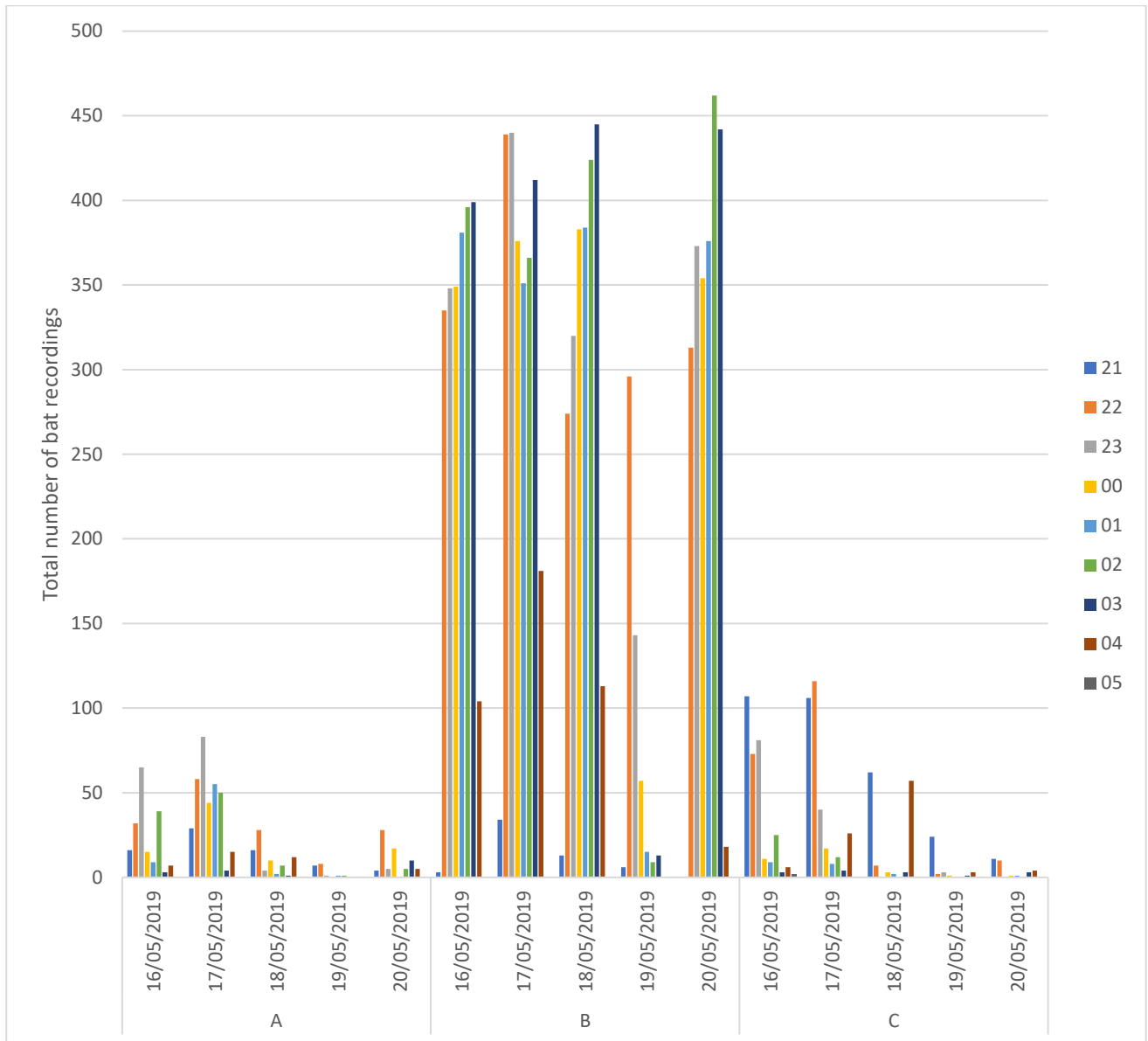
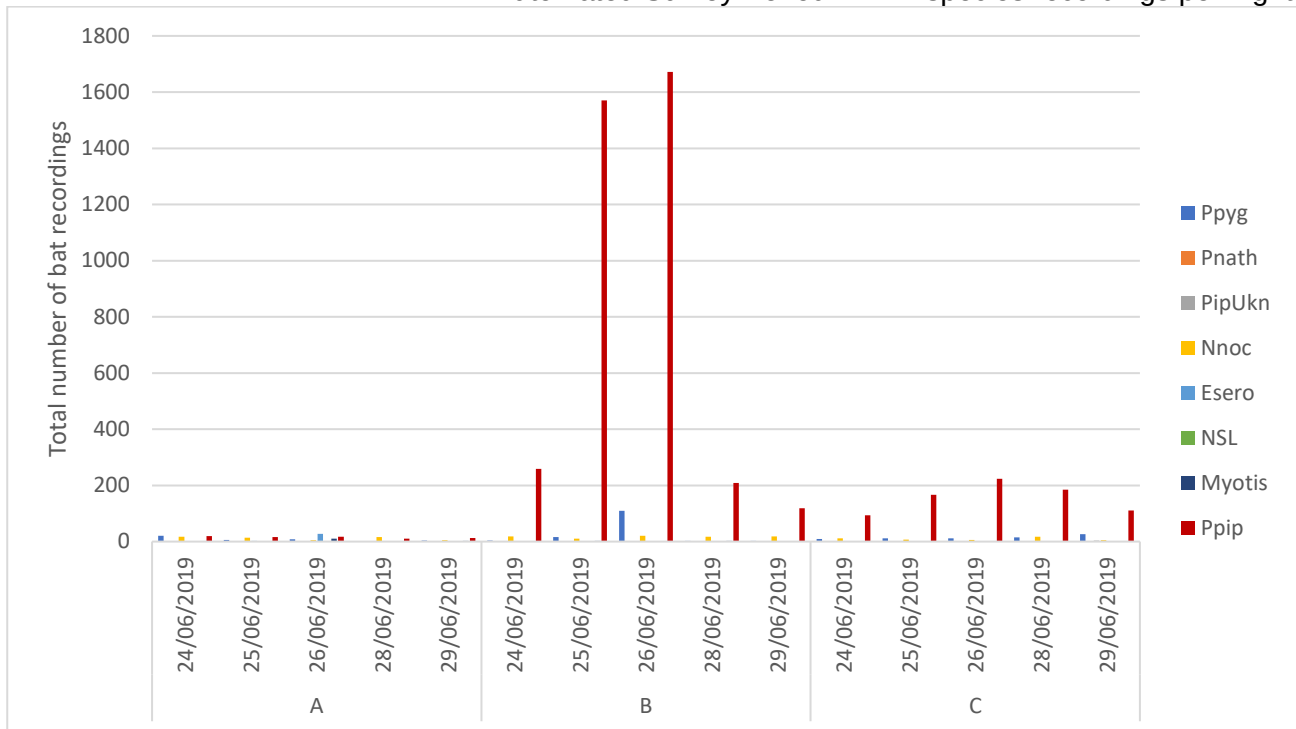
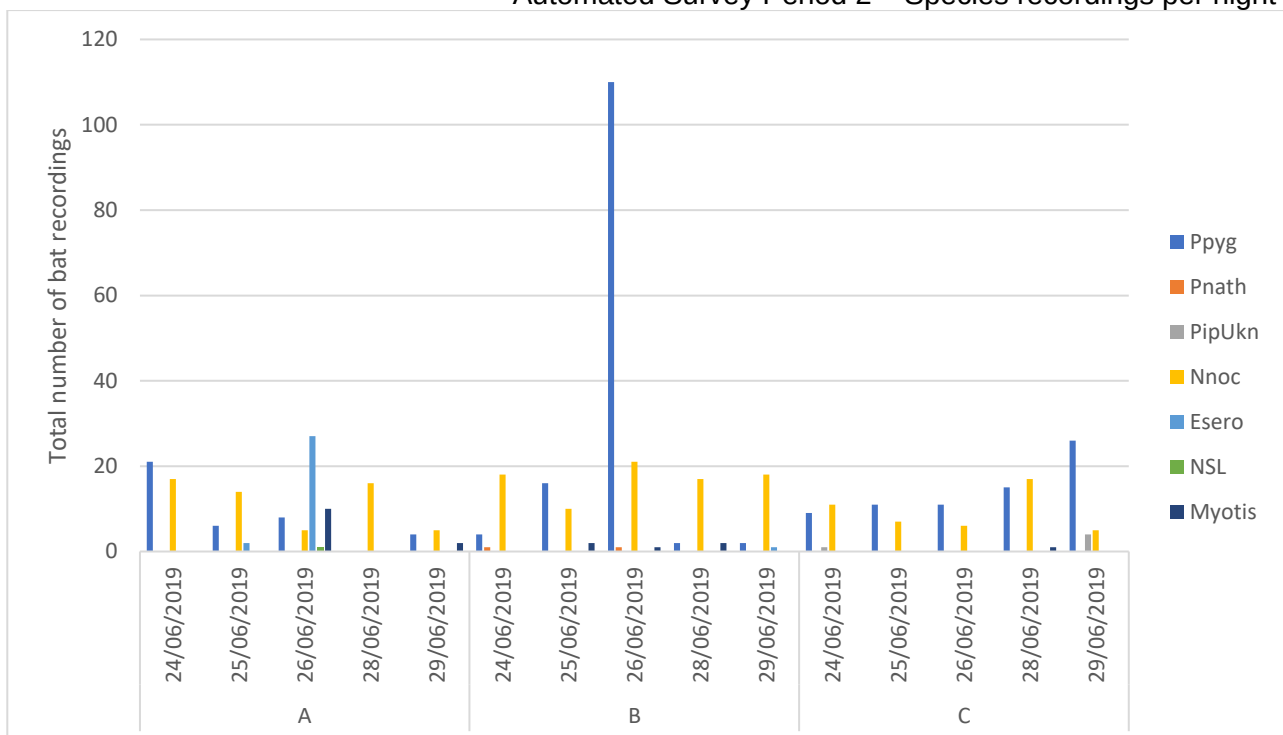


Figure 17a:

Automated Survey Period 2 – All species recordings per night

**Figure 17b:**

Automated Survey Period 2 – Species recordings per night*



*excluding Common Pipistrelle (Ppip)

Ppyg = Soprano pipistrelle (*Pipistrellus pygmaeus*), Pnath = Nathusius pipistrelle (*Pipistrellus nathusii*), PipUkn = *Pipistrellus* spp. (common, soprano or Nathusius pipistrelle), Nnoc = Noctule (*Nyctalus noctula*), Esero = Serotine (*Eptesicus serotinus*), NSL = Noctule, Serotine or Leisler's, Myotis = *Myotis* spp., Ppip = Common pipistrelle (*Pipistrellus pipistrellus*).

Figure 18:
Automated Survey Period 2 – Total recordings per hour

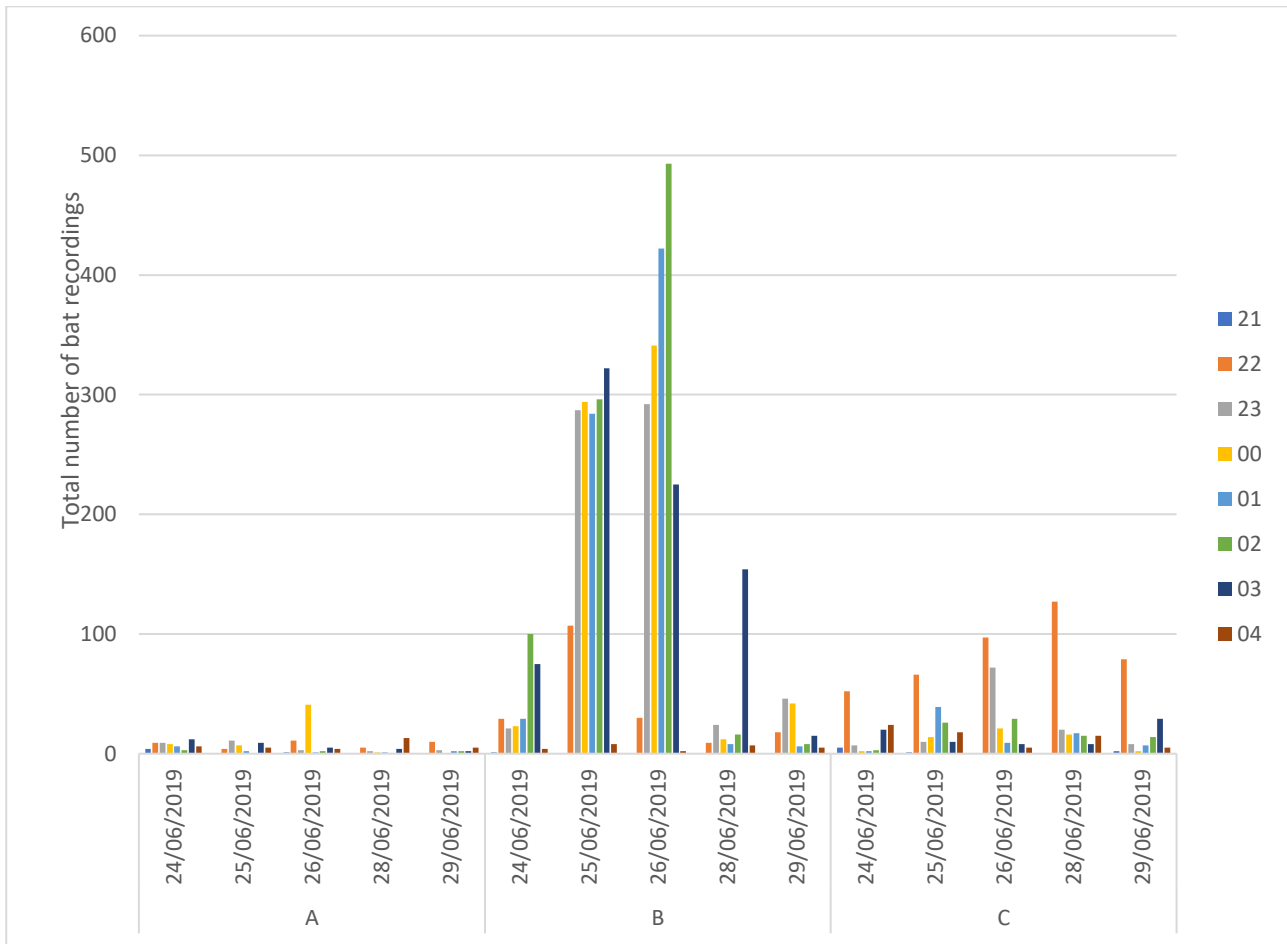


Figure 19a:
Automated Survey Period 3 – All species recordings per night

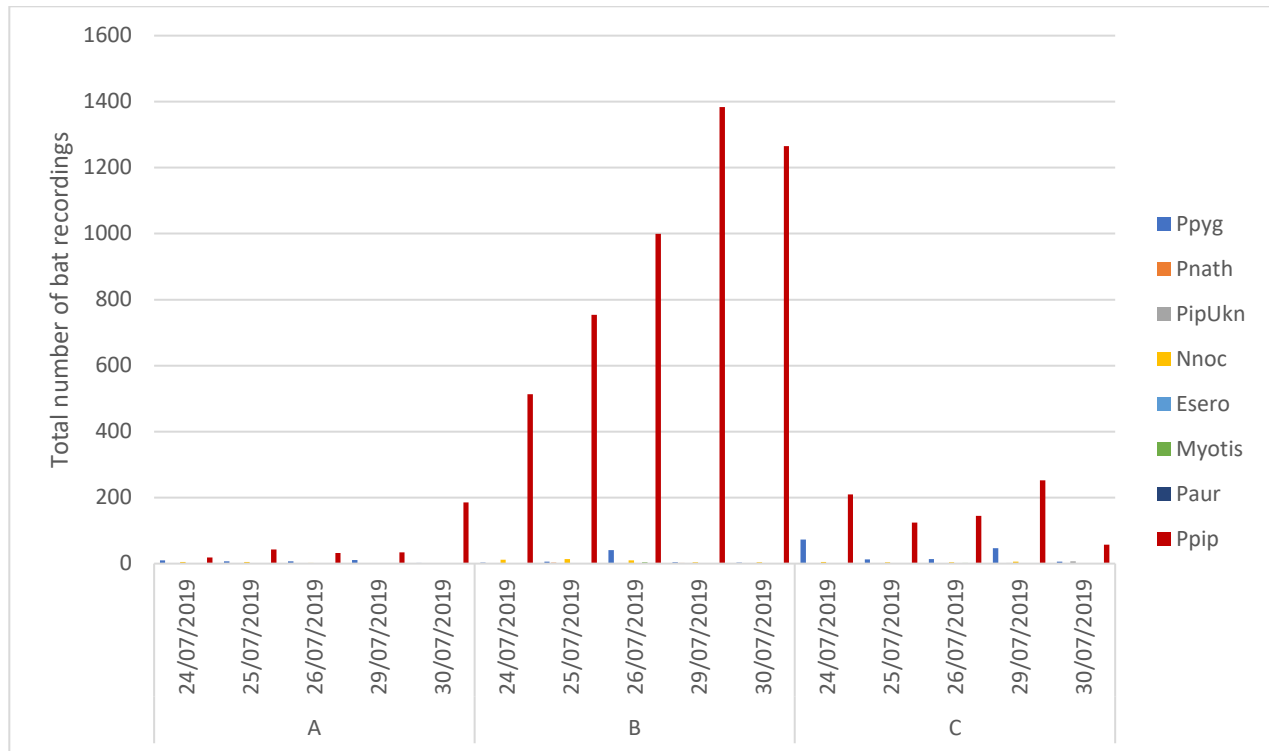
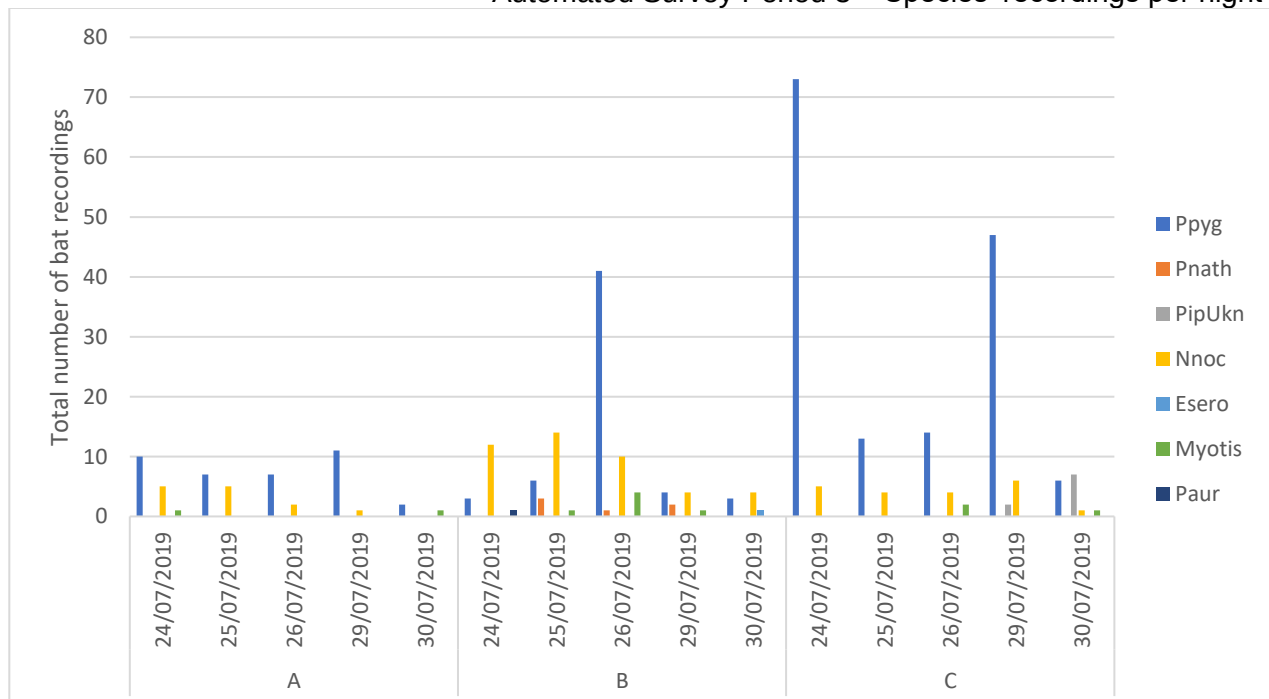


Figure 19b:
Automated Survey Period 3 – Species' recordings per night*



*excluding Common Pipistrelle (Ppip)

Ppyg = Soprano pipistrelle (*Pipistrellus pygmaeus*), Pnath = Nathusius pipistrelle (*Pipistrellus nathusii*), PipUkn = *Pipistrellus* spp. (common, soprano or Nathusius pipistrelle), Nnoc = Noctule (*Nyctalus noctula*), Esero = Serotine (*Eptesicus serotinus*), Myotis = *Myotis* spp., Paur = Brown long-eared (*Plecotus auritus*), Ppip = Common pipistrelle (*Pipistrellus pipistrellus*).

Figure 20:
Automated Survey Period 3 – Total recordings per hour

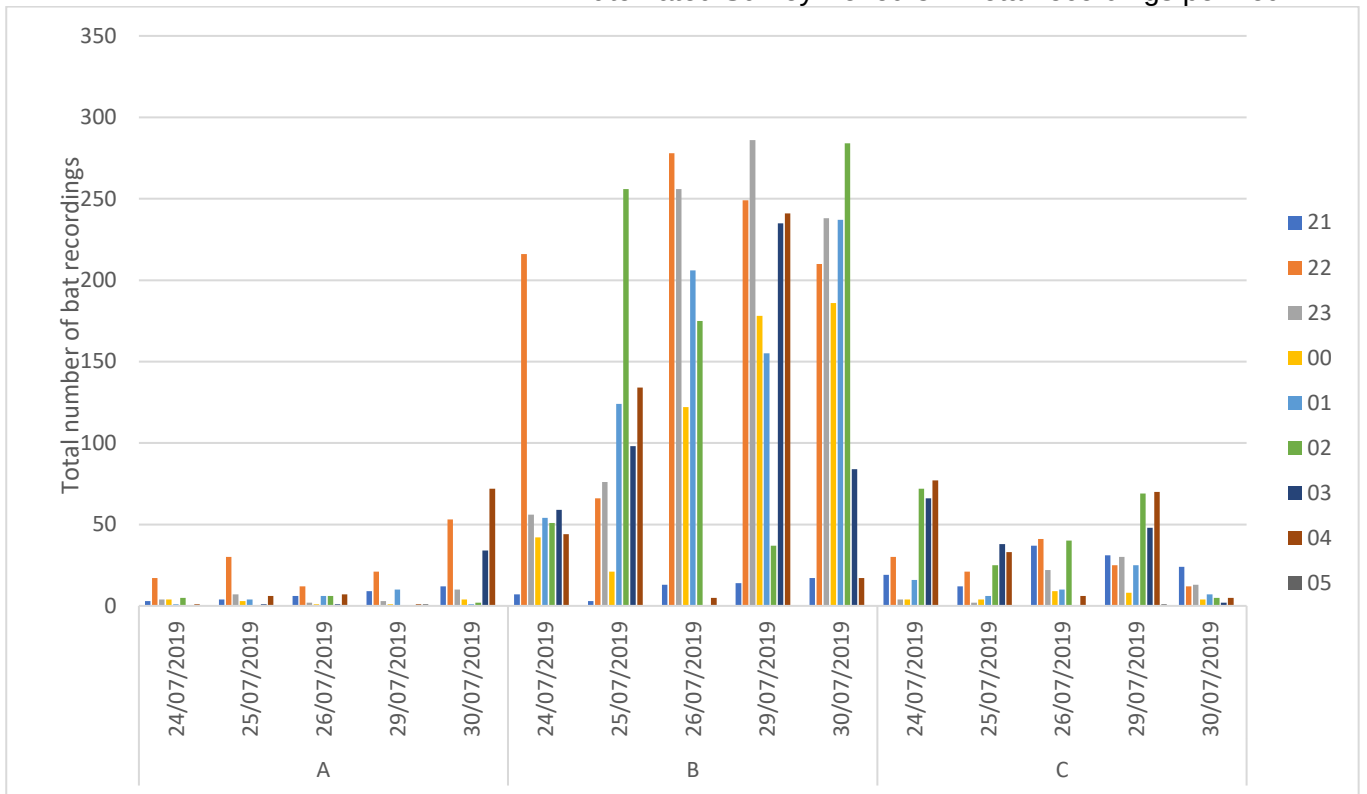


Figure 21a:
Automated Survey Period 4- All species recordings per night

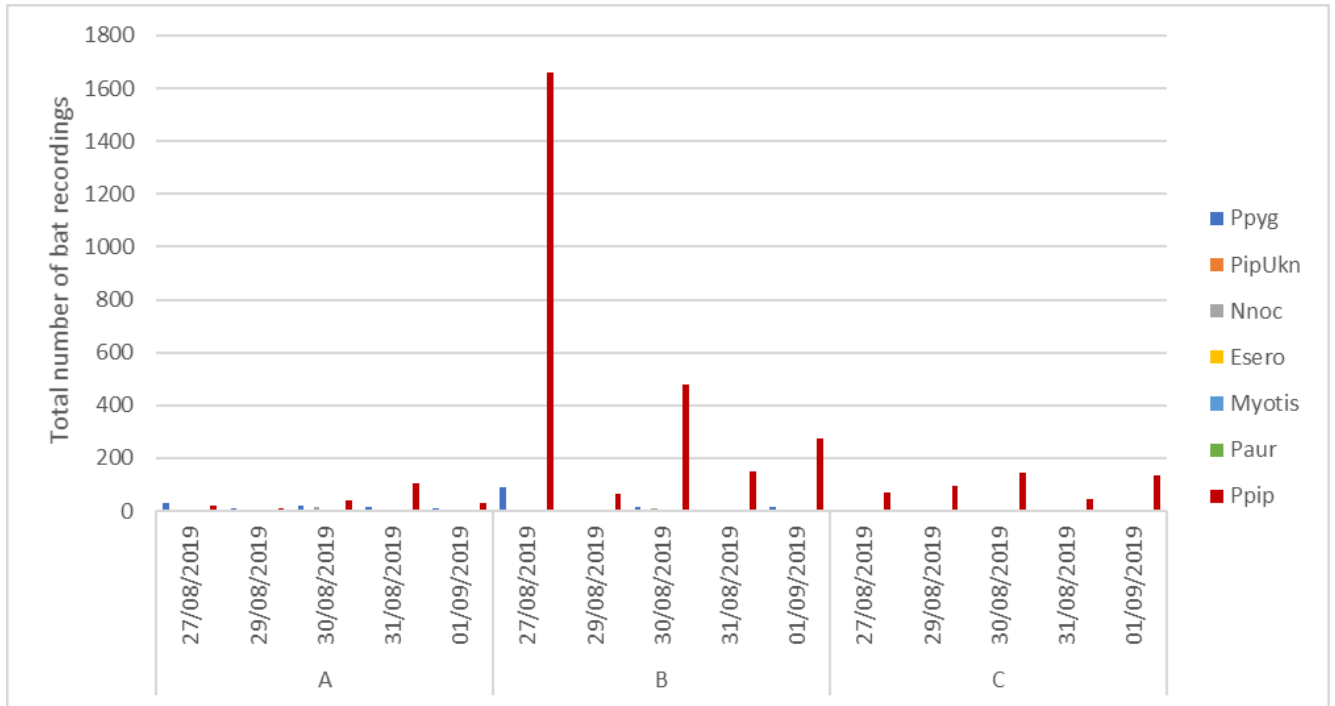
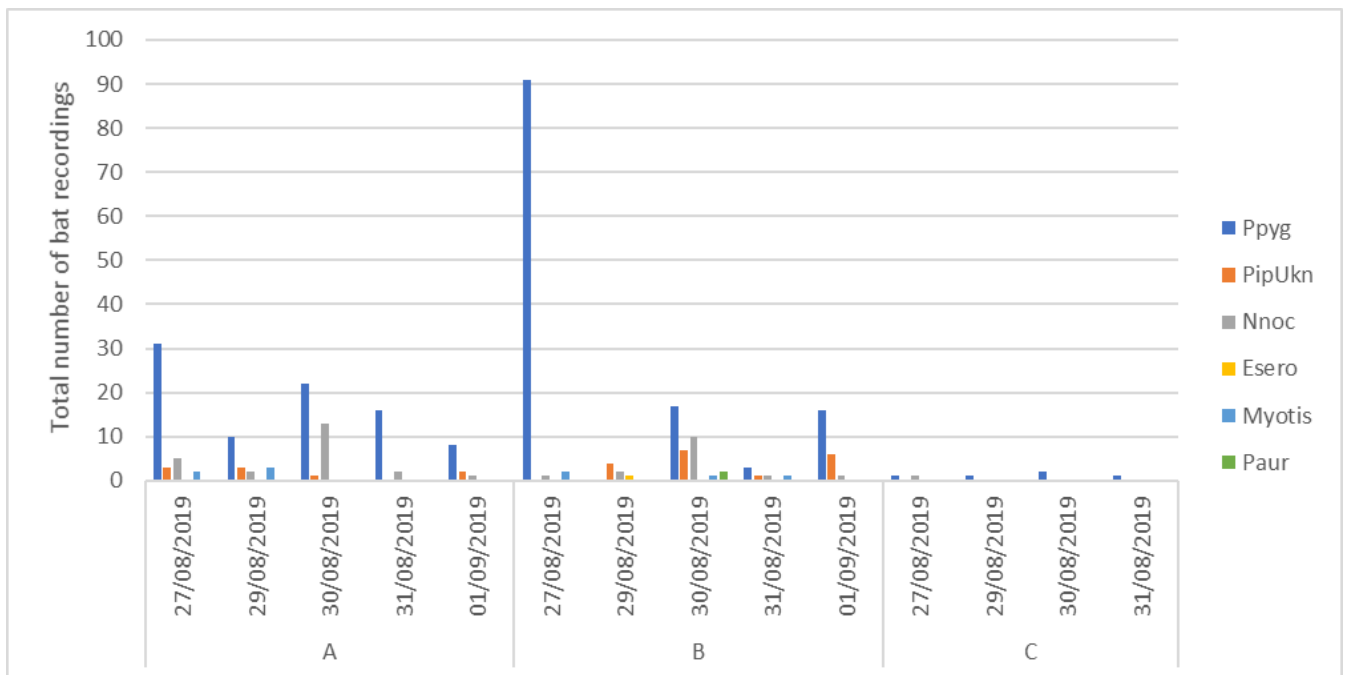


Figure 21b:
Automated Survey Period 4- Species' recordings per night*



*excluding Common Pipistrelle (Ppip)

Ppyg = Soprano pipistrelle (*Pipistrellus pygmaeus*), PipUkn = *Pipistrellus* spp. (common, soprano or Nathusius pipistrelle), Nnoc = Noctule (*Nyctalus noctula*), Esero= Serotine (*Eptesicus serotinus*), Myotis = *Myotis* spp., Paur = Brown long-eared (*Plecotus auritus*), Ppip = Common pipistrelle (*Pipistrellus pipistrellus*).

Figure 22:
Automated Survey Period 4- Total recordings per hour

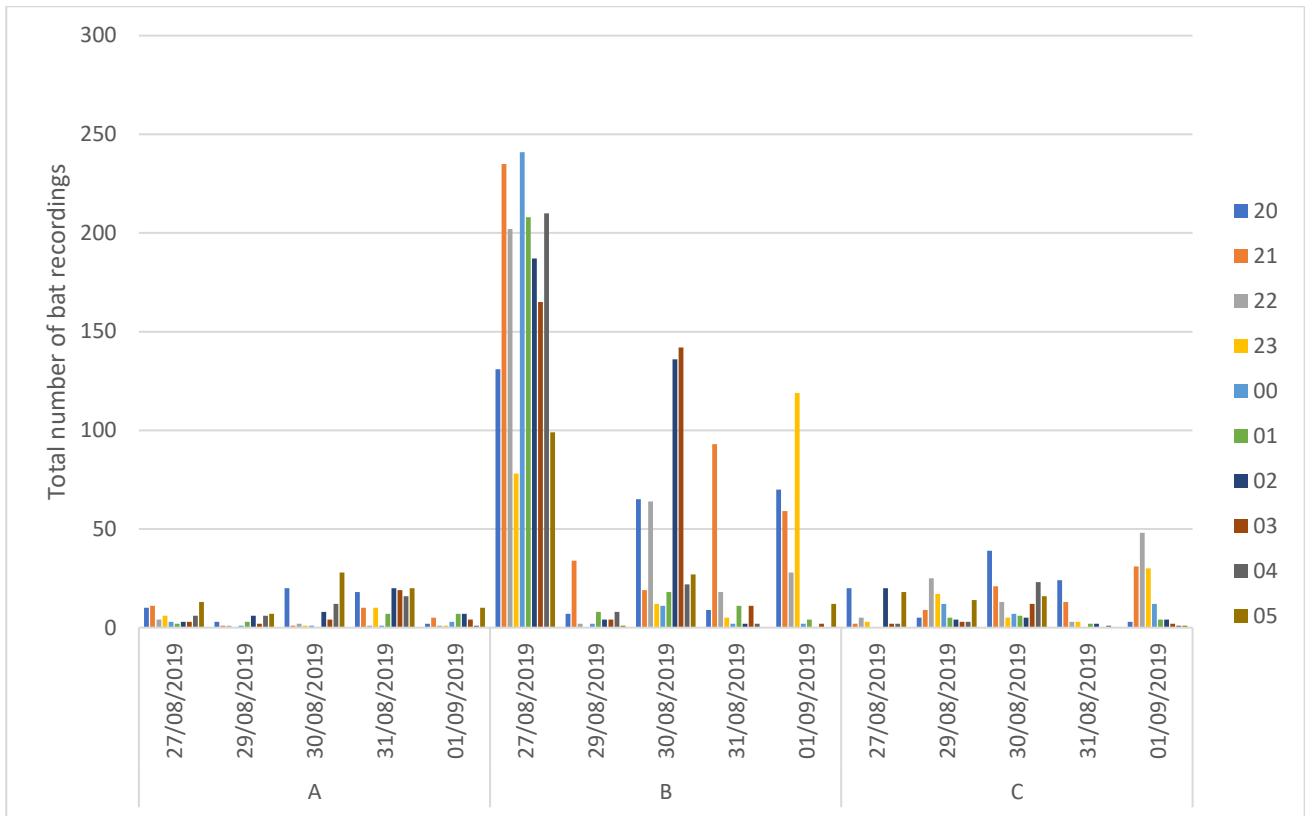


Figure 23a:
Automated Survey Period 5 – All species recordings per night

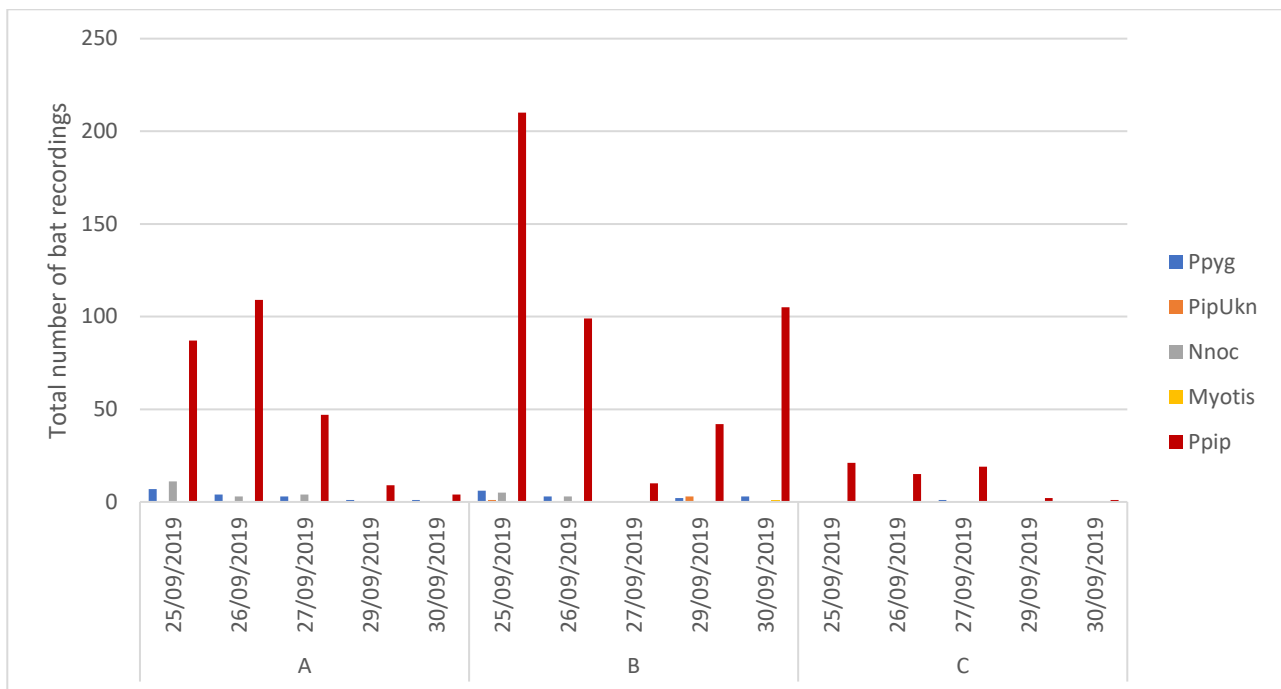
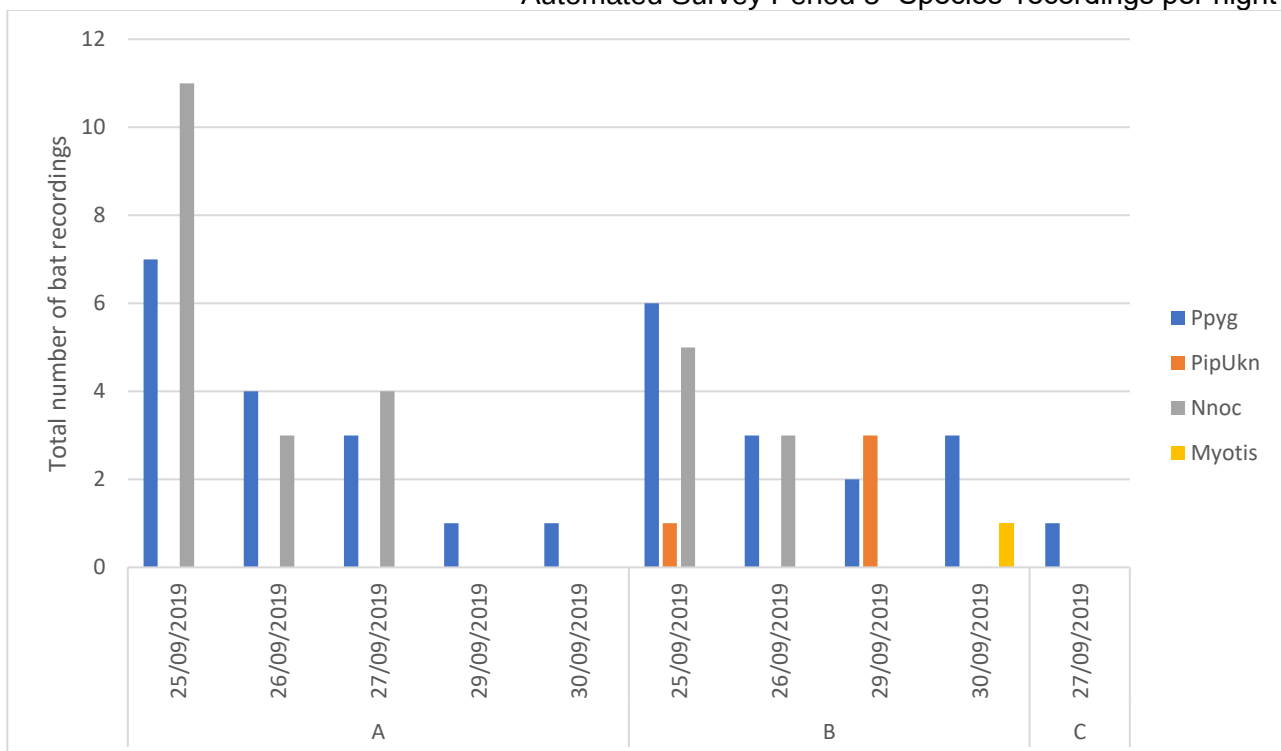


Figure 23b:
Automated Survey Period 5- Species' recordings per night*



*excluding Common pipistrelle (Ppip)

Ppyg = Soprano pipistrelle (*Pipistrellus pygmaeus*), PipUkn = *Pipistrellus* spp. (common, soprano or Nathusius pipistrelle), Nnoc = Noctule (*Nyctalus noctula*), Myotis = *Myotis* spp., Ppip = Common pipistrelle (*Pipistrellus pipistrellus*).

Figure 24:
Automated Survey Period 5- Total recordings per hour

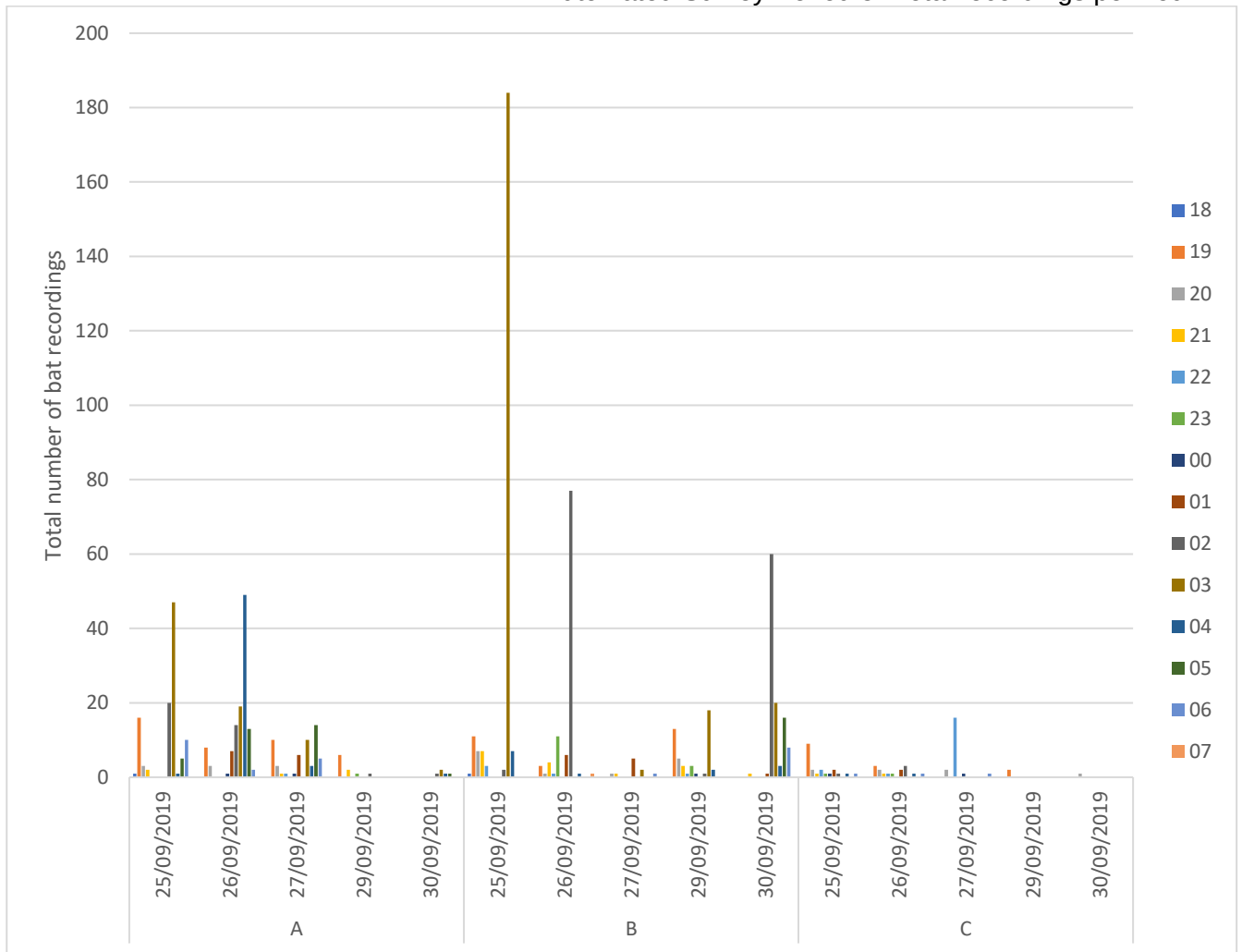


Figure 25a:
Automated Survey Period 6- All species recordings per night.

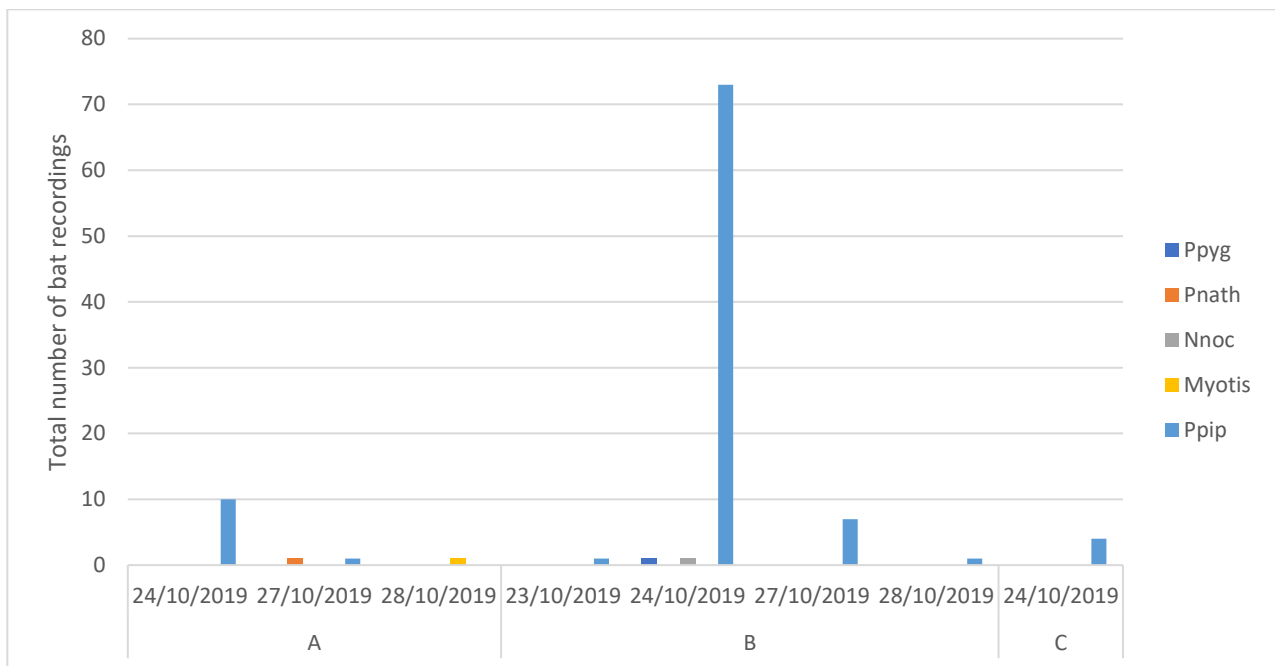
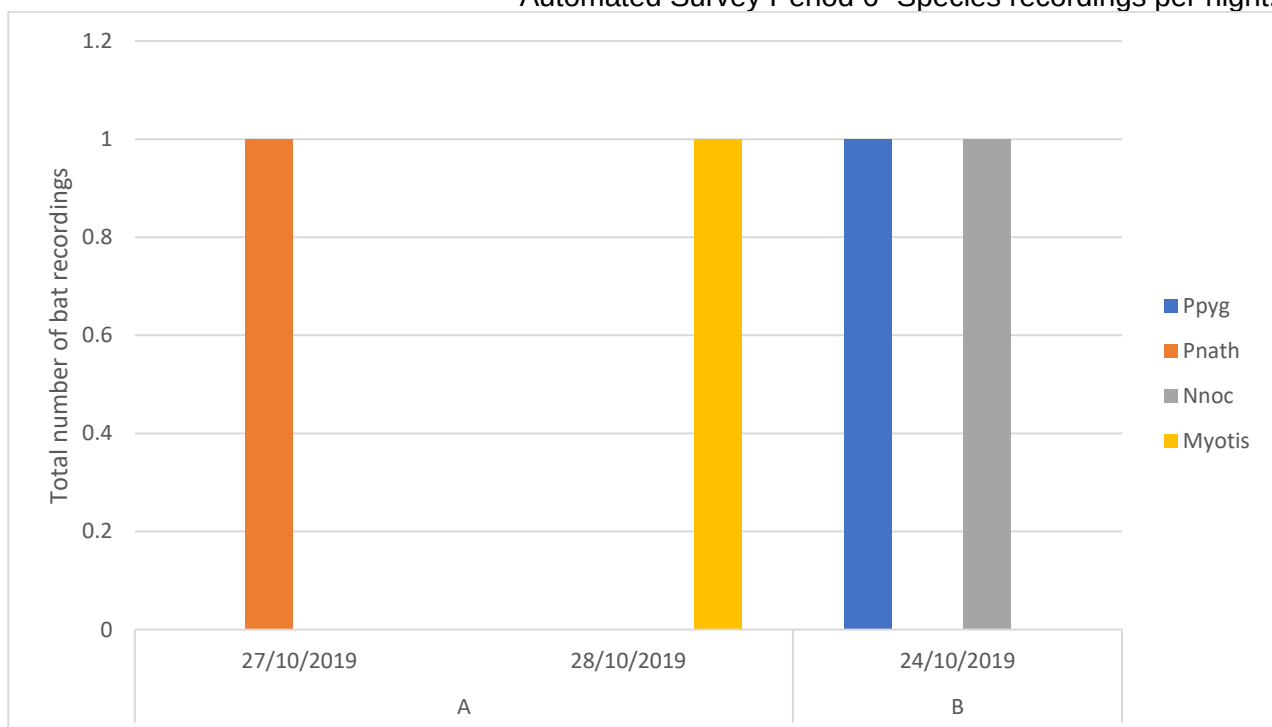


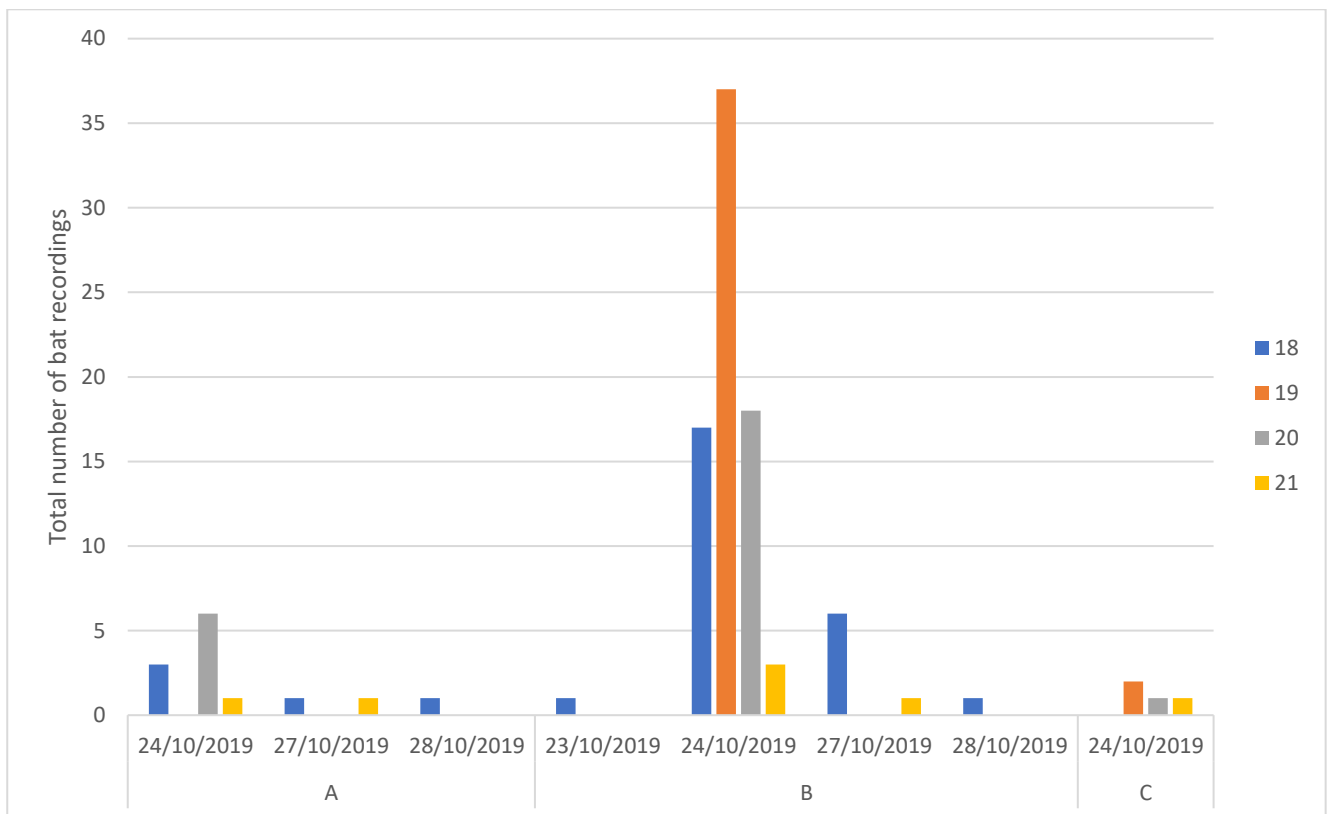
Figure 25b:
Automated Survey Period 6- Species recordings per night.



*excluding Common pipistrelle (Ppip)

Ppyg = Soprano pipistrelle (*Pipistrellus pygmaeus*), Pnath= Nathusius pipistrelle (*Pipistrellus nathusii*), Nnoc = Noctule (*Nyctalus noctula*), Myotis = *Myotis* spp., Ppip = Common pipistrelle (*Pipistrellus pipistrellus*).

Figure 26:
Automated Survey Period 6- Total recordings per hour



Appendix 1:**Table 4.1** Guidelines for assessing the potential suitability of proposed development sites for bats, based on the presence of habitat features within the landscape, to be applied using professional judgement (Taken from the Bat Conservation Trust Bat Surveys for Professional Ecologists: Good Practice Guidelines, 2016).

Suitability	Description	
	Roosting habitats	Commuting & foraging habitats
Negligible	Negligible habitat features on site likely to be used by roosting bats.	Negligible habitat features on site likely to be used by commuting or foraging bats.
Low	A structure with one or more potential roost sites that could be used by individual bats opportunistically. However, these potential roost sites do not provide enough space, shelter, protection, appropriate conditions¹ and/or suitable surrounding habitat to be used on a regular basis or by larger numbers of bats (i.e. unlikely to be suitable for maternity or hibernation²). A tree of sufficient size and age to contain PRF's but with none seen from the ground or features seen with only very limited roosting potential³.	Habitat that could be used by small numbers of commuting bats such as gappy hedgerow or un-vegetated stream, but isolated, i.e. not very well connected to the surrounding landscape by other habitat. Suitable, but isolated habitat that could be used by small numbers of foraging bats such as a lone tree (not in a parkland situation) of a patch of scrub.
Moderate	A structure or tree with one or more potential roost sites that could be used by bats due to their size, shelter, protection, conditions ¹ and surrounding habitat but unlikely to support a roost of high conservation status (with respect to roost type only – the assessments in this table are made irrespective of species conservation status, which is established after presence is confirmed).	Continuous habitat connected to the wider landscape that could be used by bats for commuting such as lines of trees and scrub or linked back to gardens. Habitat that is connected to the wider landscape that could be used by bats for foraging such as trees, scrub, grassland and water.
High	A structure or tree with one or more potential roost sites that are obviously suitable for use by larger numbers of bats on a more regular basis and potentially for longer periods of time due to their size, shelter, protection, conditions ¹ and surrounding habitat.	Continuous, high quality habitat that is well connected to the wider landscape that is likely to be used regularly by commuting bats such as river valleys, streams, hedgerows, lines of trees and woodland edge. High quality habitat that is well connected to the wider landscape that is likely to be used regularly by foraging bats such as broad-leaved woodland, tree-lined watercourses and grazed parkland. Site is close to and connected to known roosts.

¹For example, in terms of temperature, humidity, height above ground level, light levels or levels of disturbance.²Evidence from the Netherlands shows mass swarming events of common pipistrelle bats in the autumn followed by mass hibernation in a diverse range of building types in urban environments (Korsten *et al.*, 2015). This phenomenon requires some research in the UK but ecologists should be aware of the potential for larger numbers of this species to be present during the autumn and winter in large buildings in highly urbanised environments.³This system of categorisation aligns with BS8596:2015 Surveying for bats in trees and woodland (BSI, 2015).

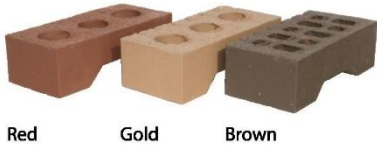
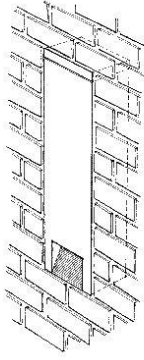
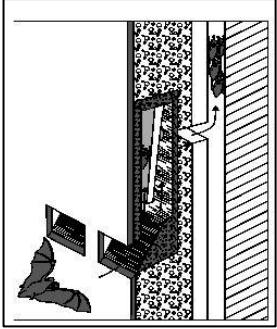
Appendix 2: Artificial bat roost provision

The below artificial bat roost provision could be incorporated at the site. If the types listed are not available then similar types can be selected providing that they are confirmed by the manufacturer as providing a similar roost purpose. Bat boxes should ideally be constructed out of durable materials other than raw timber to prevent damage by predators and ensure long term availability.

Location

All bat boxes should be sited as high as possible being a minimum of 3 - 4 meters above the ground, ideally 4 meters and above where safe installation is possible. Locations to avoid are above high traffic areas such as footpaths, driveways, patios and decked areas, away from windows and doorways, boilers and chimney outlets, artificially lit places and areas cluttered by trees.

Boxes Ideally Suited to Trees	
Hibernation Bat Box: During the hibernation period bats need constant cool temperatures. Therefore, the hibernation box shall be located on the northern aspect of mature trees, away from direct sunlight. Ideally within woodland areas and not on individual scattered trees, throughout the site. Bat Hibernation Box – ideal for use on mature trees, the box is very heavy and will require a good firm fixing to make sure it is safe. Dimensions: 500 x 380 (diameter) mm.	Schwegler 1FW Bat Hibernation Boxes 
Maternity Bat Box: to provide suitable maternity roosting habitat on site. During the maternity period bats require warm temperatures to raise young. The maternity bat box should, therefore, be positioned where it is unshaded for most of the day, ideally with a southerly or westerly aspect. The internal space is suitable to support groups of smaller female bats assembling for maternity purposes. Dimensions: 360 x 160 (diameter) mm. Ideal for trees.	Schwegler 1FD Maternity Bat Box 
General Purpose Bat Box: These provide roosting opportunities for many bat species, in particular pipistrelle and noctule species. General bat boxes should be sited on trees in groups of three, located on the south westerly, southerly and south easterly aspects to provide various temperatures and conditions. General bat boxes should be positioned in places where they are unshaded for most of the day. General Purpose Bat Boxes can be located together, ideally on trees. Dimensions: 330 x 160 (diameter) mm.	Schwegler 2F General Purpose Bat Box 

Hibernation Bark Box: Bark boxes are a new breed of boxes tailored to those sites where boxes need to blend in and remain unseen. This box is suitable for hibernating bats and boasts an insulated chamber with bat sized cone shaped crevices. There is a light internal finish to facilitate detection of droppings or rub marks. The top loop makes initial attachment to the tree easier – with two further attachment points for 6" nails for security.	
Boxes Ideally Suited to Buildings (can be used for all roost types)	
The bat brick is a standard sized brick, shaped especially to allow bats to access the cavity of a house. They can be incorporated during both new build or renovation projects. (A cavity chamber may need to be constructed to maintain an area free of insulating material where bats can roost). The bricks are available in three standard colours - Red, Golden and Brown. Dimensions: Height: 60mm, Width: 215mm and Depth: 100mm.	Bat Bricks  Red Gold Brown
The bat tube 1FR is designed to be installed on the external walls of buildings, either flush or beneath a rendered surface. This makes it ideal for situations where you wish the box to be discrete as only the entrance hole will be visible. It can also be painted to match your building with an air permeable paint if desired. The bat tube 1FR is specifically designed to meet the characteristic behavioral requirements of the types of bats that inhabit buildings. It has an integrated wooden panel onto which bats can cling and a ridged entrance slope which makes it easy for them to enter and leave the box safely. The design maintains excellent climatic conditions inside providing bats with a safe and stable environment in which to roost and it requires no maintenance because droppings fall out of the entrance ramp. For bat tubes that allow bats to enter the cavity, use the bat tube 2FR.	Schwegler Bat tube 1FR  Schwegler Bat tube 2FR 
The Enclosed Bat Box 'C' from Ibstock is designed for the pipistrelle bat. It is ideal for new builds as it can be integrated directly into the brickwork to produce a discrete but attractive home for bats. The inside of the box is designed to create several roosting zones which are ideal for crevice dwelling bats such as the pipistrelle. The bottom entrance means that no maintenance is required as droppings will simply fall out the bottom. This Ibstock Bat Box C is available in two sizes and three colours. Choose from smooth red, smooth blue or smooth cream brick. The box has an attractive bat motive on the front and is both durable and fully frost resistant. Dimensions: Two sizes - Small Box – 215mm x 215mm, Large Box – 215mm x 290mm.	The Enclosed Bat Box 'C' 

Year-Round use - This highly sophisticated Bat Roost is designed for the safe hibernation of bats in winter as well as for roosting, forming of colonies and raising of young during summer. The layered structure of the bat roost materials means that the 1WQ has excellent insulating properties whilst guaranteeing air convection and permeability. The interior of the 1WQ provides a selection of surface textures and areas with different hanging depths making it easy for different bat species to find their ideal position throughout the year. The entrance area is also purposely designed to allow the bats good grip during their approach and entry. This is particularly important for juvenile and inexperienced bats. Dimensions: Height: 580, Width: 380 and Depth 120mm	1FQ Schwegler Bat Roost (For External Walls) 
All-purpose Bat box, Stretcher bond brick fronted These bat boxes are best positioned in sunlit clusters and ideally facing a variety of aspects as bats will move around a building as the seasons change. This product makes an ideal bat house for most of the UK's bat species, including Pipistrelles, who will use it for roosting, hibernating and (in maternity roosts) bringing up their young. The entrance hole and internal design can be tailored to suit different species of bat. The box is self-cleaning thanks to an internal tilt board at the base; this works by diverting droppings out of the entrance hole. The back of each box is lined with wood; in front of this sits a removable untreated sawn timber baffle board which divides the main area into two, giving extra roosting space.	From Bird Brick Houses 

Legal

Please note that once bats have formed a roost within a bat box then the bat box is subject to all relevant protection and legislation and further advice should be sought if the bat box is to be affected or disturbed.

The above bat provisions can be obtained from the following sources:

<https://www.nhbs.com/>

<https://www.wildcare.co.uk/>

<https://www.barkboxes.co.uk/>

<https://www.birdbrickhouses.co.uk/>

<https://www.ibstockbrick.co.uk/kevington/eco-products/>