

1.0 Introduction

- 1.1 This appendix has been produced by CSA Environmental on behalf of Taylor Wimpey Strategic Land. It sets out the methods and results of bat activity surveys undertaken at Land at Ratby Lane, Markfield (hereafter referred to as 'the Site'), where residential development is proposed.
- 1.2 Preliminary Roost Assessments (PRA) of trees within the Site was carried out to determine the presence/absence of Potential Roost Features (PRF) and to categorise each tree in terms of its suitability for roosting bats to allow potential impacts to be predicted and appropriate mitigation proposed.
- 1.3 Bat activity surveys, consisting of walked transects and static monitoring surveys were undertaken to:
 - Establish the diversity of bat activity at the Site (i.e. which bat species/genera make use of the Site).
 - Establish the distribution of on-site activity, including any hotspots or key flight lines.
 - Complete a qualitative assessment of bat behaviour/use of the Site (e.g. foraging, or 'commuting' to off-site habitat resources).
 - Complete a quantitative assessment of the relative level of bat activity at the Site (including spatial and/or temporal variation).
 - Facilitate the design of development proposals which are sensitive to the bats found to use the Site.
 - Support an evidence-based assessment of the likely effects of development on bat population.

2.0 Legislation

- 2.1 All British bat species are legally protected under Regulation 43 of the Conservation of Habitats and Species Regulations 2017 (as amended). These Regulations make it an offence to:
 - Deliberately capture, injure, or kill a bat
 - Deliberately disturb bats, impairing their ability to survive, breed, reproduce or rear/nurture their young, or which significantly affects the local distribution or abundance of the species
 - Damage or destroy a breeding site or resting place used by bats
- 2.2 All bats and their roosts in the UK were previously fully protected under the Wildlife & Countryside Act 1981 (as amended). Amendments to the Act have removed most provisions as they relate to bats, however it remains an offence to:
 - Intentionally or recklessly disturb a bat while it is occupying a structure or place which it uses for shelter or protection
 - Intentionally or recklessly obstruct access to any structure or place used for shelter or protection

- 2.3 It is important to note that bat roosts are protected throughout the year, regardless of whether or not bats are present at the time. Under the Regulations, the offence of damaging or destroying a breeding site or resting place is subject to 'strict liability', i.e. an offence is committed irrespective of whether the causal act was deliberate or otherwise.
- 2.4 Where development is proposed that would result in an offence under the Regulations, a European Protected Species (EPS) statutory derogation licence (often termed 'EPS Mitigation Licence') will need to be secured from Natural England to permit an act that would otherwise be unlawful. Such a licence can only be granted following receipt of planning permission with all relevant conditions discharged, and where it has been demonstrated that specific statutory derogation tests have been met.

3.0 Methods

- 3.1 The following survey methods, design, data analysis and interpretation have been undertaken with due consideration of the Bat Conservation Trust (BCT) guidelines 3rd Edition (Collins, 2016).

Preliminary Roost Assessment (PRA)

Trees

- 3.2 All trees on-site were inspected from ground level, using binoculars and high-powered torches as appropriate. Particular attention was given to woodpecker holes, limb splits, lifting bark and mature ivy stems. The survey was completed on 03 June 2021 by Alex Perry ACIEEM (Bat Class Survey Licence WML-CL18, Registration Number 2017-32919-CLS-CLS).
- 3.3 A description of each tree was made, including the species, height, diameter at breast height and condition.
- 3.4 The aim of this inspection was to record direct (i.e. actual roosting bats) or indirect evidence of roosting bats (e.g. droppings), as well as the nature and number of features with 'potential' to support roosting bats. This includes consideration of trees to support bats whilst in hibernation.

Assessing 'Potential' of Trees to Support Roosting Bats

- 3.5 All trees were assigned to one of four categories in respect of their 'potential' to support roosting bats, or the confirmation of any bat roosts identified. 'Potential' in this context is taken to be the broad suitability of features to support roosting bats, based upon the nature, condition or structure of such features, in the absence of confirmed evidence of roosting.
- 3.6 Assigning the following categories is intended to determine the effort of any further targeted survey or inspections which are necessary to prove presence or likely absence of roosting bats, rather than to assign importance to such features.
- 3.7 The following categories are assigned to structures and/or trees herein, Either:
- **Confirmed Roost** – where one or more bat roosts are identified during PRA inspections, either through direct sightings of bats, and/or indirect evidence such as bat droppings. Or;
 - **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 and surrounding habitat.
 - **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 and surrounding habitat but unlikely to support a roost of high conservation status (with respect to roost type only, assessments at this stage are made irrespective of species conservation status).

- **Low** – A structure or tree with one or more potential roost sites that could be used by individual bats opportunistically. However, these potential roost sites do not provide enough space, shelter, protection, appropriate conditions and/or suitable surrounding habitat to be used on a regular basis or by larger numbers of bats (i.e. unlikely to be suitable for maternity or hibernation).
- **Negligible** – Negligible habitat features on site likely to be used by roosting bats.

3.8 The potential of a tree to support roosting bats is often influenced by its age and construction, thermal stability, lighting and levels of human activity. Furthermore, the proximity to foraging habitat - particularly woodland, parkland and wetland- as well as the presence of navigational routes (e.g. hedgerows, treelines and watercourses) influence both the potential for bats to roost, as well as the species which may roost. Professional judgement is therefore applied, based upon known factors which effect the potential of features to support roosting bats, insofar as determining the need or scope of further surveys or inspections.

Limitations

3.9 There were no limitations to the Preliminary Roost Assessment.

Activity Surveys

Transect Surveys

- 3.10 Transect surveys were undertaken in May, July and September 2021. On each occasion a single transect route aimed to cover all accessible areas, features and habitats at the Site. Each transect route was repeated at least once during each survey to minimise temporal bias.
- 3.11 Each transect was walked at a moderate and consistent speed with qualitative observations of bat behaviour made by the surveyor. Each survey commenced at sunset (British Summer Time), continuing for the following two hours.
- 3.12 Bat calls were recorded using Elekon Batlogger M detectors. This detector automatically records ultrasonic signals with a one second delay between recordings. Recordings of bat contacts were subsequently analysed using BatExplorer software, with sonograms reviewed to confirm bat identification to genera, or where possible, species level.
- 3.13 Each of the recorded files, which contain a variable number of call 'pulses', was designated a 'bat contact'. At the point of contact, each sound file is assigned a GPS location.
- 3.14 Transect surveys are intended to gather data on the spatial distribution of bat activity across the Site, identifying areas of relative importance for bats, including key flight lines. In addition direct observation of bats

allows for qualitative assessments of how bats use the Site to be made complementing quantitative data collected through remote monitoring.

Remote Monitoring

- 3.15 Two Wildlife Acoustics Songmeter (SM4) detectors were deployed during May, July and September to provide six data-sets. The locations of these Monitoring Locations (ML) are shown on Figure 1 below.



Figure 1. The locations of each Monitoring Location (ML) surveyed during remote monitoring surveys in May, July and September

- 3.16 The detectors were setup to automatically record ultrasonic signals for the period from half an hour before sunset to half an hour after sunrise each night, with each monitoring period spanning at least five consecutive nights.
- 3.17 Weather conditions were obtained for each night surveyed using historic weather data from the World Weather Online website, with weather observations taken from the nearest weather station in Leicester Forest

East. The five nights showing the most optimal weather conditions (in terms of temperature, precipitation and wind speed, see Table 3) were taken forward for analysis.

- 3.18 Recordings are triggered when a bat echolocation call is detected and will contain a variable number of call 'pulses'. Each file containing call pulses by a bat/s is designated as a 'bat contact' for each species present. The maximum recording duration is 15 seconds after which time a new recording file, and thus a new bat contact, is generated if echolocation calls are still being detected. This means that periods of prolonged bat activity near a detector is represented as multiple bat contacts, rather than a single one
- 3.19 Recorded bat calls were analysed using the specialist software AnalookW to identify the species present. Quantitative analysis of bat activity was then undertaken by calculating the average bat contacts per hour on each night monitored, for each species.
- 3.20 Bat activity can show considerable inter-night variability and is dependent on a number of variables, including temperature, wind, and seasonality, amongst others. To account for this variability the median values for the average hourly bat contacts per night are reported, rather than a mean value which would misrepresent the average activity.

Limitations

- 3.21 It should be noted that the findings described herein for remote monitoring surveys are based on the bat activity recorded at the location immediate to each detector, and therefore only describe localised activity at the Site.
- 3.22 In addition, comparisons drawn on the number of detector activations by different species/genera can only give an indication of relative species abundance at the Site, as detectability varies between species.
- 3.23 It is acknowledged that the quantum of bat contacts recorded during a survey may not give a true reflection of the abundance of bats using the Site. For example, a single bat foraging close to a detector may trigger several hundred activations in the course of one night. However, this activity level does provide a proxy for the level of use by bats, and therefore its relative importance.
- 3.24 The static detector at Monitoring Location ML1 in July only recorded for three nights instead of the full five-night period due to an error with the detector. This small reduction in the number of nights monitored at this location is not considered to have significantly altered the ability to assess impacts related to bats.

4.0 Results

Preliminary Roost Assessment

Trees

- 4.1 All trees and tree groups on-site were included in the assessment. Tree numbers are consistent with those used within the Tree Survey Report (report reference: BHA_4237_TS).
- 4.2 Generally, trees on-site are small and restricted to within hedgerow features. Only trees within the site boundary were assessed, resulting in one tree, Tree T12, identified as having Low potential to support bats. The tree comprises a mature oak and although no features were identified, it is of a size that may support features further in the canopy that may not have been visible from ground level.

Activity Surveys

Transect Surveys

- 4.3 The weather conditions experienced during the transect surveys are provided in Table 1 below.

Table 1. Bat transect survey timings and weather conditions

Survey Date	Sunset Time	Start Time	End Time	Temp. (°C)		Cloud Cover (oktas)		Wind (Beaufort Scale)		Rain
				Start	End	Start	End	Start	End	
24/5/21	21:09	21:09	23:09	11	8	7	1	3	3	Dry
17/8/21	20:27	20:27	22:27	16	15	5	4	2	2	Dry
29/9/21	18:47	18:47	20:47	11	10	8	8	2	1	Dry

- 4.4 One species was recorded during the transect survey, comprising common pipistrelle *Pipistrellus pipistrellus*. The majority of contacts were recorded along the western boundary where a single bat was observed foraging under an adjacent streetlight along Ratby Lane.
- 4.5 The number of bat contacts recorded for each species are summarised in Table 2 below. The locations of each bat contact and the overall distribution of activity across the Site are illustrated in Figures 2 and 3.

Table 2. Summary of bat contacts recorded during transect surveys

Month	Common pipistrelle
May	25
July	42
September	46
Total	113



Figure 2. Locations of bat contacts recorded across all transect surveys

- 4.6 Figure 3 below provides an indicative illustration of 'hotspots' in bat activity recorded across all transect surveys undertaken at the Site. No key commuting lines were observed, but constant foraging by a common pipistrelle bat underneath a streetlight on the western boundary was seen during the transect survey, as is reflected within the results. This area of the Site is also more sheltered due to topography.



Figure 3. Indicative 'Utilisation Distribution' (UD) of all bat species/genera at the Site estimated from all transect data combined. The UD illustrates the relative probability of a bat in flight being present at a given point at the Site, with higher/central contours having a greater probability, and lower/peripheral contours having less probability.

Remote Monitoring

- 4.7 The weather conditions experienced during the 15 nights where data was analysed are provided in Table 3 below.
- 4.8 Weather conditions during May 2021 were unseasonably wet and cold, as can be seen within Table 3. The period of static monitoring tried to capture a period of drier, warmer weather however May 2021 was consistently wet and colder than average and this has been reflected within Table 3 below.

Table 3. Overnight weather conditions during remote monitoring

Survey Month	Dates Sampled (2021)	Temp. (°C)		Cloud Cover (%)		Wind (km/h)		Precipitation
		Min	Max	Min	Max	Min	Max	
May	28/05/21	10	11	49	100	4	6	None
	29/05/21	9	13	16	83	2	5	Very light rain at 21:00

	30/05/21	7	15	0	0	6	10	None
	31/05/21	9	13	5	70	7	12	Very light rain at 21:00
June	01/06/21	9	15	19	99	11	13	None
July	29/07/21	13	14	36	100	11	19	Very light rain at 03:00
	30/07/21	6	13	28	82	12	15	Dry
	31/07/21	12	15	57	100	7	9	Very light rain from 21:00 to 06:00
August	01/08/21	11	13	31	46	3	10	Dry
	02/08/21	11	13	18	58	1	8	Very light rain at 21:00
Sept.	21/09/21	10	12	0	0	6	9	Dry
	22/09/21	11	14	10	78	16	20	Dry
	23/09/21	11	12	9	39	5	13	Dry
	24/09/21	14	17	47	100	6	14	Dry
	25/09/21	14	18	58	70	6	11	Moderate rain at 21:00, very light rain at 00:00 and 03:00

4.9 The total number of bat contacts recorded across all monitoring locations and monitoring periods for each bat species/genera are provided in Figure 4 and Table 4 below.

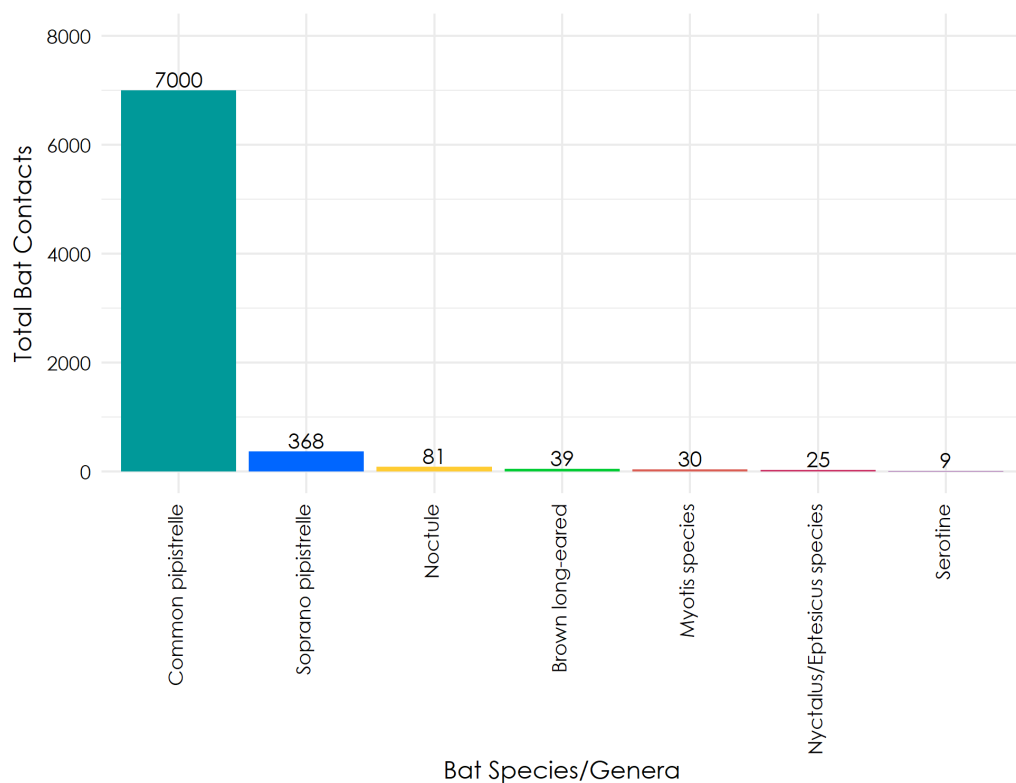


Figure 4. Total bat contacts by species/genera recorded across all remote monitoring periods and monitoring locations

Table 4. Total bat contacts by species/genera recorded across all monitoring locations and each monitoring period

Month	Common pipistrelle	Soprano pipistrelle	Noctule	Brown long-eared	Myotis species	Nyctalus/Eptesicus species	Serotine
May	2137	185	2	2	0	6	2
July	1841	38	22	8	4	5	7
September	3022	145	57	29	26	14	0
Total	7000	368	81	39	30	25	9

4.10 Figures 5 and 6 below shows the variance in nightly activity levels for each of the bat species recorded on-site. More detailed data describing these figures are provided in Table 5. The activity data in Figures 5 and 6 is presented as boxplots for each bat species, which show the inter-night variability in bat activity across the 15 nights monitored. The median value (middle line of the boxplot) is taken as the typical level of activity for that species on-site at the point monitored. The length of each coloured boxplot is the interquartile range which shows the variance in nightly activity around the median value. The ends of each whisker line define the minimum and maximum nightly activity values recorded at the monitoring location. Outlying values are nightly activity levels that are greatly different when compared to the distribution of the remaining nightly activity levels. Outliers are illustrated as black points away from the boxplot. While important to note, these outliers do not represent the bat activity more commonly found at the Site for the species in question.



Figure 5. Average bat contacts per hour per night for common pipistrelle bats recorded across all remote monitoring locations

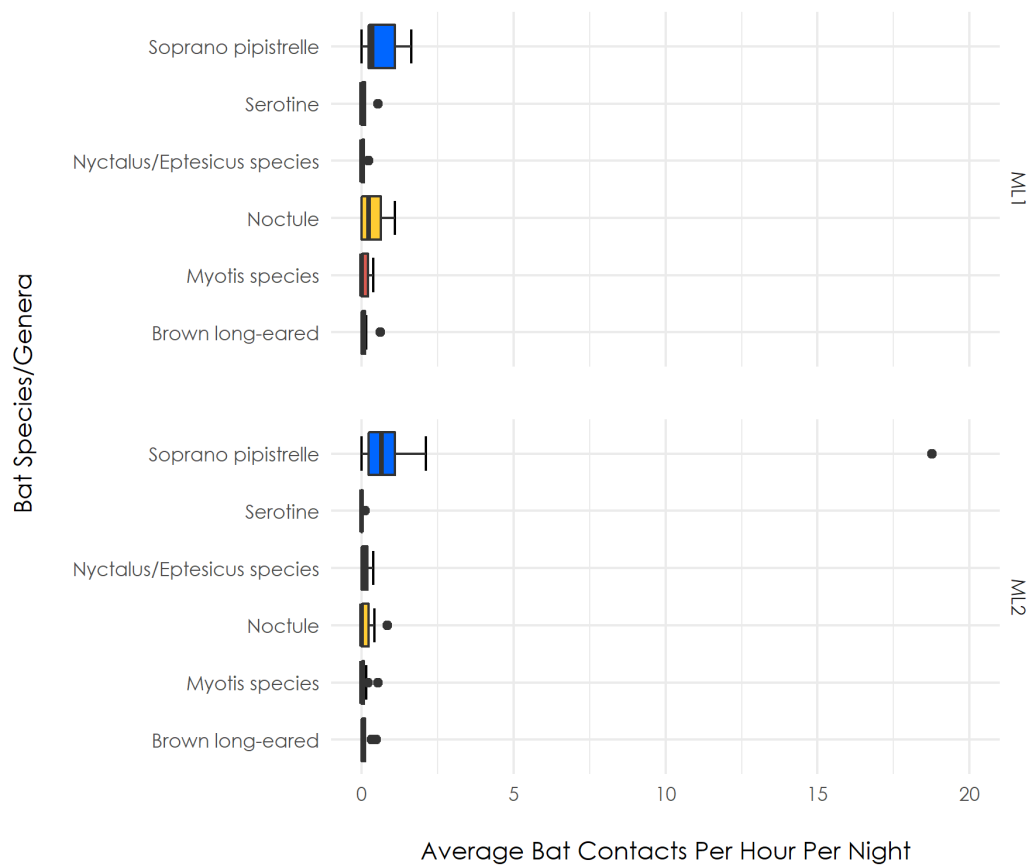


Figure 6. Average bat contacts per hour per night for all other bat species recorded across all remote monitoring locations

- 4.11 Markedly higher contact numbers of common pipistrelle bat were recorded overall, with very low levels of all other species. Bat activity for common pipistrelle bats seems to be slightly elevated at ML1 where 4648 contacts were recorded compared to 2352 at ML2. Analysis of average nightly activity levels shows that while greater numbers of contacts for this species were recorded at ML1, the median activity values were relatively similar at both locations (16.436 average contacts per hour per night at ML1 compared to 6.298 at ML2), although still reduced at ML2. Common pipistrelle activity at ML1 was more variable than ML2 and both location recorded outlying values where nightly activity was considerably greater than was typically recorded across the remaining nights.
- 4.12 Activity levels for the remaining species recorded at the Site were very similar at both monitoring locations, with similarly low median values (<1 contact per hour per night on average) for each species.

Table 5. Average bat contacts per hour per night recorded during remote monitoring surveys

ML	Species	Average bat contacts per hour per night				Total bat contacts	Number of nights monitored
		Minimum	Maximum	Median	IQ range		
ML1	Brown long-eared	0.000	0.614	0.078	0.117	17	13
	Common pipistrelle	3.851	126.361	16.436	29.225	4648	13
	Myotis species	0.000	0.388	0.000	0.215	16	13
	Noctule	0.000	1.096	0.233	0.637	57	13
	Nyctalus/ Eptesicus species	0.000	0.236	0.000	0.077	6	13
	Serotine	0.000	0.531	0.000	0.107	8	13
	Soprano pipistrelle	0.000	1.628	0.352	0.860	102	13
ML2	Brown long-eared	0.000	0.470	0.078	0.112	22	15
	Common pipistrelle	1.281	101.275	6.298	7.625	2352	15
	Myotis species	0.000	0.538	0.000	0.078	14	15
	Noctule	0.000	0.854	0.000	0.221	24	15
	Nyctalus/ Eptesicus species	0.000	0.386	0.107	0.184	19	15
	Serotine	0.000	0.117	0.000	0.000	1	15
	Soprano pipistrelle	0.000	18.772	0.644	0.864	266	15

5.0 Summary

- 5.1 Bat activity at the Site is dominated by common and widespread species. Arable habitat is of low foraging habitat for bats, with on-site hedgerows, woodland and trees offering most potential.

6.0 References

Chartered Institute of Ecology and Environmental Management, 2017. *Guidelines for Ecological Report Writing*. Winchester: CIEEM.

Chartered Institute of Ecology and Environmental Management, 2018. *Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine version 1.1*. Winchester: CIEEM.

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

Lintott, P. R., Davison, S., van Breda, J., Kubasiewicz, L., Dowse, D., Daisley, J., Haddy, E. and Mathews, F, 2017. *Ecobat: An online resource*

to facilitate transparent, evidence-based interpretation of bat activity data. Ecology and evolution, 8(2), pp.935-941.

Appendix A

Preliminary Roost Assessment of Trees: Detailed Results

Project No.	2550	Project Name	Ratby Lane, Markfield
Date	03/06/21	Surveyor	Alex Perry ACIEEM

Suitability	Description Roosting Habitats
Roost	A known or confirmed tree roost present.
High	Trees with one or more potential roosting features (PRF's) that are obviously suitable for use by larger numbers of bats on a more regular basis and potentially for longer periods of time due to their size, shelter, protection, conditions and surrounding habitat.
Moderate	Trees with one or more potential PRF's that could be used by bats due to their size, shelter, protection, conditions and surrounding habitat; but unlikely to support a roost of high conservation status.
Low	Trees of sufficient size and age to contain PRFs but none seen from the ground or features seen only with very limited roost potential.
Negligible	Negligible habitat features likely to be used by roosting bats.

Tree ID No.	Species	Potential Roosting Feature (x: few...xxx: many)					Description of features (including aspect of feature)	Bat Roost Suitability
		Rot Hollows/ wounds	Cracks / Splits	WP Holes	Loose Bark	Ivy Cover		
T12	Oak				+	+	Ivy cover and loose bark. Tree is of size and shape to support features higher in canopy	Low
T10/11	Ash						No potential features seen	Negligible