Table 12. Spatial Distribution of Bat Species Across Transect Routes (excl. PIPPIP)

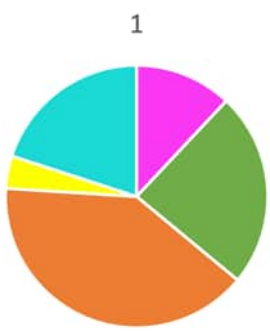


Chart 8: Relative abundance of bat species recorded on Transect 1, excluding common pipistrelle.

Chart 9: Relative abundance of bat species recorded on Transect 2, excluding common pipistrelle.

Chart 10: Relative abundance of bat species recorded on Transect 3, excluding common pipistrelle.

Chart 11: Relative abundance of bat species recorded on Transect 4, excluding common pipistrelle.

Survey Validity

Lifespan of this Report

3.5 Owing to the highly mobile nature of bats, and the inherent unpredictability of their roosting habits, this assessment will be valid for a maximum of 12 months from the date of the most recent survey (i.e., until October 2023), in accordance with published guidance[6]. Beyond this period, new bat roosts may have established within the suitable roosting features within the habitat.

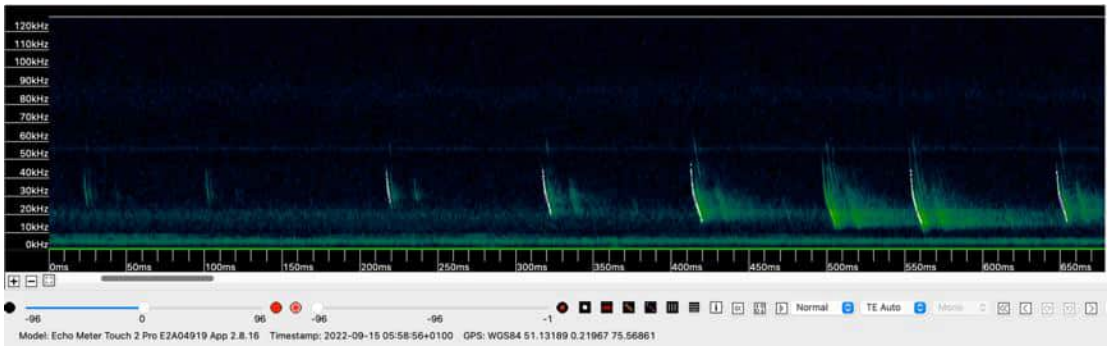
3.6 If the works have not commenced before 14 October 2023, the Bat Activity Assessment findings must be reviewed to ensure that the findings still present an accurate account of conditions within the Application Site.

6 CIEEM (2019) *Guidance Note on the Lifespan of Ecological Reports and Surveys*. Chartered Institute of Ecology and Environmental Management, Winchester.

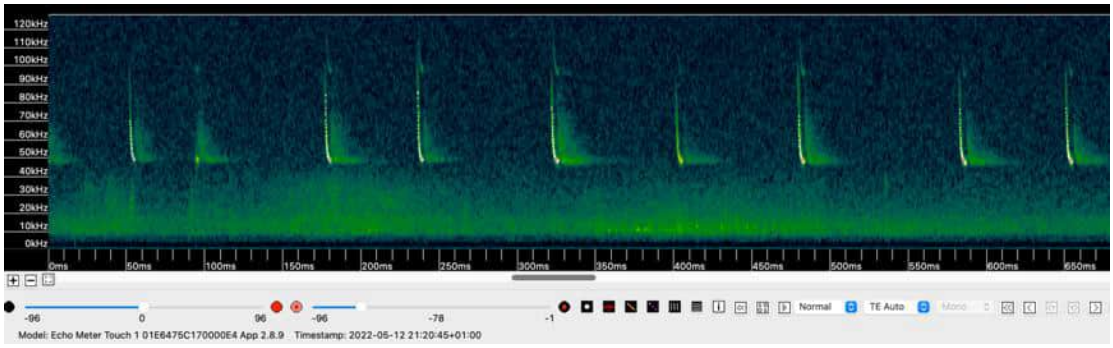
Appendix 1: Bat Species Stills

Table 13. Bat Species Sonogram Stills

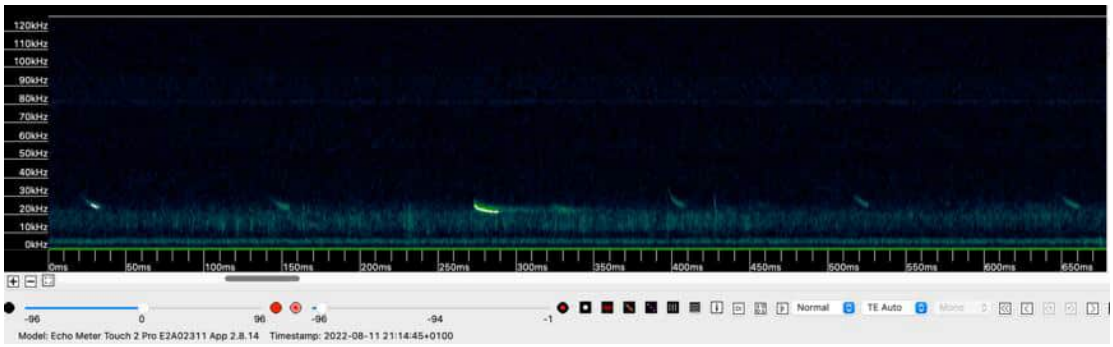
Brown long-eared *Plecotus auratus*



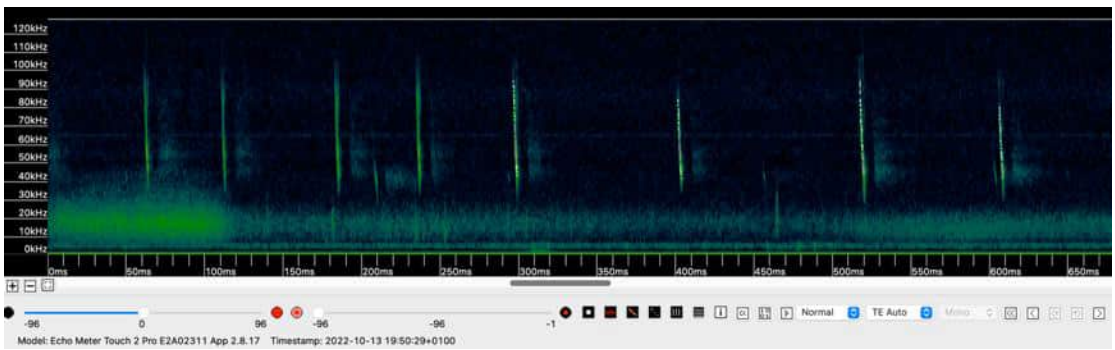
Common pipistrelle *Pipistrellus pipistrellus*



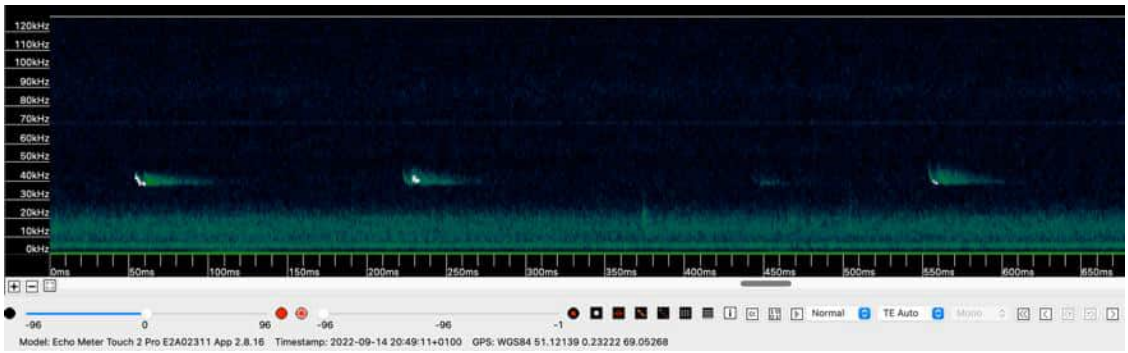
Leisler's bat *Nyctalus leisleri*



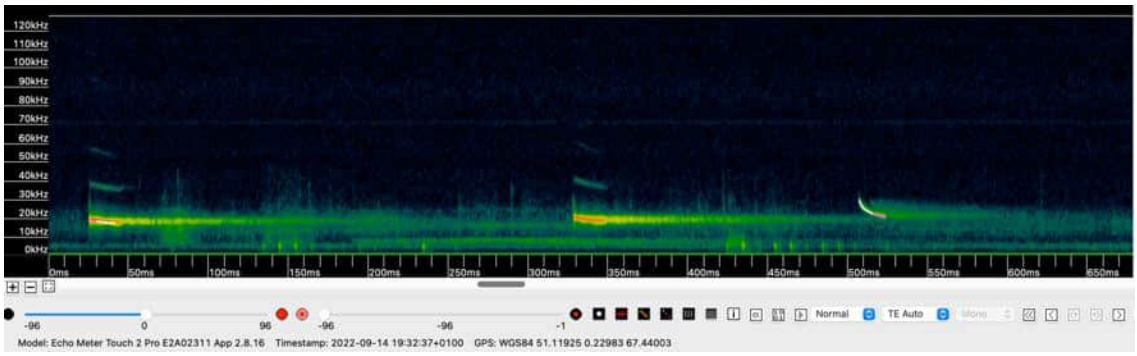
Myotis sp. *Myotis*



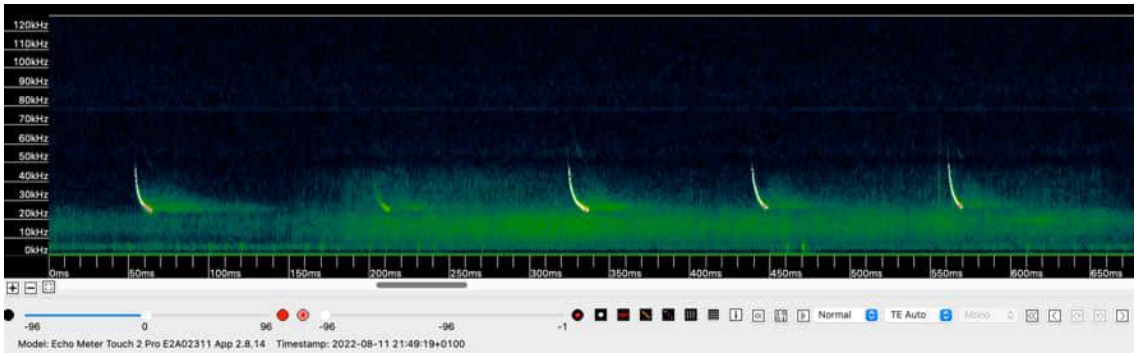
Nathusius' pipistrelle *Pipistrellus nathusii*



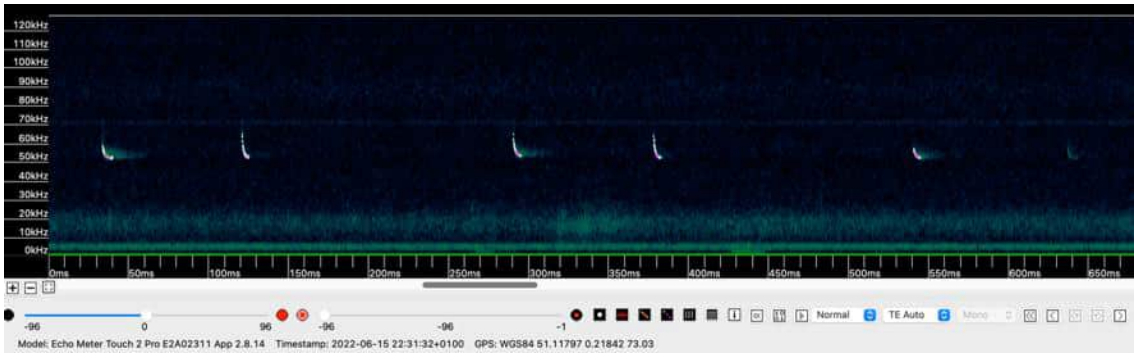
Noctule *Nyctalus noctula*



Serotine *Eptesicus serotinus*



Soprano pipistrelle *Pipistrellus pygmaeus*



Bat Activity Assessment
Land west of Ifield, Crawley
Report for Ramboll

APPENDIX 8.25: LAND WEST OF IFIELD, CRAWLEY – BAT TRAPPING AND RADIO-TRACKING

Bat Trapping and Radio-tracking 2024
Further Baseline Report and Evaluation
For Land West of Ifield, Crawley
For Ramboll
08 October 2024

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CONTENTS

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Advanced Bat Survey Report V3 11 December 2024	Dr Ian Davidson-Watts MCIEEM	Diane Davidson-Watts MCIEEM

1 Introduction

1.1 BACKGROUND

1.1.1 The proposed Land West of Ifield development is currently in design and plans are being finalised. The proposals are for the creation of new residential neighbourhoods. These neighbourhoods will deliver homes, schools, green spaces and community infrastructure. The applicant is committed to creating a sustainable new community and to ensuring biodiversity net gain. An Environmental Impact Assessment (EIA) is being undertaken in support of the proposed development. At the time of writing a fixed and final parameters plan for the proposed development was not available.

1.1.2 Bat records in the area of the urban expansion have highlighted the area's importance and potential importance to Bechstein's *Myotis bechsteinii* and a number of other tree-roosting bat species that are likely to use the semi-natural habitats associated with forest and woodland habitats, which will be directly and indirectly affected.

1.1.3 Advanced surveys undertaken in 2020/21 by AEWC Ltd and by Davidson-Watts Ecology in 2022 have confirmed the presence of Bechstein's bat on the site and a breeding population in adjacent woodland areas. This species was captured on the Site and in woodlands adjacent to the site, with a high proportion of the bats captured being females and juveniles. Further radio-tracking found maternity roosts in off-site nearby woodlands. In addition, a trapping and radio-tracking project conducted by The Ecology Consultancy around Gatwick Airport had previously identified a Bechstein's colony north of the site, and one bat caught on site in 2020/21 was confirmed by AEWC (through radio tracking) to be part of this colony.

1.1.4 With the rarity of the species, the local Bechstein's population is considered of high importance. Further trapping, radio-tracking and roost monitoring was recommended to build on the 2020/21 and 2022 data. This will enable population level radio tracking and more accurately ascertain the status and determine the number of populations present and identify population range and core areas of importance to identify the potential impacts. The greater the number of bats (samples) tagged and tracked over a number of years, the greater confidence can be provided in understanding the respective use of the proposed development site to Bechstein's bats, which will also assist in the design and planning of mitigation measures necessary to address any potential impacts to these and other bats species.

1.1.5 Given the potential importance of the site for use by foraging and commuting Bechstein's and other bat species, Ramboll UK Ltd (lead ecologists and EIA consultants for the overall development proposals) have highlighted the need for more detailed information on the current status of Bechstein's and other tree-roosting species (*Myotis* species of bat) in the area, and a greater understanding of the use of area affected by the proposed scheme. Therefore, as part of a suite of studies, including acoustic bat surveys and further detailed investigation of the use of the site by Bechstein's bat and other tree-roosting bats is proposed to build upon the previous advanced bat surveys to provide information to inform specific bat related impacts and detailed mitigation measures to ensure the favourable conservation status of the species concerned.

1.2 OBJECTIVES

1.2.1 Davidson-Watts Ecology Ltd were commissioned to undertake advanced bat surveys (trapping and radio-tracking) of the area of the urban expansion proposals in 2024 to achieve the following objectives:

1.2.2 The aims of this project were to build on the surveys of 2021/22 to continue to:

- Investigate the status of Bechstein's and other tree-roosting bats (e.g. *Myotis*, *Plecotus*) in the zone of influence of the proposed scheme(s), with an emphasis on woodland habitat and treelines during early to mid-late summer 2024.

- Radio-track key individuals using the site to locate breeding colonies of Bechstein's and other tree-roosting bats, to determine activity patterns and habitat use.
- Present a robust data set of the use of the site and surrounding areas by Bechstein's and other significant populations of tree roosting bats, to further establish an ecological baseline, assess potential impacts, and assist the development of appropriate mitigation including appropriate roost protection measures, lighting design, bat road crossing mitigation and detailed landscaping/planting inventories and habitat management.

2 Methodology

2.1 OVERVIEW

2.1.1 As Bechstein's bats roost in trees and are almost impossible to detect/identify using standard bat surveys (Collins, 2023) the primary approach to meeting the project aims was to trap free-flying bats and to radio-track individual bats to locate maternity and other roost types and to investigate use of the site by bats when active at night.

2.1.2 The 2024 surveys aimed to proportionately increase the number of radio-tagged Bechstein's by at least 10 bats, and two survey sessions of approximately one week to 10 days, each were undertaken between 20 and 30 May and 30 July and 8 August 2024 which aimed to sample the pre and post parturition periods for breeding female bats.

2.1.3 Each session began with the trapping of bats. Radio-tagged bats were simultaneously/subsequently followed by radio-tracking during the week to locate roost sites and to examine nocturnal activity of bats, with a focus on collecting activity data for bats within the development boundary. Where access was possible, emergence counts were undertaken at identified roosts to determine the function of the roost and to provide an estimate of population sizes.

2.1.4 The following methods were undertaken in line with Chapter 9 (Advanced licensed bat survey methods) in Collins, 2023.

2.2 TRAPPING METHODS

2.2.1 Bats were caught using up to seven 4 m^2 harp traps or 6-12m mist nests placed in woodlands and significant treelines within the land subject to investigation (the 'Site' - see Figure 1). Acoustic lures (e.g. Sussex Autobats) were used to improve catch efficiency in woodland (Hill and Greenaway, 2005). The lures emitted synthesised or pre-recorded bat social calls. Lures were placed next to harp traps and any bats captured were identified, sexed, aged and breeding status determined.

2.2.2 Prior to using lures, known roosts from previous data (e.g. AEWC 2021, DWE 2022) were positively identified and mapped on Google Earth app, to ensure they were not used within 50m.

2.2.3 Generally trapping teams monitored trap sites with handheld bat detectors (Pettersson 240x or Elekon Batlogger M) during the trapping survey, mainly to assess bat activity in the vicinity of the traps.

2.3 TRACKING METHODS

2.3.1 Target bats were fitted with lightweight radio-transmitter tags (Lotek Ltd, Wareham, Dorset, United Kingdom) weighing <5 % of the weight of the bat using skin bond/torb or similar proven adhesive. Tagging of female bats in advanced stages of pregnancy was avoided. Lactating bats were tagged if they met the target weight and were in good condition, although early lactating bats were not tagged for welfare reasons. Bats were processed quickly and released within 30 minutes of capture provided the glue attaching the transmitter had cured sufficiently.

2.3.2 Tracking of bats was undertaken for a period of five to six nights following capture. Bechstein's bats were followed from dusk until dawn post capture, other bats were generally released and roost finding took place at dawn or during the day, with observations made of the general locations of these bats whilst monitoring the movements of the Bechstein's bats during the night.

2.3.3 Positions of tagged bats were pinpointed at regular intervals throughout the night depending on whether the tracker was in contact with the bat. Tracking aimed to record positional fixes that enabled determination of home ranges and core areas of activity and when in contact, position fixes were recorded approximately every 10-15 minutes.

2.3.4 Surveyors obtained a fix on a bat by driving or walking in the direction of the strongest signal of the tagged bat. A bat's position was estimated by close approach (White and Garrott, 1990) on foot whenever possible. Where safe and permitted access was not possible, multiple compass bearings were taken by circling around the signal in as short a time period as practically possible, keeping contact with the bat to assess any change in location. These approaches enabled an estimate of a bat's location depending on the distance.

2.3.5 Accuracy of triangulated locations on the Site were considered accurate by +/-20m. This was based on observer experience, knowledge of the area and the combined use of close approach and triangulation, rather than triangulation alone. Off Site, where access was more restricted, location error could be up to 250m. For analysis of home ranges in Ranges 9, a tracking resolution of 20m was applied.

2.3.6 The digitised radio tracking data was analysed in Ranges 9 to calculate home range areas, which are also known as 100% Minimum Convex Polygons (MCPs), and core activity areas using objective core analysis (Kenwood *et al*.,2001). MCP mapping is a polygon based on the outside of all the fixes associated with a tagged bat. The MCP technique of determining home range was used as it is considered relatively unaffected by the effects of autocorrelation (Harris *et al*., 1990). However, this method does overestimate home range and often includes large areas that the tagged bat flew through to get to possible foraging or roosting areas.

2.3.7 The identification of core areas for each bat is important as it highlights the habitats in which the bats are spending most of their time. Cluster polygons were considered the most appropriate minimum-linkage estimators to define the areas bats were using. This is because most of the tagged/tracked bats spent the majority of their time in relatively small areas compared to their full home range, moving quickly between them. The fragmented cluster polygons show where bats were highly active (e.g. foraging/social activity) or night roosting/returning to roosts, rather than the area travelled through to get to such areas.

2.3.8 For the estimation of core areas, 'objective core analysis' was the chosen method. Importantly this method of core area analysis was used in DWE 2022 study which means that both datasets can be used together to provide a comparative assessment of Bechstein's bat home ranges.

2.3.9 This approach is scientifically rigorous as it calculates core areas from the distribution of the bats' locations themselves rather than manual determination of what percentage of fixes should be excluded from the analysis, usually from assessment of utilisation distributions continuities (a manual method of excluding outlying locations). The objective core analysis method (Kenwood *et al.,* 2014) uses the distribution of nearest-neighbour distances detecting and excluding outlying location resulting in an objective core activity area.

2.3.10 Use of objective core analysis was especially relevant to this study as it was considered that all estimated bat fixes should be used to determine overall activity patterns, and would provide a more conservative method, smoothing any accuracy issues with the collection of fixes.

2.4 ROOST EMERGENCE

2.4.1 When tagged bats were tracked to accessible roost sites, subsequent roost exit counts were undertaken using infrared cameras (Canon XA10/XA40) with infrared illuminators, and/or thermal scopes (e.g. Guide 19mm) to determine roost size and status (e.g. maternity roost). Roost attributes such as location, type of structure and other descriptors were recorded where possible.

2.5 LICENSING

2.5.1 All 2024 trapping and tracking surveys were undertaken under a project licence from Natural England number 2024-68029-SCI-SCI-1 obtained by Dr Ian Davidson-Watts, with over 30 years bat survey experience, designed and coordinated the field surveys and undertook the analysis of the results. The field surveys were undertaken by surveyors with significant bat trapping and radio tracking experience, with all tagging and trapping undertaken by those named on the above licence.

2.6 ADJUSTMENTS AND LIMITATIONS

2.6.1 Ecological surveys are limited by factors which affect the presence of animals such as the time of year, migration patterns and behaviour. Therefore, the absence of evidence of any species should not be taken as conclusive proof that the species is not present or that it will not be present in the future.

2.6.2 The survey techniques described in this report involve a sampling effort that is considered appropriate for obtaining information on the location of roosts and core activity areas potentially affected by the proposed development, while ensuring that local bat populations are not disturbed adversely by the survey method itself. The methods used here do not provide a full account of all bat activity in the area or activity at other times of the year outside of the survey period, but are a robust method of determining activity patterns and roost sue during the key maternity season.

2.6.3 The limitation of objective coring analysis is that the process sometimes estimates core areas larger than those from an equivalent number of locations compared to more manual methods. This method was used however as it is the most robust approach to assessing core areas of tagged bats in a precautionary manner to ensure important areas used by bats were not overlooked.

2.6.4 Weather conditions were appropriate throughout trapping and emergence survey work (i.e. sunset temperature 10◦C or above, no rain or strong wind). As such the results of trapping and radio tracking were not constrained or affected by significant weather changes. During rain events, tagged bats generally remained active during the dusk to dawn surveys. However, the rain events were all brief showers and no prolonged rain or poor weather conditions were encountered (see Appendix B for summary weather data).

2.6.5 Usual scientific best practice avoids using data collected on the night of capture for analysis of ranging behaviour due to the effects of disturbance from the capture/tagging procedure on behaviour of the bats. In this study, data collected during the first night of tracking was incorporated for analysis as some bats were trapped in locations where they were not recorded for the remainder of the study. The exclusion of this information would not have reflected what was known of their home range and whilst rigorous scientific approaches have been adopted to objectively record and asses/interpret the radio tracking data, the study's objectives were to primarily understand as much about the movement of bat species affected by the proposed development rather than test any hypotheses.

2.6.6 A limitation of radio tracking studies relates to accuracy of positional fixes. Accuracy of fixes can be a common problem in studies of fast-moving bats, particularly those species that have relatively large home ranges. Whilst methods such as biangulation/triangulation can provide relatively rapid and systematic location data for bats, studies have shown that due to variability of surveyor skill, especially at distance, positional fixes might only be accurate to >250m2 (Botandina and Schofield 2002).

2.6.7 A combination of triangulation and close approach methods were therefore adopted to increase accuracy, fixes were more accurate when on Site and on adjacent land where access was permitted as a close approach method could be ustiled more frequently. A number of factors such as the landform, safe and permitted access to private land and time bats spent in an area can affect the accuracy of fixes. To take account of these variables, the analysis of radio tracking data has been relatively conservative, especially when estimating core areas of activity

2.6.8 The other major limitation influencing the ability to obtain data for this project were land access restrictions. Notwithstanding this limitation, the use of the acoustic lure assisted the trapping of sufficient bats within their foraging areas and previously unrecorded roost sites, from which a defensible radio tracking dataset could be obtained for the period of survey.

2.7 EVALUATION CRITERIA

2.7.1 Ecological features and resources have been evaluated based on the approach described in 'Guidelines for Ecological Impact Assessment in the United Kingdom' published by the Chartered

Institute of Ecology and Environmental Management (2016) whereby the value of an ecological feature or resource is determined within a defined geographical context using the following criteria:

- International,
- National (England),
- Regional (South-East),
- County/District (West Sussex),
- Local (or Parish) (Horsham); and
- At the site level only.

3 Results

3.1 BAT TRAPPING

3.1.1 In May 2024 six trapping areas were sampled across the Site over six nights (see Appendix A for trapping data and Figure 1 showing trapping areas). A total of 53 bats of nine species were recorded.

3.1.2 Bat species captured included three female adult Bechstein's bats captured in trapping area (TA) 7 and 8 (both located in Hyde Hill Wood) and an adult male Bechstein's bats in TA1 (small wood south-east of Ifield Wood). The other bat species captured included common and soprano pipistrelle (*Pipistrellus pipistrellus and P. pygmaeus*), brown long-eared (*Plecotus auritus*), Natterer's (*Myotis nattereri*), whiskered (*M. mystacinus*), Brandt's (*M. brandtii*), Daubenton's (*Myotis daubentonii*) and noctule (*Nyctalus noctula*) bats. No bats were captured along the River Mole (TA5).

3.1.3 In July/August 2024 six trapping areas were sampled over with a total of 30 bats of seven species captured during four nights of trapping. Trapping ceased when all target bats for radio tracking had been tagged and all resources focused on tracking bats.

3.1.4 Species recorded in July/August included a total of seven Bechstein's bats. Three Bechstein's (two juveniles and an adult male) that were captured at TA6 on the eastern part of the golf course, two juvenile Bechstein's bats captured at TA7 in Hyde Hill Wood, and a female adult and male juvenile Bechstein's bat were captured in TA2 on the southern boundary of Ifield Wood.

3.1.5 Other bats captured on the Site during July/August 2024 included brown long-eared, Natterer's, Daubenton's, common and soprano pipistrelle and whiskered bat.

3.2 RADIO TRACKING AND ROOSTING PATTERNS

3.2.1 A total of 15 bats were fitted with radio transmitters. This included 10 target Bechstein's bats, which comprised of one breeding adult female, three non-breeding adult females (although two of these could have been in early pregnancy), two adult males, and four juveniles (one female and three male). Subsequent radio tracking surveys then went on to locate roost sites and determine broad activity areas including foraging sites. Table 1 provides summary statistics of their ranges and the Figures (Appendix A) which contains maps showing their ranges.

3.2.2 In addition, three female brown long-eared bats, one female whiskered bat and one female Natterer's bat were tagged for the purposes of finding roosts.

Table 1 - Summary data of tagged bats and their home range statistics.

ID	Species	Sex	Date captured	Location	No. Fixes/ nights	Range span (m)	MCP (ha)	Mean core area (ha)	No. core areas
MB03	*Bechstein's*	Female	20/05/2024	TA8	152/5	852	33.8	0.6	8
MB04	*Bechstein's*	Female	20/05/2024	TA7	129/4	2151	62.5	0.9	5
MB07	*Bechstein's*	Male	24/05/2024	TA1	39/3	1164	24.4	1.4	4
MB09	*Bechstein's*	Female*	27/05/2024	TA7	70/3	857	31.7	4.9	1
MB06A	*Bechstein's*	Female**	30/07/2024	TA6	48/3	557	9.0	0.6	3
MB05A	*Bechstein's*	Male	30/07/2024	TA6	122/4	1193	26.3	1.7	3
MB03A	*Bechstein's*	Male**	29/07/2024	TA7	163/6	1423	108.0	2.1	8
MB04A^	*Bechstein's*	Male**	29/07/2024	TA7	8/2	N/A	N/A	N/A	N/A
MB07A	*Bechstein's*	Female	31/07/2024	TA2	120/5	1023	30.9	4.0	3
MB09A	*Bechstein's*	Male**	2/08/2024	TA2	65/3	1187	65.5	5.4	3

**Breeding bat. ** Juvenile bat. ^Bat MB04A was not considered further in home range analysis due to the low number of fixes recorded.*

Table 2 – Roost locations and summary roost attributes of tagged bats (refer to Figures 4-7).

Roost ID	Tagged Bat	Date	Type	Feature	Count	Status
RM01	MB03	20/05/2024	Oak Tree	Cavity	1	Night roost
RM02	MB03	21/05/2024	Oak tree	NC	1	Day roost
RM03	MB04	21/05/2024	Woodland	NA	NA	Likely maternity
RM04	BL02	21/04/2024	Oak Tree	Cavity	10	Maternity
RM05	MB03	22/05/2024	Oak Tree	WPH	28	Maternity
RM06	MB04	23/05/2024	Pine Tree	WPH	37	Maternity
RM07	BL05	24/05/2024	House	Unknown	1	Day roost
RM08	MB03, MB09	25/05/2024	Ash Tree	Cavity	28	Maternity
RM09	MB07	25/05/2024	Horse Chestnut	Unknown	NC	Day roost
RM10	BL08	26/04/2024	Tree	Unknown	NE	Likely maternity
RM11	MM06	28/05/2024	House	Unknown	NE	Likely maternity
RM12	MB09	29/05/2024	Oak	Cavity	28	Maternity
RM13	MB03	29/05/2024	Hornbeam	Cavity	11	Maternity
RM14	MB03, MB09	30/05/2024	Ash Tree	WPH	NE	Likely maternity
RA01	BL01A	30/07/2024	Unknown	Unknown	NA	Likely maternity
RA02	MN02A	30/07/2024	Oak tree	Unknown	NE	Likely maternity
RA03	MB03A	30/07/2024	Ash	Cavity	32	Maternity
RA04	MB03A/MB06A	31/07/2024	Ash	Cavity	39	Maternity
RA05	MB05A	31/07/2024	Oak	Unknown	1	Day
RA06	BL01A	1/08/2024	Ash	Unknown	NC	Likely maternity
RA07	MB07A	1/08/2024	Oak Tree	Tag drop	NC	Likely maternity
RA08	MN08A	2/08/2024	Oak Tree	No access	NA	Likely maternity
RA09	MB07A/MB09A	3/08/2024	Sessile Oak	knot hole	31	Maternity
RA10	MN08A	4/08/2024	Oak	Unknown	NE	Likely maternity
RA11	MB07A	6/08/2024	Ash	WPH	2	Day
RA12	MN08A	6/08/2024	Oak	Unknown	NC	Likely maternity

NA- No access for count, based on presence of tagged bats only.

NE- No emergence undertaken as priority was for other roosts

NC- Not confirmed means that an emergence survey was undertaken of the tree supporting the tagged bat(s), but the actual roost feature in use was not identified. As a result, either no bats were visually observed emerging or fewer than the likely number of bats present were observed despite the use of night vision equipment etc.

WPH- Woodpecker Hole

3.3 RADIO TRACKING DATA

Bechstein's bat (Figures 8-16)

3.3.1 Eleven Bechstein's bats were captured during the 2024 trapping surveys. From there 10 bats were tagged. Four bats in May 2024 and six bats in July/August 2024.

3.3.2 In May, three of the four bats caught (all female adults MB03, MB04 and MB09) were captured in Hyde Hill Wood (TA7 and TA8). One adult male (MB07) was captured in the northern part of the Site at TA1.

3.3.3 In July/August, two juvenile bats and an adult male bat were captured on the eastern side of the golf course TA6 (north of Hyde Hill Wood). One juvenile and the male bat were tagged (MB06A and MB05A respectively) In Hyde Hill Wood two juvenile Bechstein's bats MB03A and MB04A were tagged having been captured at TA7. Two further Bechstein's bats (MB07A and MB09A) were captured and tagged south of Ifield Wood (TA2).

3.3.4 All Bechstein's bats (n=10) were tagged and followed for 3-5 nights post capture night. Although ranges data are provided for MB04A captured in July 2024, this bat is not included in the analysis below or the figures due to the very low fixes obtained for this bat (*n*=8). This bat was captured in Hyde Hill Wood, but visited the study area on an *ad hoc* basis, with its roost likely occurring in woodland complexes to the west and where access was not possible. Due to the likely roost location, very few fixes could be obtained from public rights of way.

3.3.5 For the nine Bechstein's bats where sufficient fixes were obtained over the tracking period, the analysis shows that flying distances (span of home ranges) were between 0.4 and 2.2km with a mean of 1.1km. Home ranges (using 100% of all bat fixes) ranged between 9ha and 108 ha, and an average (mean) home range size was 43.5 ha.

3.3.6 Core areas for the nine tagged Bechstein's bats that had sufficient fixes, ranged between 0.6ha and 5.4ha. The mean core area size of all Bechstein's bats was 2.4 ha.

3.3.7 Overall home and core ranges of the three-adult female Bechstein's bats in May 2024 (MB03/MB04/MB09) were predominantly within Hyde Hill Wood, the southern edges of Hyde Hill Wood, and south of Kilnwood Lane, including the woodlands adjacent to Bewbush which were all off Site. MB04 travelled the greatest distance south and was found roosting in a Corsican pine tree (RM06) with 36 other bats in a forest area south of the A2464 (Holmbush Forest area). All the bats used mature treelines and small woodlands in these areas for foraging. Another six maternity roosts and two day roosts for the female bats were located during the survey period.

3.3.8 Male adult Bechstein's bat (MB07) was captured on the Site at TA1 and this bat's activity was recorded mainly between the small copse at TA1 and the eastern fringes of the Site, including Rectory Farm and the woodlands around the Ifield Brook to the south. This bat was found roosting in a mature horse chestnut (RM09).

3.3.9 In late July and early August, six Bechstein's bats were tagged, including four juveniles, one adult female and one adult male (MB05A). MB05A was captured on the golf course on Site and was then found solitarily roosting in RA05 of Site, in the Ifield Brook and Meadows Local Wildlife Site (LWS),

where it spent the majority of its flying time in the local area. It did commute between the golf course and its roost to the north-east via the large gardens of houses along Rusper Road, east of the golf course, and to the north of housing west of Ifield Brook and Meadows.

3.3.10 The three juvenile bats (MB03A/MB04A and MB06A) were captured and tagged at Hyde Hill Wood (TA7) off Site and on the golf course on Site (TA6) respectively. MB04A only had 8 fixes due to its *ad hoc* flight behaviour and was rarely detected. MB03A (captured in Hyde Hill Wood) had the widest home ranges of all bats, utilising and roosting in Hyde Hill Wood (RA03 and RA04), and flying between Hyde Hill Wood, the central and north-western parts of the golf course on Site, and further north-west to woodlands and treelines in the area of Stumbleholm Farm and Grantham's Bridge.

3.3.11 MB06A, also a juvenile, was captured on the golf course on Site (TA6), and used a smaller section of the golf course just north of Hyde Hill wood but spent the majority of its flying time in Hyde Hill Wood, where it also was found roosting (RA04).

3.3.12 MB07A and MB09A were a juvenile and adult female bat respectively, that were captured on the Site in TA2 south of Ifield Wood, both with homes ranges and core areas that were within and on the fringes of Ifield Wood. This included two small woodlands on the Site.

3.3.13 In addition to the Bechstein's bats, a further 10 roosts of other species were located. This included three maternity roosts for brown long-eared bats, three maternity roosts for Natterer's bats and one likely maternity roost for whiskered. However just one Natterer's roost occurred on the Site (RA12), and this is a suspected maternity roost.

4 Discussion

4.1 USE OF THE SITE BY BECHSTEIN' S BAT

4.1.1 The results of the 2024 survey provide additional data to support the initial surveys by AEWC (2021) and the further radio tracking surveys by DWE in 2022 (DWE, 2022), with this study using comparable data collection and analysis methods to the 2024 survey. Combined, the 2022 and 2024 data provide robust information on the activity patterns and roosts of 16 Bechstein's bats (seven bats in 2022 and nine bats in 2024) which had included adult females, males, and juvenile bats. Although 10 Bechstein's bats were tagged in 2024, only eight fixes for MB04A were obtained due to the majority of this bat's activity being located away the Site in inaccessible areas.

4.1.2 These data combined with the capture and radio tracking data from 2022 suggest the Site is used, in part, by two breeding populations of Bechstein's bats, and especially during the post parturition period when juveniles are flying. One population is centred around the Hyde Hill Wood area to the south of the Site, and the other population associated with the Ifield Wood area to the north-west of the Site.

4.1.3 In 2022 there was evidence of some relationship between the two populations, with one male juvenile bat that moved between the two populations. Similarly in the 2024 surveys, MB04A, another male juvenile Bechstein's bat, was loosely associated with Hyde Hill Wood, although the majority of its activity and all roosting was elsewhere to the west of the Site (not in Hyde Hill wood, nor Ifield Wood or on the Site), and this bat may be part of another population of Bechstein's bats to the west, possibly the population reported by AEWC (2021).

4.1.4 Kerth and Schaik (2012) consider Bechstein's bat breeding populations to be closed societies of females living together for their entire lives, where immigration is virtually absent. This may well be relevant to the two populations associated with the Site, and the two juvenile males travelling between different colony areas in 2022 (DWE, 2022) and potentially in 2024, may be dispersal behaviour as males are solitary during summer and disperse from their natal colony in the first year of life (Kerth and Morf, 2004).

4.1.5 The three adult male Bechstein's bats tagged in 2022 (n=1) and 2024 (n=2) occupied areas that were not used by adult females during the summer surveys. In 2024 these were areas to the east of the Site, in and around the Ifield Brook and Meadows corridor. In June 2022 the male adult's home range did include parts of Ifield Wood, which is also used by female adult bats. However, when looking at when the bats could have overlapped in ranges, it would appear that neither the AWEC 2020/2021 surveys, DWE 2022 nor the DWE 2024 surveys captured any adult female Bechstein's bats during the pre-parturition period and only during the post-parturition period, suggesting that there may be temporal as well as spatial separation between adult female and adult male bats during the summer.

4.1.6 This analysis and discussion of the sociality of Bechstein's bats is important to understand how the Site is used by the breeding populations in particular. The general pattern of behaviour is that the adult female Bechstein's bats are predominantly using the main woodland areas in which they roost, such as Hyde Hill Wood and Ifield Wood. They also use small copses on the fringes of these woodlands and to a lesser extent the woodland associated with the golf course (north of Hyde Hill Wood). However, greater use of the golf course and other woodlands on the Site is made by juvenile bats and adult male bats.

4.1.7 Whilst these fringe areas of the proposed development Site (i.e. the golf course), may not form part of the breeding population's core areas (i.e. core foraging areas for adult females), they do provide a resource for the juveniles and the overall ecological function of the colonies, especially during the post parturition stage. Appropriate mitigation will be required to maintain such areas as foraging sites/connective habitat and manage any indirect effects on the core roosting and foraging habitats of the breeding female Bechstein's bats in particular.

4.2 OTHER BAT SPECIES USE OF THE SITE

4.2.1 The 2024 survey re-confirmed the presence of at least nine bat species using the Site or woodland adjacent to the Site, including Bechstein's bat.

4.2.2 The 2024 results show that there is a resident brown long-eared bat population using Hyde Hill wood as a maternity roosting area.

4.2.3 One likely maternity roost of Natterer's bat was found in the small woodland at TA1, but other than this record, no other roosts were found within the red line during the 2024. However, it should be noted that that the focus of the 2024 surveys was on the Bechstein's bats.

4.2.4 A maternity population of Natterers was confirmed in the Ifield Wood area again in 2024 with a maternity roost found bordering the Site. No counts were made due to priorities of tracking Bechstein's bats. However this species is commonly found in trees and due to fission fusion behaviour, they will utilise a range of tree roosts within an area and move frequently.

4.2.5 As part of the general mitigation of tree roosting bats, it is likely that maternity roosts of Natterer's and brown long-eared bats occur within the Site boundaries and consideration should be given to retaining and providing for the roost resource potentially affected by the development proposals.

5 Evaluation

5.1.1 Bechstein's are one of the rarest bat species in the UK and Europe and Sussex is likely to be a stronghold for the species with a number of known populations being recorded. The role of woodland habitat on the Site and in the surrounding areas is likely to be important in terms of supporting individual bats from at least two nearby maternity populations. It is therefore considered that, in the context of a number of Bechstein's bat maternity populations being present in Sussex, the proposed development Site is of at least **Regional** importance to this species.

5.1.2 Brown long-eared bats and Natterer's bats are both tree roosting species and maternity roosts were located on Site in the case of brown long-eared bat, and bordering the Site for both brown long-eared and Natterer's bats. It is likely that numerous trees will be used by these species within the Site boundary. These species are relatively common, but maternity populations of higher conservation status and therefore the regular occurrence of these breeding populations of these species on or adjacent to the Site is considered important at the **District** level.

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Figure 1 Trapping locations and survey areas (red line)

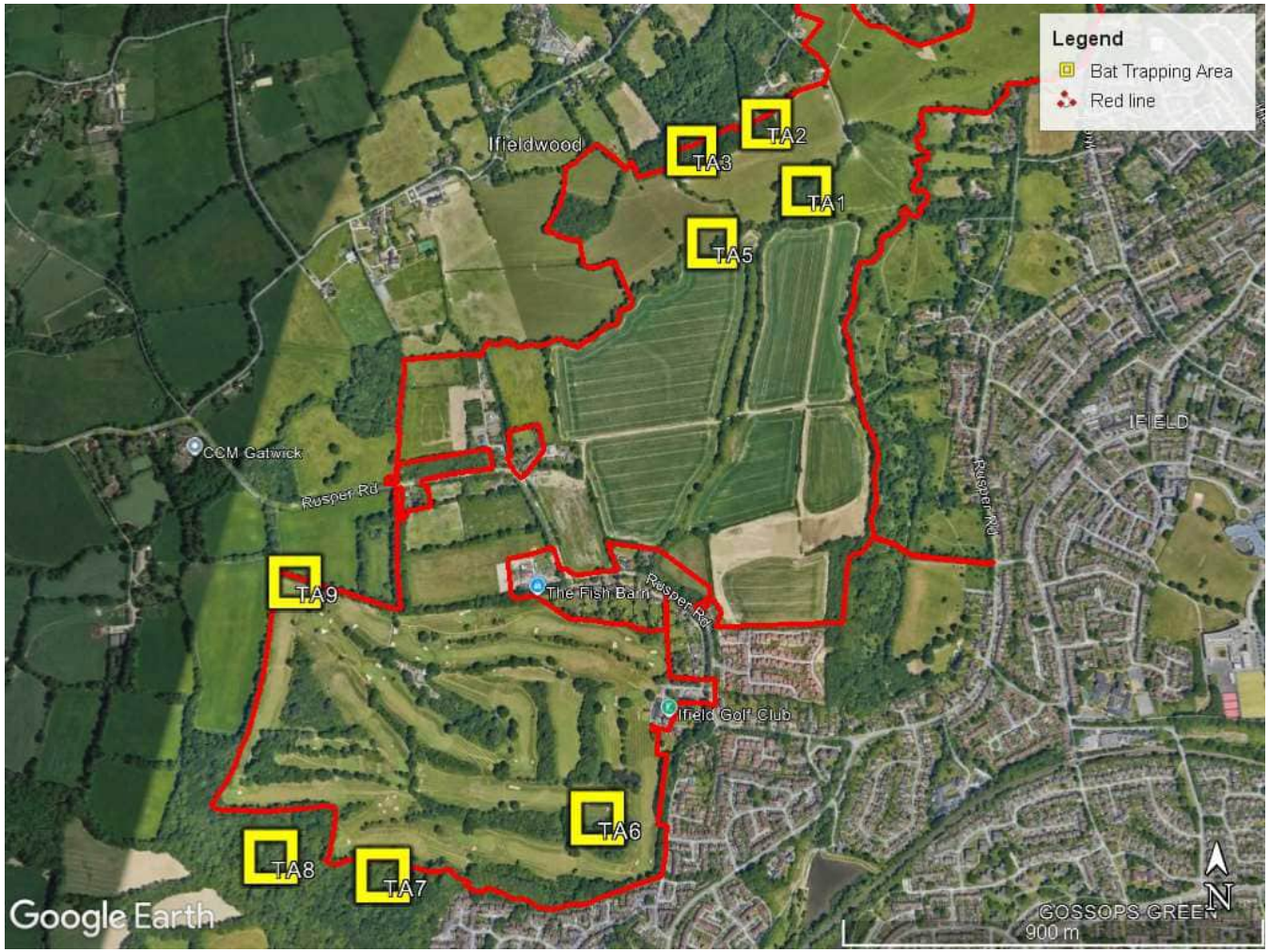

Figure 2 All Bechstein's bats RT fixes (raw data) n=10

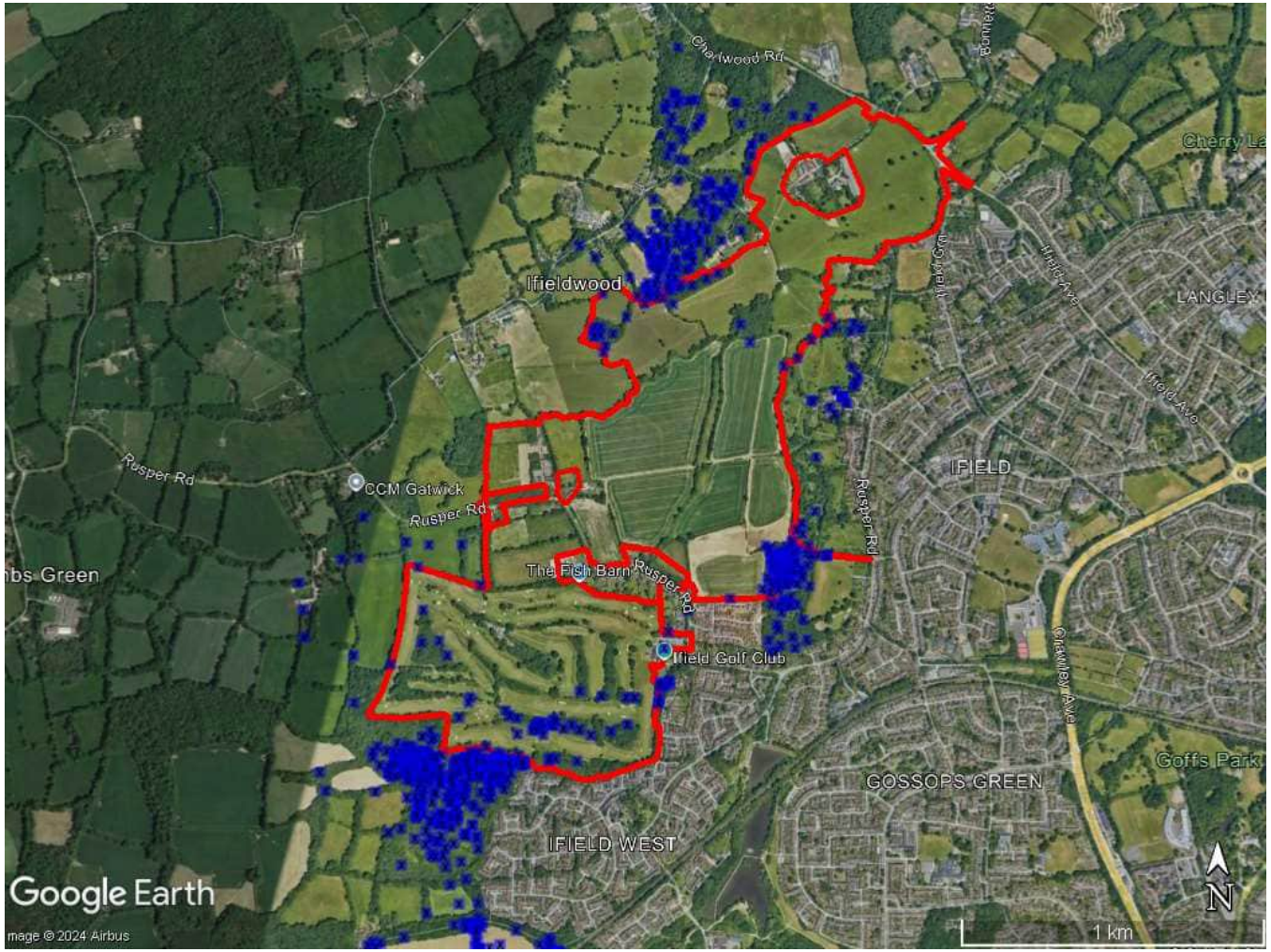

Figure 3 Bechstein's bat home ranges (n=9)

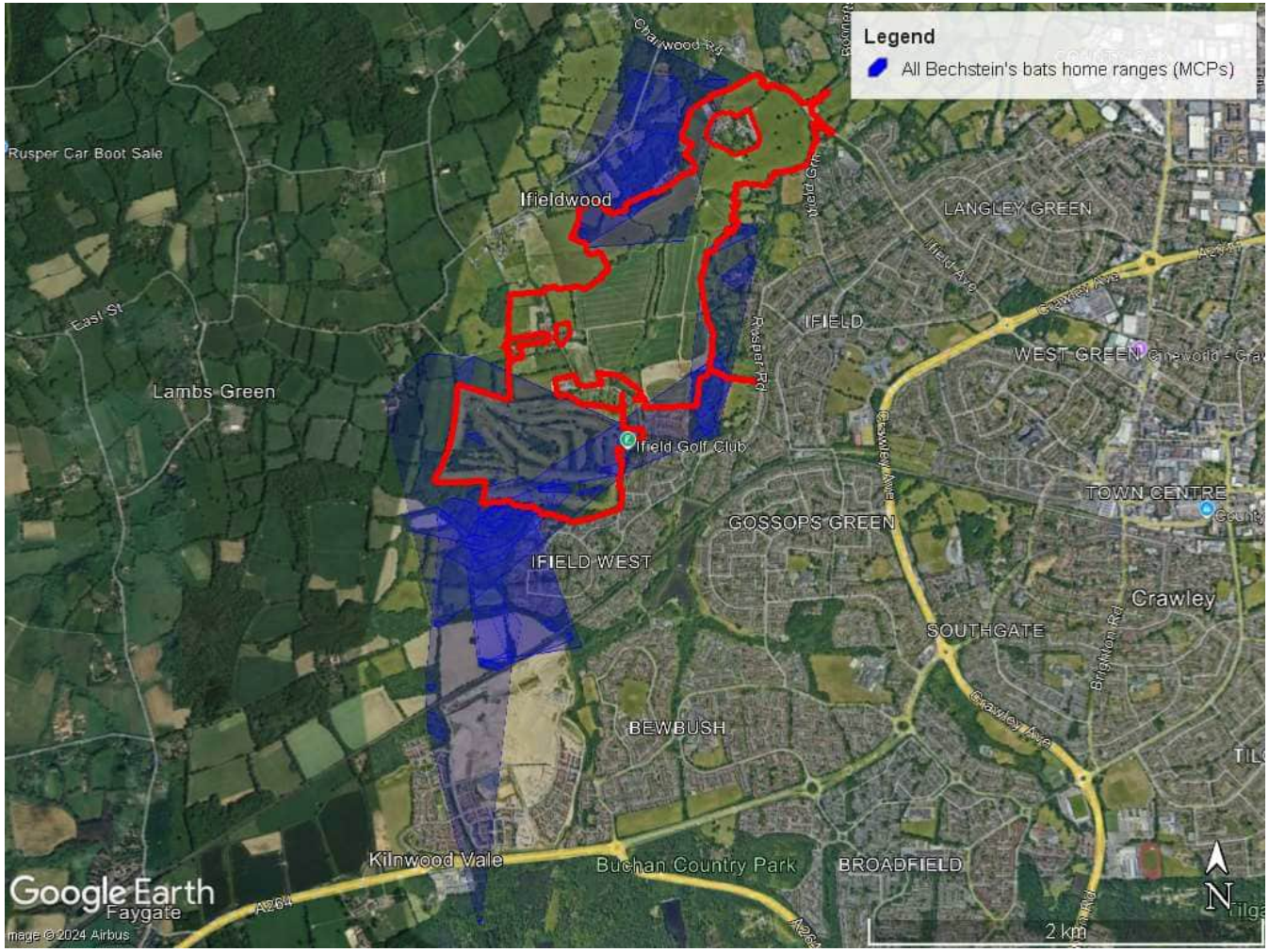

Figure 4 Bechstein's bat home core areas (n=9)

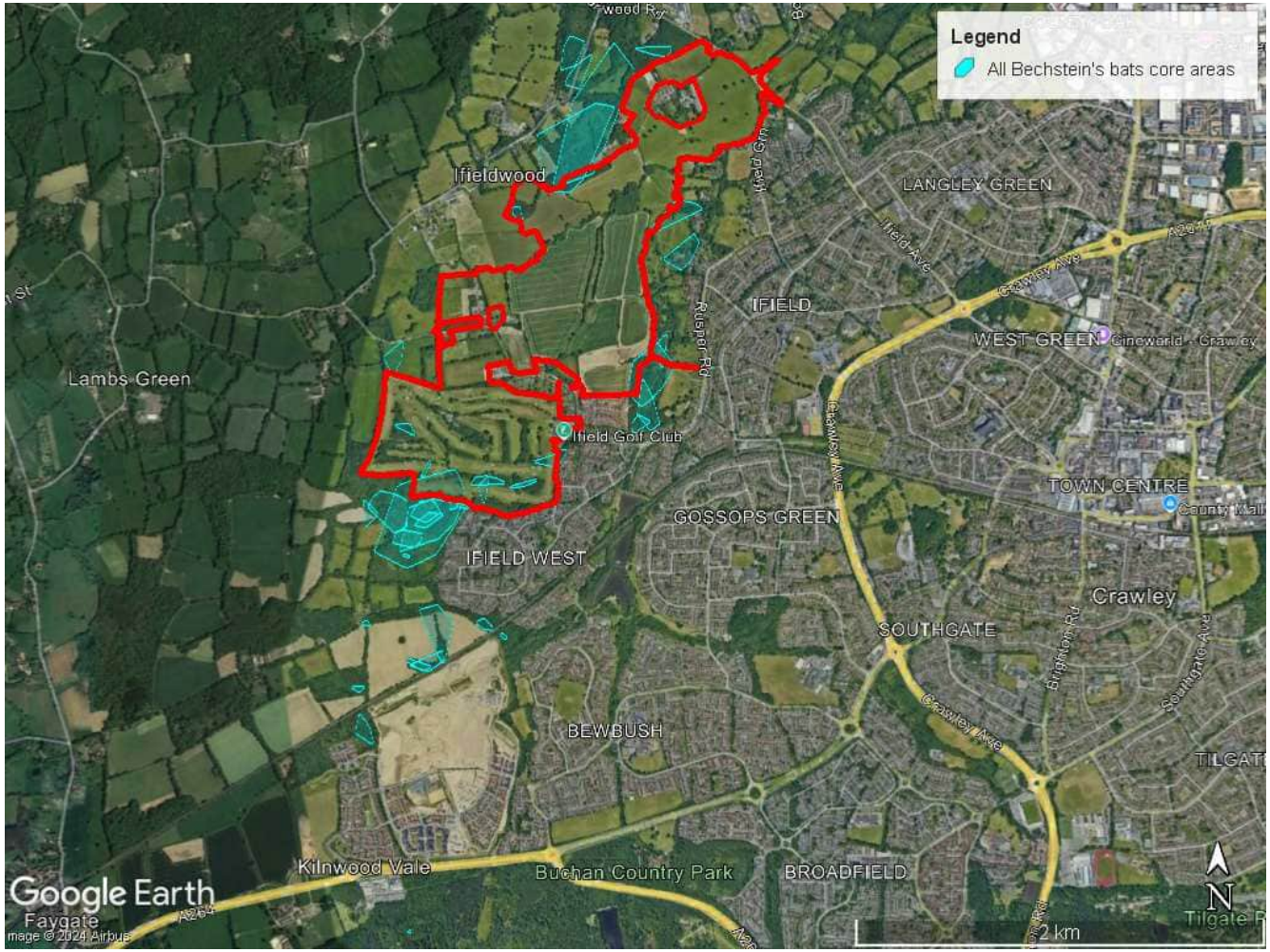

Figure 5 Roost locations – all bats

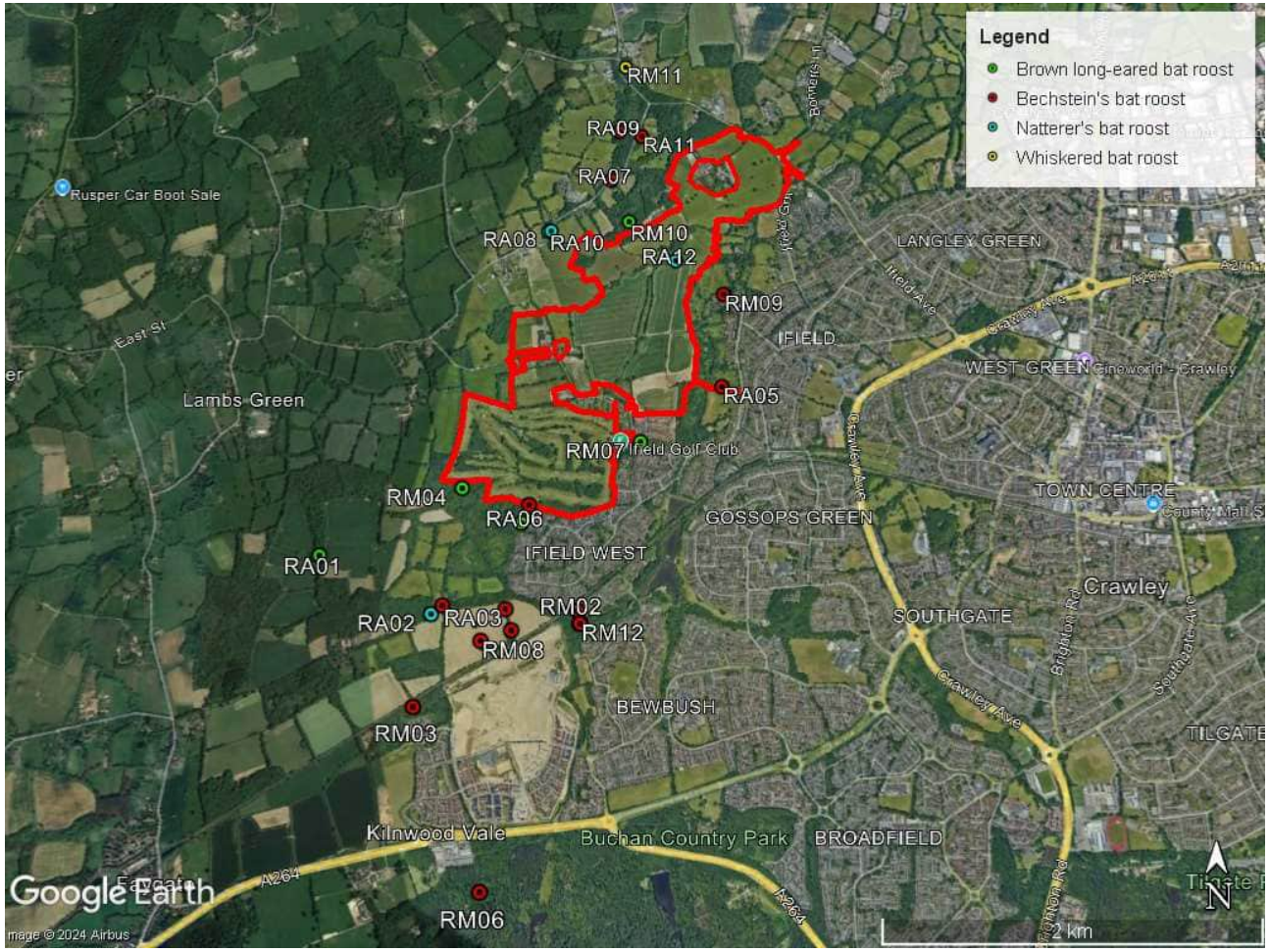

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Figure 6 Roost locations southern part of project area

Figure 7 Roost locations central and northern area

Figure 8 Female Bechstein's bat (MB03) RT data May 2024

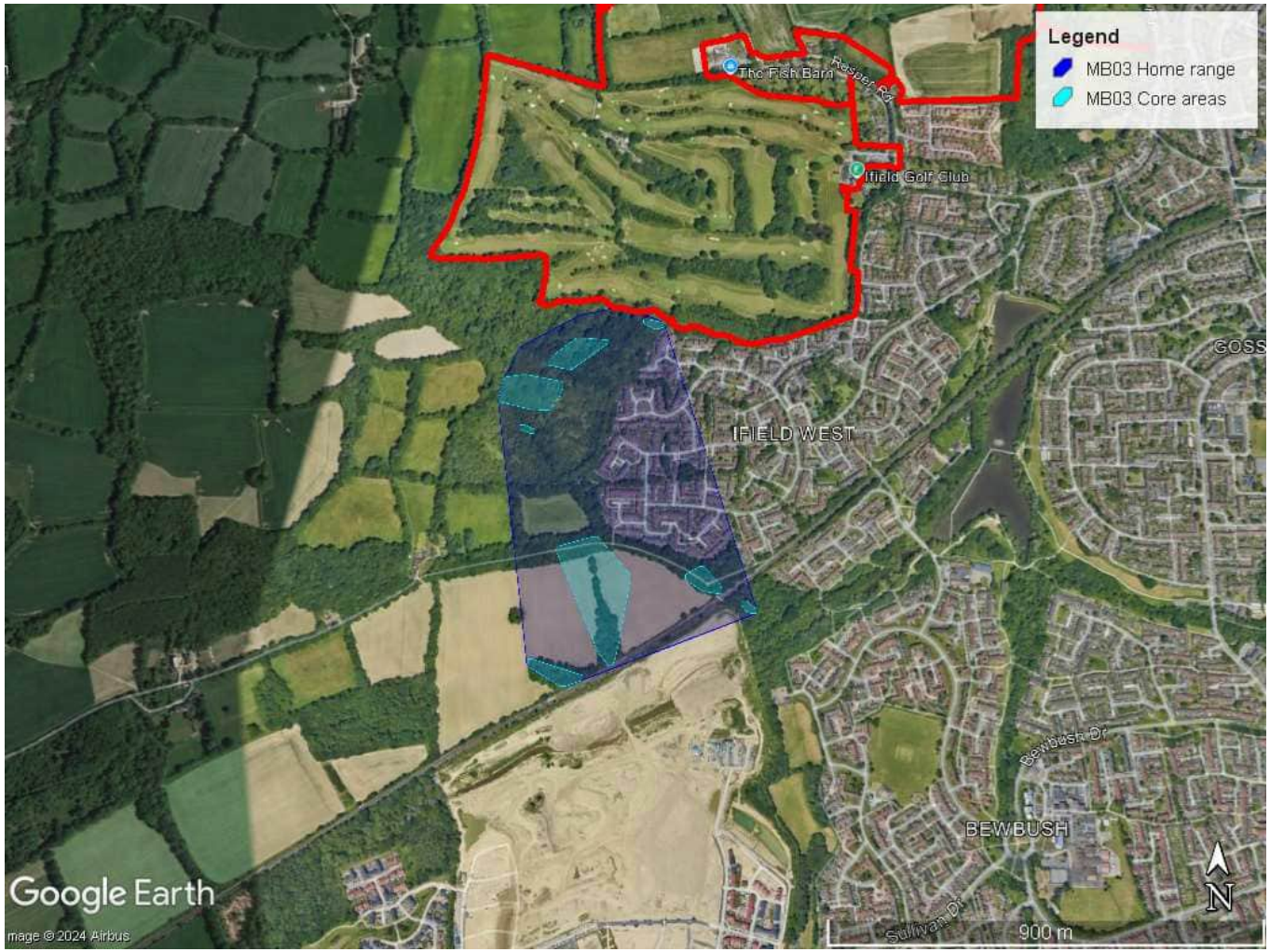

Figure 9 Female Bechstein's bat (MB04) RT data May 2024

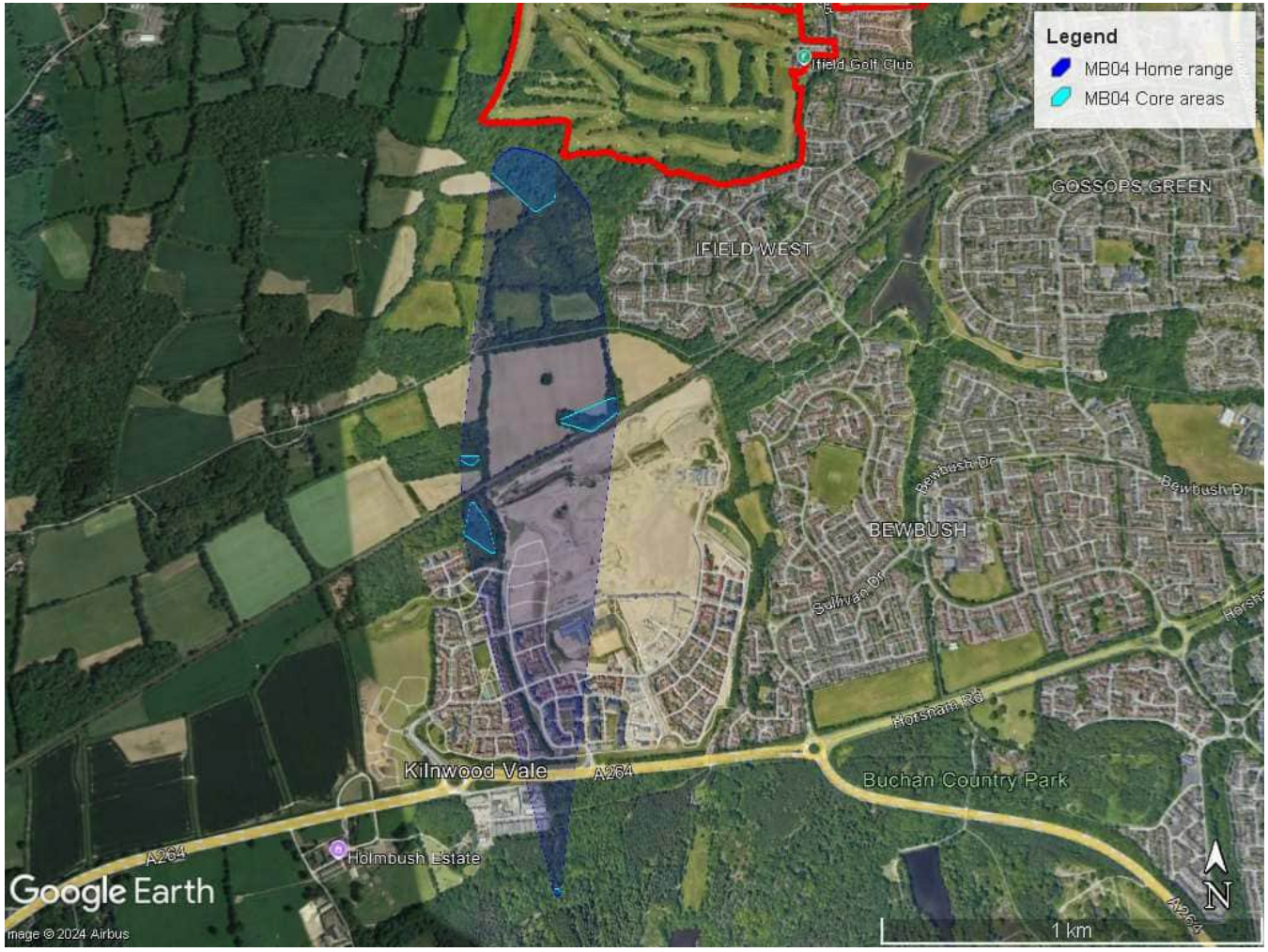

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Figure 10 Male Adult Bechstein's bat (MB07) RT data May 2024

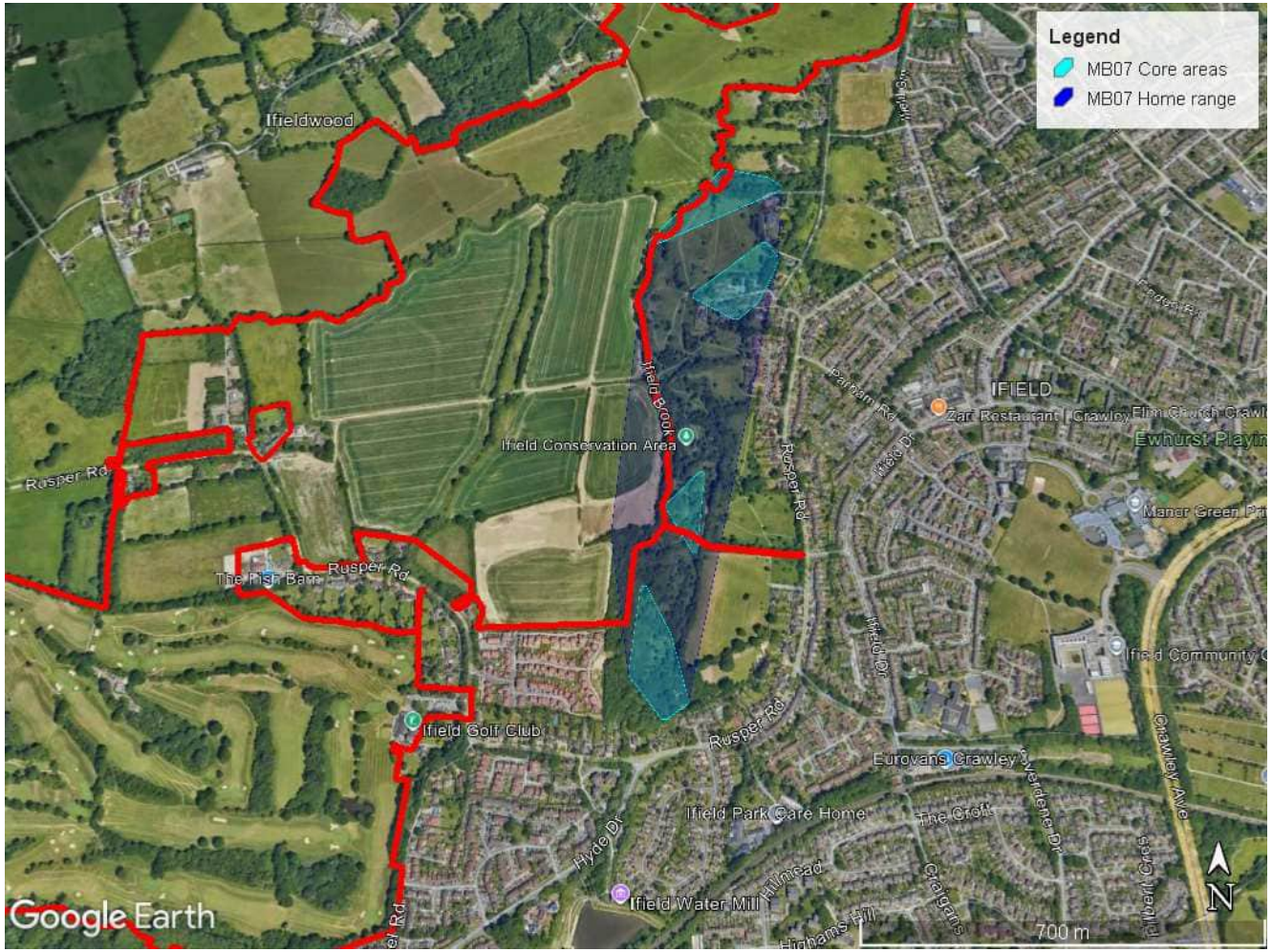

Figure 11 Female Bechstein's bat (MB09) RT data May 2024

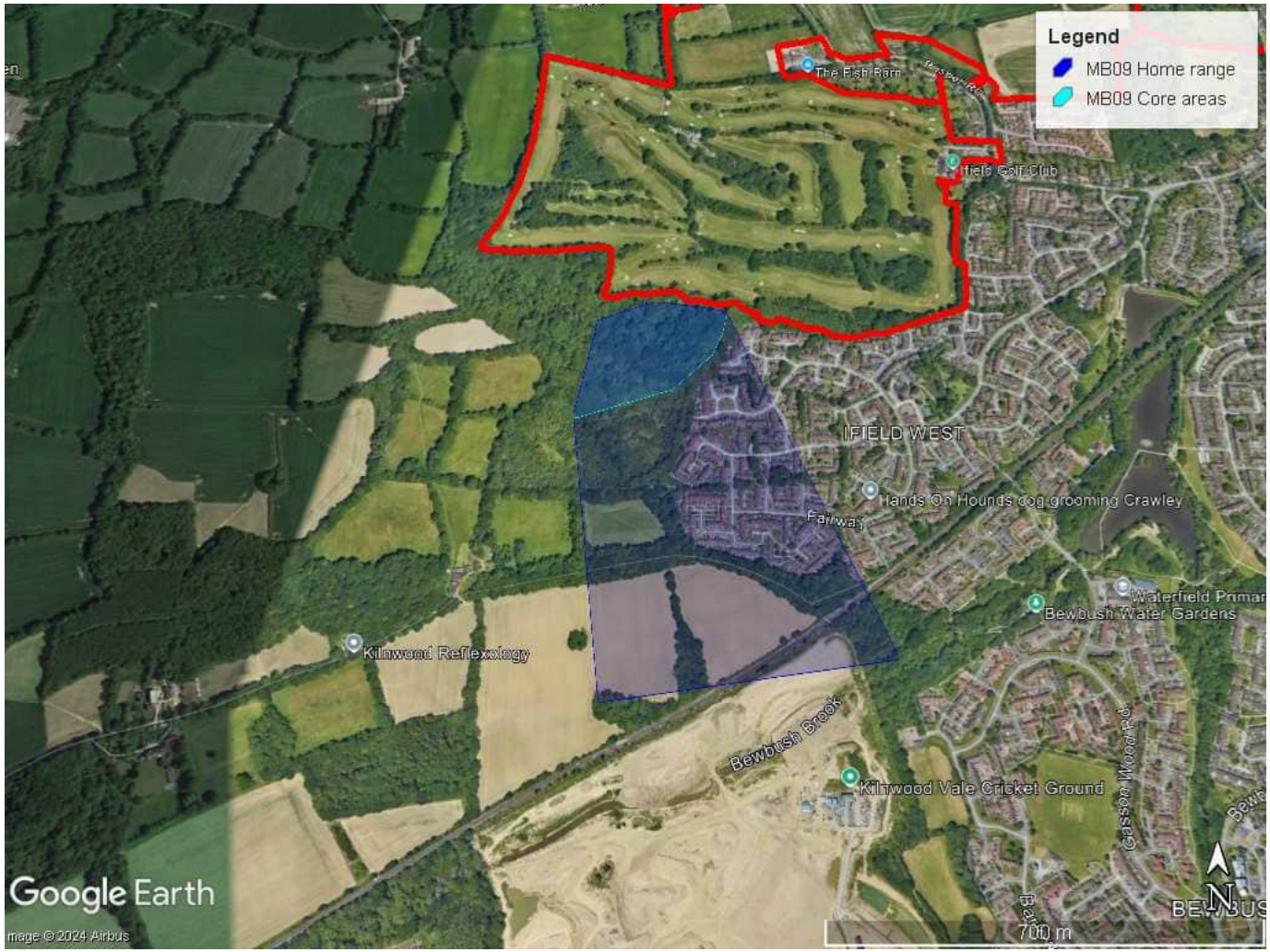

Figure 12 Male juvenile Bechstein's bat (MB03A) RT data July/August 2024

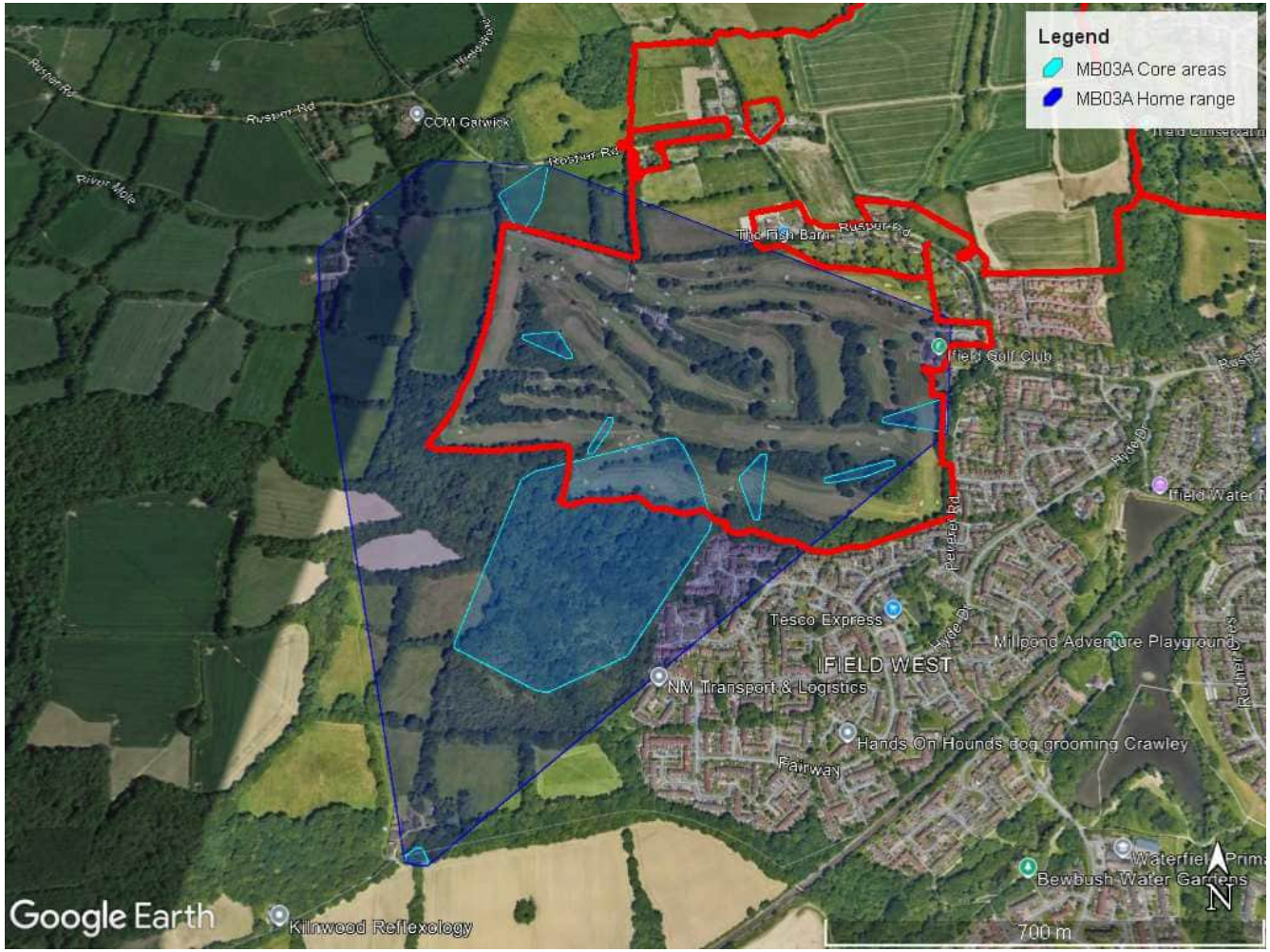

Figure 13 Male adult Bechstein's bat (MB05A) RT data July/August 2024

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Advanced bat surveys
Ramboll

Figure 14 Female juvenile Bechstein's bat (MB06A) RT data July/August 2024

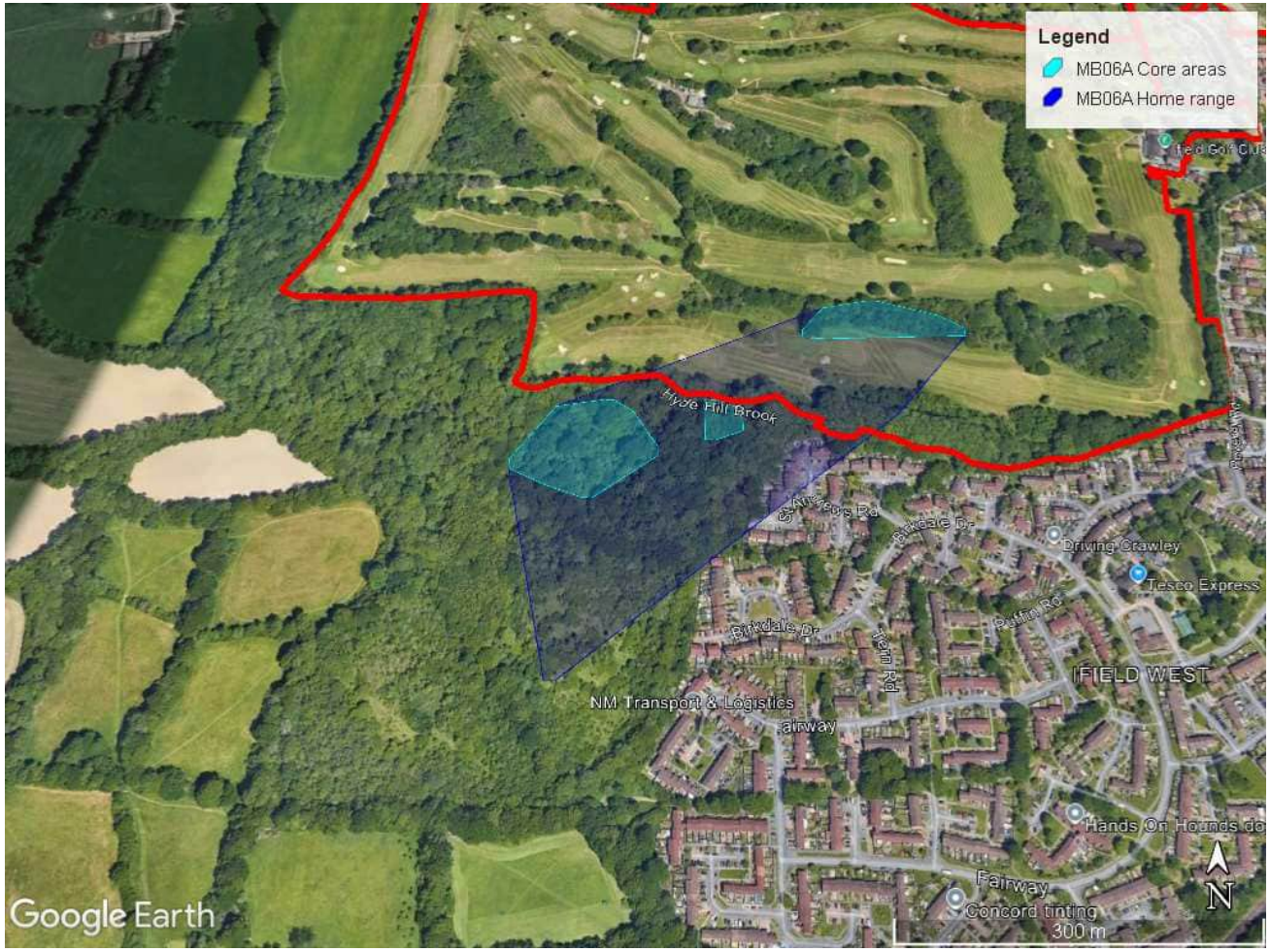
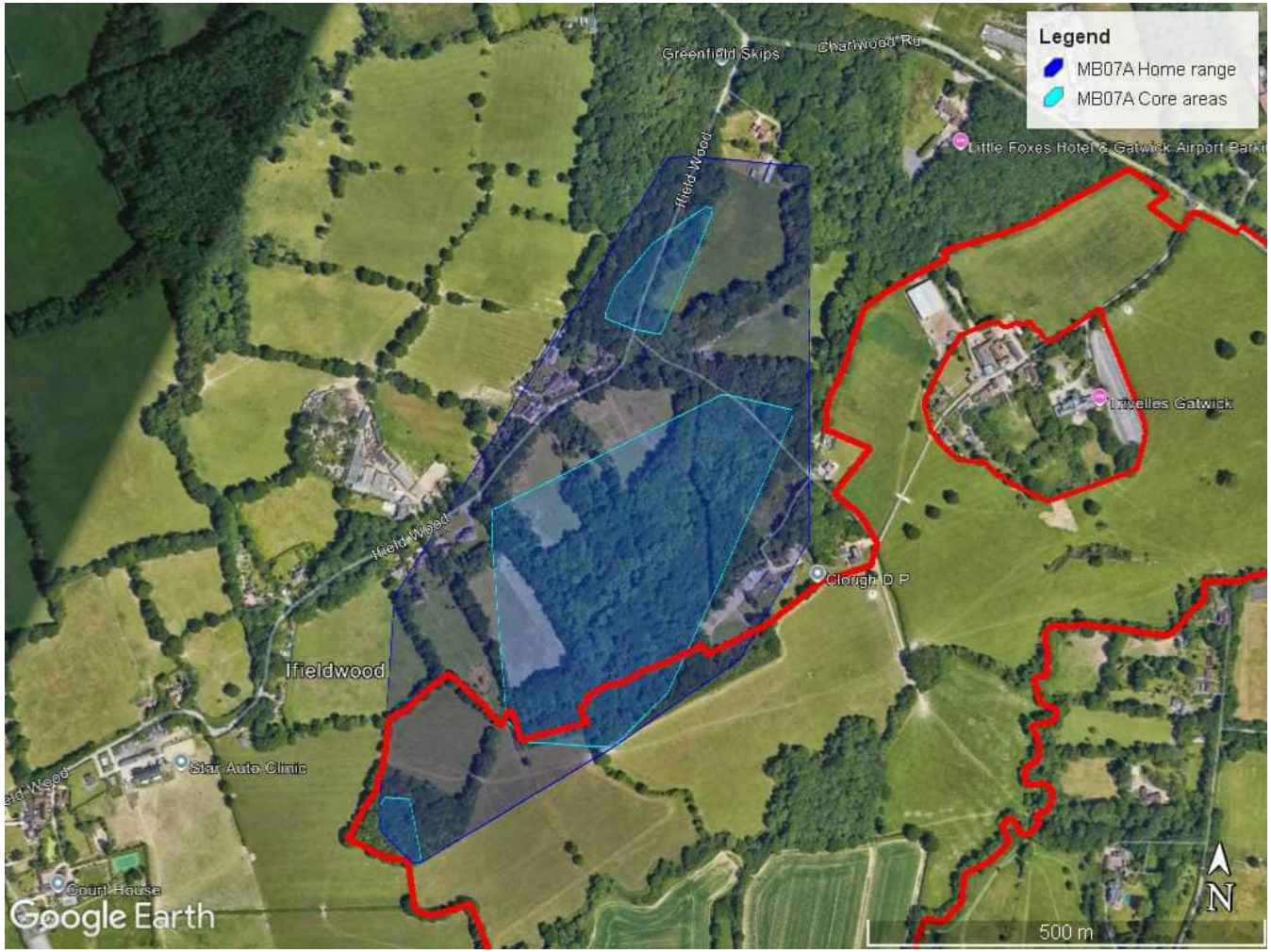
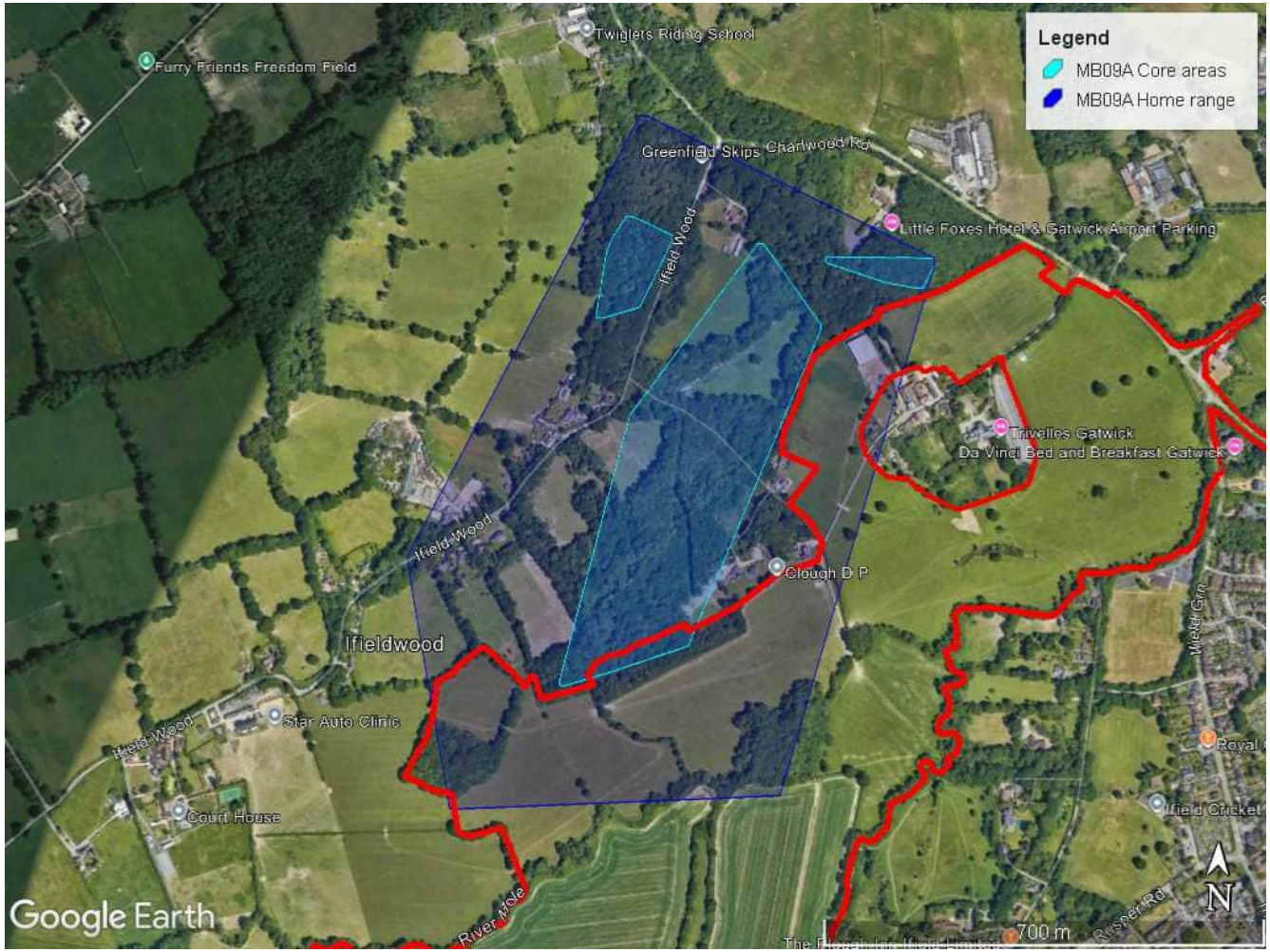


Figure 15 Female Bechstein's bat (MB07A) RT data July/August 2024



Land West of Ifield 2024
Advanced bat surveys
Ramboll

Figure 16 Male juvenile Bechstein's bat (MB09A) RT data July/August 2024



Appendix A Bat trapping data

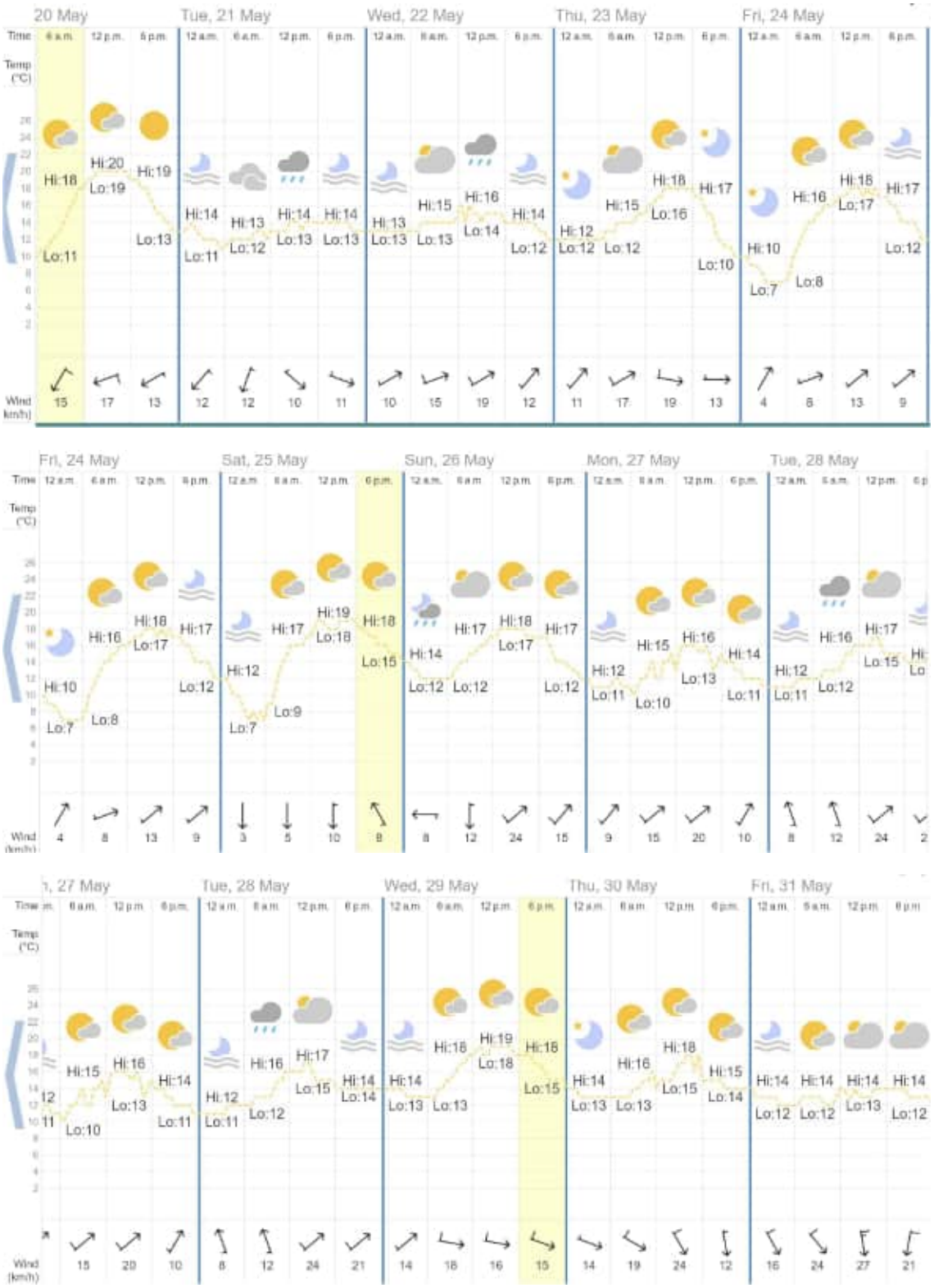
Trap area	Date (at start)	Species	Sex	Age (class)	Breeding status	Bat ref
TA8	20/05/2024	P. pipistrellus	Male	Adult		
TA8	20/05/2024	P. pipistrellus	Female	Adult	Not obviously pregnant	
TA8	20/05/2024	P. pipistrellus	Female	Adult	Pregnant	
TA8	20/05/2024	P. pipistrellus	Male	Adult		
TA8	20/05/2024	P. pipistrellus	Male	Adult		
TA8	20/05/2024	P. pipistrellus	Male	Adult		
TA8	20/05/2024	M. brandtii	Male	Adult		
TA8	20/05/2024	M. mystacinus	Male	Adult		
TA8	20/05/2024	M. mystacinus	Female	Adult	Not obviously pregnant	
TA8	20/05/2024	M. mystacinus	Female	Adult	Pregnant	MM01
TA8	20/05/2024	P. pipistrellus	Female	Adult	Not obviously pregnant	
TA8	20/05/2024	P. pipistrellus	Female	Adult	Pregnant	
TA8	20/05/2024	P. auritus	Male	Adult		
TA8	20/05/2024	P. auritus	Female	Adult	Not obviously pregnant	
TA8	20/05/2024	P. auritus	Female	Adult	Not obviously pregnant	BL02
TA8	20/05/2024	P. pipistrellus	Female	Adult	Not obviously pregnant	

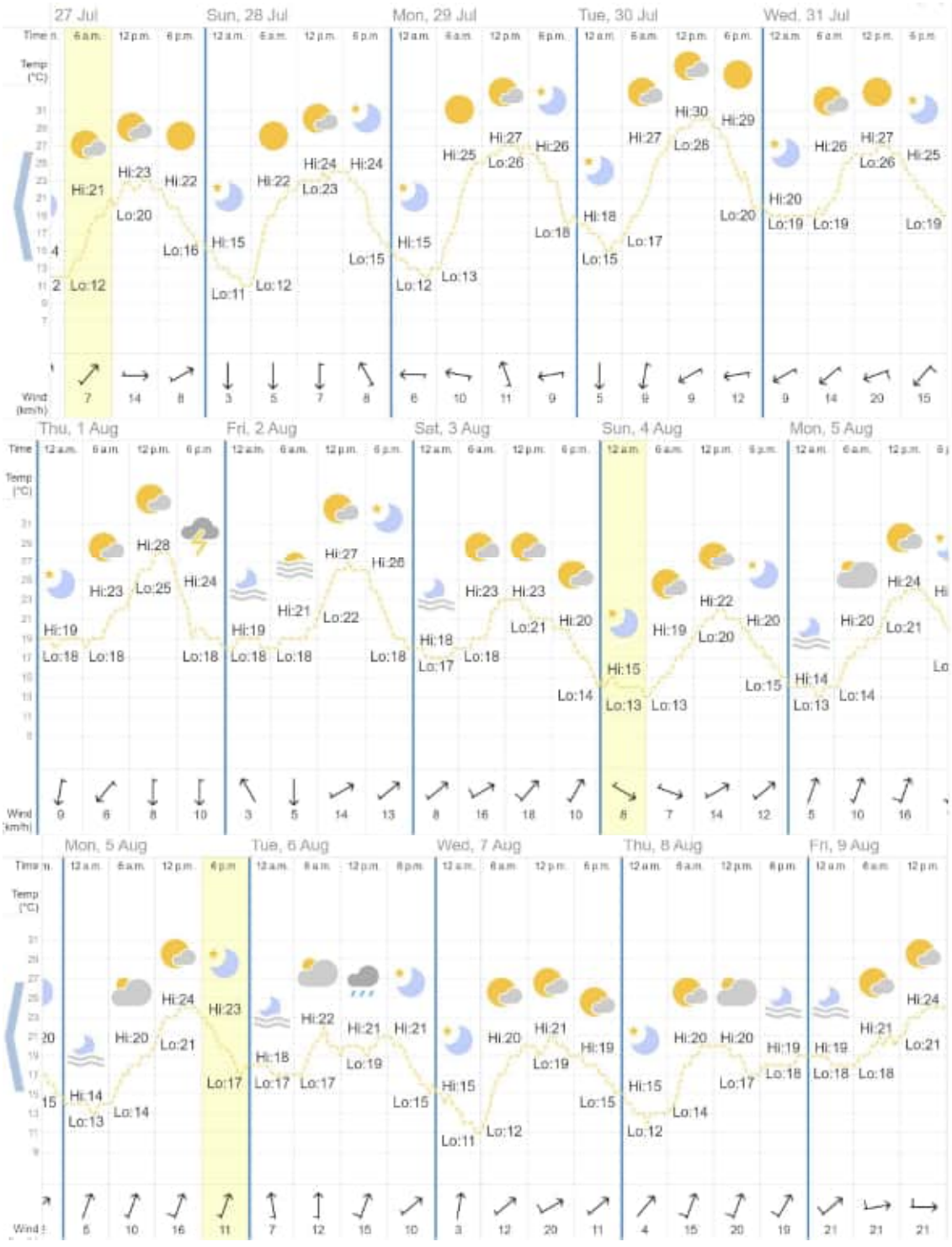
Trap area	Date (at start)	Species	Sex	Age (class)	Breeding status	Bat ref
TA8	20/05/2024	P. pipistrellus	Female	Adult	Pregnant	
TA8	20/05/2024	M. daubentonii	Male	Adult		
TA8	20/05/2024	P. pygmaeus	Male	Adult		
TA8	20/05/2024	P. pipistrellus	Female	Adult	Not obviously pregnant	
TA8	20/05/2024	P. pygmaeus	Male	Adult		
TA8	20/05/2024	M. mystacinus	Male	Adult		
TA8	20/05/2024	M. bechsteinii	Female	Adult	Non-breeding	MB03
TA7	20/05/2024	M. bechsteinii	Female	Adult	Non-breeding	MB04
TA6	21/05/2024	P. pipistrellus	Female	Adult	Non-breeding	
TA6	21/05/2024	N. noctula	Male	Adult	Swollen testes pale epids	
TA6	21/05/2024	P. pipistrellus	Female	Adult	Non-breeding	
TA6	21/05/2024	P. pipistrellus	Male	Adult	Non-breeding	
TA6	21/05/2024	P. auritus	Male	Adult	Non-breeding	
TA6	21/05/2024	P. pipistrellus	Male	Adult	Non-breeding	
TA6	21/05/2024	M. mystacinus	Male	Adult	Non-breeding	
TA6	21/05/2024	P. pipistrellus	Male	Adult	Non-breeding	
TA9	22/05/2024	P. auritus	Female	Adult	Non-breeding	
TA3	23/05/2024	M. mystacinus	Female	Adult	Pregnant	

Trap area	Date (at start)	Species	Sex	Age (class)	Breeding status	Bat ref
TA3	23/05/2024	M. mystacinus	Male	Adult	Non-breeding	
TA3	23/05/2024	M. mystacinus	Female	Adult	Non-breeding	
TA3	24/05/2024	M. mystacinus	Female	Adult	Non-breeding	
TA3	23/05/2024	P. pipistrellus	Female	Adult	Non-breeding	
TA3	23/05/2024	M. mystacinus	Female	Adult	Non-breeding	
TA1	24/05/2024	M. mystacinus	Female	Adult	Non-breeding	
TA1	24/05/2024	M. bechsteinii	Male	Adult		MB07
TA1	24/05/2024	P. auritus	Female	Adult	Non-breeding	BL08
TA1	24/05/2024	M. mystacinus	Female	Adult	Non-breeding	
TA1	24/05/2024	P. pipistrellus	Male	Adult	Non-breeding	
TA9	22/05/2024	P. pipistrellus	Female	Adult	Pregnant	
TA8	27/05/2024	P. auritus	Female	Adult	Non-breeding	
TA7	27/05/2024	P. pipistrellus	Male	Adult	Non-breeding	
TA7	27/05/2024	P. pipistrellus	Male	Adult	Non-breeding	
TA7	27/05/2024	M. mystacinus	Female	Adult		
TA7	27/05/2024	M. bechsteinii	Female	Adult	Pregnant	MB09
TA8	27/05/2024	P. pipistrellus	Male	Adult	Non-breeding	
TA8	27/05/2024	P. auritus	Male	Adult	Non-breeding	
TA8	27/05/2024	P. pipistrellus	Female	Adult	Pregnant	
TA6	30/07/2024	P. pipistrellus	Female	Adult	Post-lactating	
TA6	30/07/2024	P. auritus	Male	Adult	Non-breeding	
TA6	30/07/2024	P. pipistrellus	Female	Adult	Post Lactating	
TA6	30/07/2024	M. mystacinus	Male	Adult	Swollen testes pale epids	
TA6	30/07/2024	M. bechsteinii	Female	Juvenile		MB06A
TA6	30/07/2024	P. pygmaeus	Male	Adult	Non-breeding	
TA6	30/07/2024	P. pipistrellus	Female	Adult	Post Lactating	
TA6	30/07/2024	M. bechsteinii	Male	Adult		MB05A
TA6	30/07/2024	P. pygmaeus	Male	Adult	Swollen testes pale epids	
TA6	30/07/2024	P. pygmaeus	Female	Adult	Non-breeding	

Trap area	Date (at start)	Species	Sex	Age (class)	Breeding status	Bat ref
TA6	30/07/2024	P. pipistrellus	Male	Adult	Swollen testes pale epids	
TA6	30/07/2024	M. bechsteinii	Male	Juvenile		
TA6	30/07/2024	P. pygmaeus	Female	Adult	Post Lactating	
TA7	29/07/2024	P. auritus	Female	Adult	Post Lactating	BL01A
TA7	29/07/2024	M. mystacinus	Female	Adult	Non-breeding	
TA7	29/07/2024	M. bechsteinii	Male	Juvenile		MB03A
TA7	29/07/2024	M. bechsteinii	Male	Juvenile		MB04A
TA7	29/07/2024	M. mystacinus	Male	Adult	Non-breeding	
TA8	29/07/2024	M. daubentonii	Male	Adult	Non-breeding	
TA8	29/07/2024	P. auritus	Female	Adult	Post Lactating	
TA3	31/07/2024	P. auritus	Male	Adult	Non-breeding	
TA3	31/07/2024	P. pipistrellus	Female	Juvenile		
TA3	31/07/2024	P. auritus	Male	Adult	Non-breeding	
TA3	31/07/2024	P. pygmaeus	Male	Adult	Swollen testes pale epids	
TA2	31/07/2024	M. bechsteinii	Female	Adult	Non-breeding	MB07A
TA1	1/08/2024	M. nattereri	Female	Adult	Post-lactating	MN08A
TA1	1/08/2024	P. pipistrellus	Male	Juvenile		
TA2	2/08/2024	P. pipistrellus	Female	Adult	Post-lactating	
TA2	2/08/2024	M. mystacinus	Female	Juvenile		
TA2	2/08/2024	M. bechsteinii	Male	Juvenile		MB09A

Appendix B Weather summary during surveys (Time and Date for Crawley)

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Sun, 4 Aug
Mon, 5 Aug
Mon, 5 Aug
Tue, 6 Aug
Wed, 7 Aug
Thu, 8 Aug
Fri, 9 Aug

APPENDIX 8.26: BAT TRAPPING AND RADIO-TRACKING BASELINE REPORT AND EVALUATION FOR LAND WEST OF IFIELD, CRAWLEY FOR RAMBOLL

Bat Trapping and Radio-tracking
Baseline Report and Evaluation
For Land West of Ifield, Crawley
For Ramboll
26 September 2022

CONTENTS

Report	Prepared by:	Reviewed by:
Advanced Bat Survey Report Final 26 September 2022	Dr Ian Davidson-Watts MCIEEM	Diane Davidson-Watts MCIEEM

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1 Introduction

1.1 BACKGROUND

1.1.1 Residential development is proposed on approximately 194 ha of pastureland and golf course interspersed with small copses, woodland and riparian habitats on the west of the existing suburban areas of Ifield (the Scheme). The area subject to this survey and report includes the redline boundary (hereafter referred to as the Site), and some adjacent woodlands where access was possible to undertake the necessary trapping surveys, including Ifield Wood and Hyde Hill Wood.

1.1.2 The Site was found to support at least 10 species of bats including the rare Bechstein's *Myotis bechsteinii* bat in 2020/21 following studies by AEWC (AEWC Ltd, 2021). Further surveys were recommended to further understand the distribution of Bechstein's bat on the Site and bordering woodland areas.

1.1.3 Davidson-Watts Ecology Ltd (DWEL) were therefore commissioned by Ramboll UK Ltd to undertake the advanced surveys of the Site and adjacent areas in 2022 to achieve the following objectives:

- Further investigate the status of Bechstein's bats at the proposed Site with an emphasis on woodland habitat and tree lines during the breeding season;
- To capture and radio-track individual Bechstein's and where appropriate other tree roosting bat using the Site to locate breeding roosts, and in respect of Bechstein's bats, determine their activity patterns and habitat use; and
- Present a robust baseline of the use of the Site and adjacent areas by Bechstein's bats and other tree roost bat species, to support an effective impact assessment and development of mitigation measures.

2 Methodology

2.1 OVERVIEW

2.1.1 As Bechstein's bats roost in trees and are almost impossible to detect/identify using standard bat surveys, the primary approach to meeting the project aims was to trap free-flying bats and to radio-track individual bats to locate maternity and other roost types and to investigate use of the Site by bats when active at night.

2.1.2 Prior to 2022, three survey sessions of approximately one week duration each were undertaken in July/August 2020, June and August 2021 by AEWC (AEWC 2021). These captured circa 150 bats of 10 species and resulted in the tagging and radio-tracking of six individual Bechstein's bats. One bat in 2020 and five in 2021.

2.1.3 The 2022 surveys aimed to proportionately increase the number of radio-tagged Bechstein's, and two survey session of approximately one week each were undertaken between 6-12 June and 25 July and 1 August 2022.

2.1.4 Each session began with the trapping of bats. Radio-tagged bats were simultaneously/subsequently followed by radio-tracking during the week to locate roost sites and to examine nocturnal activity of bats, with a focus on collecting activity data for bats within the development boundary. Where access was possible, emergence counts were undertaken at identified roosts to determine the function of the roost and to provide an estimate of population sizes.

2.1.5 The following methods were undertaken in line with Chapter 9 (Advanced licensed bat survey methods) in Collins, 2016.

2.2 TRAPPING METHODS

2.2.1 Bats were caught using up to seven 4 m^2 harp traps or 6-12m mist nests placed in woodlands and significant treelines within the land subject to investigation (the Site - see Figure 1). Acoustic lures (e.g. Sussex Autobats) were used to improve catch efficiency in woodland (Hill and Greenaway 2005). The lures emitted synthesised or pre-recorded bat social calls. Lures were placed next to harp traps and any bats captured were identified, sexed, aged and breeding status determined.

2.2.2 Prior to using lures, known roosts from previous data (e.g. AEWC 2021) were positively identified and mapped on Google Earth app, to ensure they were not used within 50m.

2.2.3 Generally trapping teams monitored trap sites with handheld bat detectors (Pettersson 240x or Elekon Batlogger M) during the trapping survey, mainly to assess bat activity in the vicinity of the traps.

2.3 TRACKING METHODS

2.3.1 Target bats were fitted with lightweight radio-transmitter tags (Lotek Ltd, Wareham, Dorset, United Kingdom) weighing <5 % of the weight of the bat using skin bond/torb or similar proven adhesive. Tagging of female bats in advanced stages of pregnancy was avoided. Lactating bats were tagged if they met the target weight and were in good condition, although early lactating bats were not tagged for welfare reasons. Bats were processed quickly and released within 30 minutes of capture provided the glue attaching the transmitter had cured sufficiently.

2.3.2 Tracking of bats was undertaken for a period of five to six nights following capture. Bechstein's bats were followed from dusk until dawn post capture, other bats were generally released and roost finding took place at dawn or during the day, with observations made of the general locations of these bats whilst monitoring the movements of the Bechstein's bats during the night.

2.3.3 Positions of tagged bats were pinpointed at regular intervals throughout the night depending on whether the tracker was in contact with the bat. Tracking aimed to record positional fixes that enabled

determination of home ranges and core areas of activity and when in contact, position fixes were recorded approximately every 10-15 minutes.

2.3.4 Surveyors obtained a fix on a bat by driving or walking in the direction of the strongest signal of the tagged bat. A bat's position was estimated by close approach (White and Garrott 1990) on foot whenever possible. Where safe and permitted access was not possible, multiple compass bearings were taken by circling around the signal in as short a time period as practically possible, keeping contact with the bat to assess any change in location. These approaches enabled an estimate of a bat's location depending on the distance.

2.3.5 Accuracy of triangulated locations was considered +/-20m. This was based on observer experience, knowledge of the area and the combined use of close approach and triangulation, rather than triangulation alone. Therefore, for analysis of home ranges in Ranges 9, a tracking resolution of 20m was applied to take account of accuracy issues associated with triangulation at distance.

2.3.6 The digitised radio tracking data was analysed in Ranges 9 to calculate home range areas, which are also known as 100% Minimum Convex Polygons (MCPs), and core activity areas using objective core analysis (Kenwood et al 2001). MCP mapping is a polygon based on the outside of all the fixes associated with a tagged bat. The MCP technique of determining home range was used as it is considered relatively unaffected by the effects of autocorrelation (Harris et al 1990). However, this method does overestimate home range and often includes large areas that the tagged bat flew through to get to possible foraging or roosting areas.

2.3.7 The identification of core areas for each bat is important as it highlights the habitats in which the bats are spending most of their time. Cluster polygons were considered the most appropriate minimum-linkage estimators to define the areas bats were using. This is because most of the tagged/tracked bats spent the majority of their time in relatively small areas compared to their full home range, moving quickly between them. The fragmented cluster polygons show where bats were highly active (e.g. foraging/social activity) or night roosting/returning to roosts, rather than the area travelled through to get to such areas.

2.3.8 For the estimation of core areas, 'objective core analysis' was the chosen method. This approach is scientifically rigorous as it calculates core areas from the distribution of the bats' locations themselves rather than manual determination of what percentage of fixes should be excluded from the analysis, usually from assessment of utilisation distributions continuities (a manual method of excluding outlying locations). The objective core analysis method (Kenwood et al 2014) uses the distribution of nearest-neighbour distances detecting and excluding outlying location resulting in an objective core activity area.

2.3.9 Use of objective core analysis was especially relevant to this study as it was considered that all estimated bat fixes should be used to determine overall activity patterns, and would provide a more conservative method, smoothing any accuracy issues with the collection of fixes.

2.4 ROOST EMERGENCE

2.4.1 When tagged bats were tracked to accessible roost sites, subsequent roost exit counts were undertaken using infrared cameras (Canon XA10/XA40) with infrared illuminators to determine roost size and status (e.g. maternity roost). Roost attributes such as location, type of structure and other descriptors were recorded where possible.

2.5 LICENSING

2.5.1 All 2022 trapping and tracking surveys were undertaken under a project licence from Natural England number 2022-61128-SCI-SCI obtained by Dr Ian Davidson-Watts, with 29 years bat survey experience, who led the June 2022 surveys designed and coordinated the field surveys and undertook the analysis of the results. The field surveys were undertaken by surveyors with significant bat trapping and radio tracking experience, with all tagging and trapping undertaken by those named on the above licence.

2.6 ADJUSTMENTS AND LIMITATIONS

2.6.1 Ecological surveys are limited by factors which affect the presence of animals such as the time of year, migration patterns and behaviour. Therefore, the absence of evidence of any species should not be taken as conclusive proof that the species is not present or that it will not be present in the future.

2.6.2 The survey techniques described in this report involve a sampling effort that is considered appropriate for obtaining information on the location of roosts and core activity areas potentially affected by the Scheme, while ensuring that local bat populations are not disturbed adversely by the survey method itself. The methods used here do not provide a full account of all bat activity in the area or activity at other times of the year outside of the survey period.

2.6.3 The limitation of objective coring analysis of radio tracking data is that the process sometimes estimates core areas larger than those from an equivalent number of locations compared to more manual methods. This method was used however as it is the most robust approach to assessing core areas of tagged bats in a precautionary manner to ensure important areas used by bats were not overlooked.

2.6.4 Weather conditions were appropriate throughout trapping and emergence survey work (i.e. sunset temperature 10◦C or above, no rain or strong wind). As such the results of trapping and radio tracking were not constrained or affected by significant weather changes. During rain events, tagged bats generally remained active during the dusk/dawn surveys.

2.6.5 Usual scientific best practice avoids using data collected on the night of capture for analysis of ranging behaviour due to the effects of disturbance from the capture/tagging procedure on behaviour of the bats. In this study, data collected during the first night of tracking was incorporated for analysis as some bats were trapped in locations where they were not recorded for the remainder of the study. The exclusion of this information would not have reflected what was known of their home range and whilst rigorous scientific approaches have been adopted to objectively record and asses/interpret the radio tracking data, the study's objectives were to primarily understand as much about the movement of bat species affected by the Scheme rather than test any hypotheses.

2.6.6 A limitation of radio tracking studies relates to accuracy of positional fixes. Accuracy of fixes can be a common problem in studies of fast-moving bats, particularly those species that have relatively large home ranges. Whilst methods such as biangulation/triangulation can provide relatively rapid and systematic location data for bats, studies have shown that due to variability of surveyor skill, especially at distance, positional fixes might only be accurate to >250m^2 (Botandina and Schofield 2002).

2.6.7 A combination of triangulation and close approach methods were adopted to increase accuracy. A number of factors such as the landform, safe and permitted access to private land and time bats spent in an area can affect the accuracy of fixes. To take account of these variables, the analysis of radio tracking data has been relatively conservative, especially when estimating core areas of activity. For instance, a tracking resolution of 20 m has been applied to all location fixes where triangulation was used and use of objective cores also aimed to take account of these limitations.

2.6.8 The other major limitation influencing the ability to obtain data for this project were land access restrictions. Notwithstanding this limitation, the use of the acoustic lure assisted the trapping of sufficient bats within their foraging areas and previously unrecorded roost sites, from which a defensible radio tracking dataset could be obtained for the period of survey.

2.7 EVALUATION CRITERIA

2.7.1 Ecological features and resources have been evaluated based on the approach described in 'Guidelines for Ecological Impact Assessment in the United Kingdom' published by the Chartered Institute of Ecology and Environmental Management (2018) whereby the value of an ecological feature or resource is determined within a defined geographical context using the following criteria:

- International,
- National (England),
- Regional (South-East),
- County/District (West Sussex),
- Local (or Parish) (Crawley); and
- At the Site level only.

3 Results

3.1 BAT TRAPPING

3.1.1 In June 2022 nine trapping areas were sampled across the Site over four nights (see Appendix A for trapping data and Figure 1 showing trapping areas). A total of 38 bats of eight species were recorded.

3.1.2 Bat species captured that were of particular note included a pregnant female Bechstein's bat captured in trapping area (TA) 4 (Hyde Hill Wood) and an adult male Bechstein's bats in TA2 (part of Ifield Wood). The other bat species captured included common and soprano pipistrelle (*Pipistrellus pipistrellus and P. pygmaeus*), brown long-eared (*Plecotus auritus*), Natterer's (*Myotis nattereri*), whiskered (*M. mystacinus*), Brandt's (*M. brandtii*) and noctule (*Nyctalus noctula*) bats. Brandt's bat was confirmed through DNA analysis of a dropping (see Appendix B).

3.1.3 In July 2022 six trapping areas were sampled with a total of 50 bats of eight species captured during four nights of trapping.

3.1.4 Species recorded in July included Bechstein's which were captured at TA4 on the southern boundary of the Site, and TA3 and TA1, and included two lactating females and five male juveniles. In addition to Bechstein's bats, an adult male barbastelle (*Barbastella barbastellus*) bat was also captured at TA4.

3.1.5 Other bats captured on the Site during July 2022 included brown long-eared, Natterer's, Daubenton's (*M. daubentonii*), common and soprano pipistrelle and whiskered bat.

3.1.6 Combining the capture data of both June and July 2022, the Site and adjacent woodland areas are used by breeding bats of the following species; Bechstein's, brown long-eared, Brandt's, Natterer's, whiskered, common pipistrelle and soprano pipistrelle.

3.2 RADIO TRACKING AND ROOSTING PATTERNS

3.2.1 A total of 13 bats were fitted with radio transmitters. This included seven target Bechstein's bats, which comprised three breeding adult females, one adult male and three male juveniles. Subsequent radio tracking surveys then went on to locate roost sites and determine broad activity areas including foraging sites. Table 1 provides summary statistics of their ranges and the Figures which contains maps showing their ranges.

3.2.2 In addition, two Natterer's and three brown long-eared bats were tagged for the purposes of finding roosts. Where it was possible, positional data on these bats were also obtained during the dusk to dawn tracking and sufficient fixes were obtained for one brown long-eared bat and one male natterer's bat.

3.2.3 One barbastelle male (bat 770) was also captured and tagged at TA4. After release he was followed and the transmitters appeared to be faulty, following which contact with this bat was sporadic. Occasional fixes were obtained for this bat (n=18) and this bat's ranges are illustratively shown as Figure 16 given the higher conservation status of this species, although it is not possible to provide reliable range data given the low number of fixes. No roost was located for bat 770 on the Site or surrounding area, although access limitations meant that a thorough search of likely sites outside the red line boundary could not be made.

Table 1 - Summary data of tagged bats and their home range statistics

ID	Species	Sex	Date captured	Location	No. Fixes	Range span (m)	MCP (ha)	Mean core area (ha)
124	*M. bechsteinii*	Female*	06/06/22	TA4	103	1764	92.7	12.3
125	*M. bechsteinii*	Male	09/06/22	TA2	52	543	12.7	0.4
287	*M. bechsteinii*	Female*	25/07/22	TA4	117	1586	78.2	3.0
245	*M. bechsteinii*	Female*	25/07/22	TA4	123	1157	34.5	2.3
123	*M. bechsteinii*	Male**	25/07/22	TA4	93	1778	96.9	5.6
687	*M. bechsteinii*	Male**	27/07/22	TA3	71	3336	128.3	8.6
692	*M. bechsteinii*	Male**	27/07/22	TA1	83	1184	58.7	5.6
128	*P. auritus*	Female*	08/06/22	TA8	67	1506	64.2	16.2
253	*M. nattereri*	Male	25/07/22	TA4	30	1094	19.3	1.3

**Breeding bat. ** Juvenile bat.*

Table 2 – Roost locations and summary roost attributes of tagged bats (refer to Figures 4-6).

Bat ID	Species	Date	Roost				
			ID	Type	Location†	Feature#	Count
124	*M. bechsteinii*	07/06/22	R1*	Ash tree	TQ2327535842	Woodpecker hole	24
129	*P. auritus*	08/06/22	R2	House	TQ2386738155	No access**	N/A
128	*P. auritus*	09/06/22	R3*	Tree	TQ2452936844	Cavity	23
125	*M. bechsteinii*	10/06/22	R4	Ash tree	TQ2449737942	Cavity	1
130	*M. nattereri*	10/06/22	R5*	Oak tree	TQ2418238423	No access**	N/A
130	*M. nattereri*	11/06/22	R6*	Oak tree	TQ2447438229	No access**	N/A
287/ 245	*M. bechsteinii*	26/07/22	R1*	Ash tree	TQ2327535842	Woodpecker hole	30
275	*P. auritus*	26/07/22	R7*	Oak tree	TQ2306936487	Not confirmed	N/A
275	*P. auritus*	27/07/22	R8*	Ash tree	TQ2347336397	Cavity	12
253	*M. nattereri*	28/07/22	R9	Ash tree	TQ2371636357	Not confirmed	N/A
275	*P. auritus*	28/07/22	R10*	Tree	TQ2303036270	No access**	N/A
123	*M. bechsteinii*	28/07/22	R11*	Tree	TQ2267735823	No access**	N/A
692/ 687	*M. bechsteinii*	28/07/22	R12*	Ash tree	TQ2437338682	Cavity	22
287/ 245	*M. bechsteinii*	29/07/22	R13*	Tree	TQ2270935624	No access**	N/A
692/ 687	*M. bechsteinii*	29/07/22	R14*	Ash tree	TQ2423338626	Not confirmed	4+

*Likely or confirmed maternity roost. **no access for count, based on presence of tagged bats only.

†Location accurate to 20m^2 for accessible roosts as based on GPS signal under tree canopy. Location accuracy for triangulated non-accessible roosts is 100-250m^2

#Not confirmed means that an emergence survey was undertaken of the tree supporting the tagged bat(s), but the actual roost feature in use was not identified. As a result, either no bats were visually observed emerging or fewer than the likely number of bats present were observed despite the use of night vision equipment etc.

3.3 RADIO TRACKING DATA

Bechstein's bat (Figures 7-14)

3.3.1 All tagged Bechstein's bats (n=7) were captured in either Hyde Hill Wood, in copses on the north-western part of the Site (TA1 and TA3), or Ifield Wood.

3.3.2 Bechstein's bats were tagged and followed for 3-5 nights post capture night. Flying distances (span of home ranges) were between 0.5 and 3.3km with a mean of 1.6km. Home ranges (using 100% of all bat fixes) ranged between 12.1 ha for the male adult Bechstein's (bat 287) in June 2022, and 128 ha for the male juvenile Bechstein's in late July 2022. Average (mean) home range size was 71 ha.

3.3.3 Core areas for the seven tagged Bechstein's bats ranged between the adult male Bat 125 of 0.4ha – the female pregnant Bechstein's Bat 124 in June of 12.3 ha. The mean core area size of all Bechstein's bats was 5.4 ha.

3.3.4 Overall home and core ranges in June were confined to the general areas of where the two Bechstein's bats (Bat 124 adult breeding female and Bat 125 adult male) were captured. Bat 124 was captured in Hyde Hill Wood and this remained her predominant foraging area for the duration of the survey. She roosted in an Ash tree (R1) with up to 23 other bats, also for the duration of the survey.

3.3.5 Bat 125 was captured on the Site at TA1 and this bat's activity was recorded mainly between the small copse at TA1 within the red line boundary and the fringes of Ifield Wood. This bat had the smallest range of all the Bechstein's bats and roosted by itself in an ash tree (R4) on the eastern edge of the copse at TA1.

3.3.6 In late July, two adult female and one male juvenile Bechstein's bats were captured in the Hyde Hill Wood area, and home ranges and core areas remained within the woodland complexes of Hyde Hill Wood, House Copse and parts of the golf course within the red line boundary. Bat 123 (male juvenile Bechstein's) and Bat 287 (female lactating Bechstein's) ranges occurred within the Site in the golf course area. Bat 245 (lactating female Bechstein's) remained to the south of the Site in Hyde Hill Wood.

3.3.7 The lactating Bechstein's Bats 245 and 287 both used the same roosts simultaneously, which was initially R1 (same roost as used by the maternity population in June 2022), and then subsequently R13, which was not accessible for an emergence survey. R1 was used by 30 bats on the 26 July 2022.

3.3.8 The male juvenile Bat 123's roost was difficult to locate due to access issues. It was triangulated at R11 which is on the northern side of House Copse and used this site for the duration of the survey session, indicating another maternity roost occurred at this location simultaneously with the bats using R1.

3.3.9 Two male juvenile Bechstein's Bats 692 and 687 were captured in the small copses of TA1 and TA3 in the northern area of the Site, and adjacent to Ifield Wood. They were subsequently located in tree roosts in the Ifield Wood area, with both bats using R12 initially and then moving to R14. At least 22 bats were observed emerging from R12. The emergence count of R14 was inconclusive as the roost feature was out of view, however at least four Bechstein's bat were observed emerging from an area of the crown.

3.3.10 Core areas of Bat 692 were generally confined to the Ifield Wood area and TA1 crossing pasture habitats to reach the Site. The home range of Bat 687 was very different, and this bat had core areas in both Ifield Wood and Hyde Hill Wood suggesting a link between the two sub populations of Bechstein's using woodlands adjacent to and on the periphery of the proposed red line boundary of the Site.

Other bat species

3.3.11 Other bats species were tracked as a second priority to Bechstein's bat. In June 2022, the female pregnant brown long-eared Bat 128 was tracked to a maternity roost in Ifield Park (R3) containing 23 bats. Her core areas were focussed on Ifield Park and she made other flying bouts in the north west of the site in the River Mole area.

3.3.12 In July 2022, the Natterer's Bat 253 was found roosting in Hyde Hill Wood R9, with core areas located in Hyde Hill Wood and commuting through the suburbs to Ifield Mill where it was recorded foraging in riparian woodland.

4 Discussion and Evaluation

4.1 USE OF THE SITE BY BECHSTEIN' S BAT

4.1.1 The results of the 2022 surveys provide more data to support the initial surveys by AEWC (2021) that Bechstein's bats occur within the red line boundary (the Site). Both surveys have captured this species occurring on Site in the southern parts, such as in and around the golf course and Hyde Hill Wood area, and in the north-western part of the Site adjacent to and within Ifield Wood.

4.1.2 Unlike the 2020/21 surveys, the 2022 surveys did not find Bechstein's bats in the central parts of the Site, despite the Ifield Park area receiving a high level of trapping effort. However, there is no reason why Bechstein's bats are not still using these areas as whilst the trapping surveys were proportionate in respect of effort, the limitations and low frequency of trapping surveys may have resulted in the small number of bats likely to be using these areas going unrecorded.

4.1.3 The consistent captures of Bechstein's bat in June and August 2022, in the Hyde Hill Wood/golf course areas, and the Ifield Wood area including TA1 and TA3 which were alsoused in the 2020/21 surveys and shows that these areas are of significance to the local Bechstein's bat population(s).

4.1.4 The 2022 radio tracking results add more weight to this assessment, especially the capture and tracking of a breeding female in June 2022, where there was no data for breeding bat previously. One male Bechstein's bat day roost was discovered in June 2022 in the woodland at TA1. All other roosts for this species, which were maternity roosts, were located in nearby or adjacent woodland to the redline boundary e.g. House Copse SSSI, or treelines such as R1 and the roosts found in Ifield Wood. The AEWC (2021) surveys also recorded maternity roosts in Hyde Hill Wood and Ifield Wood and found night roosts for Bechstein's in the golf course. No maternity roosts for this species are known to occur on the Site.

4.1.5 The movement data from seven radio tracked Bechstein's bats in 2022 (home ranges and core areas) also suggest that the majority of core areas are outside the Site boundary focussing on extensive and well-connected woodlands, with some notable exceptions of tracked bats using the golf course in the south and the areas between TA3, TA1 and Ifield Wood in the north-west. Radio tracking is a sampling method, so it is likely that other individual Bechstein's bats will use tree lines and copses on the rest of the Site as suggested by the AEWC trapping data, however overall, the ranges data suggest that these areas are likely to be of lower importance to the local population and may be on the fringes of the population's home ranges. The AEWC 2021 study also found similar movement patterns, despite capturing bats in these areas.

4.1.6 This is consistent with the known habitat use of Bechstein's bats which generally require well-established woodland for foraging (Davidson-Watts, 2008; BCT, 2011). However, it is evident from the tracking results that open tracts of unwooded habitat are not a hinderance to bats commuting to their core areas, as frequent movements were observed over open grassland between woodland habitats, and in particular the movement of the male juvenile Bat 687 which highlighted that the Bechstein's populations at Hyde Hill Wood/House Copse and Ifield Wood are linked or related as part of a meta population occurring west of Crawley and Gatwick.

4.1.7 Core sustenance zones are areas of foraging habitat around roosts that are considered important for providing sustenance. For Bechstein's bats these are reported to be up to 3 km away from roosts (BCT 2020), which is consistent with our findings. During June and July, bats using the Site for foraging generally roosted within a 1 km radius.

4.1.8 Bechstein's bats are generally considered to be reliant on relatively cluttered habitats, such as hazel coppice understory in broadleaved woodland (BCT, 2011). Although they have been found to roost in old-growth woodlands (i.e. ancient semi-natural woodland), they will use plantations and secondary woodlands (broadleaved and coniferous) for foraging and commuting (Davidson-Watts, 2008) and this is shown in the surveys from 2022.

4.2 OTHER BAT SPECIES USE OF THE SITE

4.2.1 In total the 2022 survey re-confirmed the presence of at least eight species, including Bechstein's bat. An additional species, Brandt's bat, was also confirmed in Hyde Hill Wood (via DNA analysis of droppings). Breeding female records are a relatively uncommon finding and considered scarce in Sussex (Sussex Bat Group https://www.sussexbatgroup.org.uk/batsinsussex).

4.2.2 A male adult barbastelle bat was captured just once in August 2022 and, although the occasional barbastelle was recorded using bat detectors (during trapping surveys), no further individuals were captured. The roost site for the single captured individual was not located and thorough searches on Site were made providing confidence it was not roosting within the red line boundary or adjacent areas. The low encounters of this species during the trapping surveys and the single capture of this species by AEWC, suggest that the Site itself is not of major importance (e.g. supporting a maternity population) for this species. Nevertheless, barbastelle bats may move through the Site to known populations to the south or west.

4.2.3 The results show that there are resident brown long-eared bat populations using Ifield Park as a maternity roosting area, and also the Hyde Hill Wood area. Roosts were found within the Site and on the border of Hyde Hill Wood and the golf course. Although access was not possible for a survey a likely maternity roost was also located in a dwelling near Ifield Wood.

4.2.4 A maternity population of Natterer's was confirmed in the Ifield Wood area, with a roost found bordering the Site. No counts were made due to priorities of tracking Bechstein's bats. However, this species is commonly found in trees and move frequently.

5 Evaluation

5.1.1 Bechstein's are one of the rarest bat species in the UK and Europe and Sussex is likely to be a stronghold for the species with a number of known populations recorded. The role of woodland habitat on the Site and in the surrounding areas is likely to be important in terms of supporting individual bats from at least two nearby maternity populations. It is therefore considered that, in the context of a number of Bechstein's bat maternity populations being present in Sussex, foraging habitat within the proposed development Site is of at least **Regional** importance to this species.

5.1.2 Barbastelle bats are a rare bat species in the UK and Europe. However, in relation to the trapping and tracking surveys, there was low use of the sSite and its roost was located away from the Site. If barbastelle bats frequently used the Site then greater numbers might have expected to have captured, although DWEL cannot rule out the possibility that they were under-represented in our sample. The Site is therefore considered of **Local** importance for this species.

5.1.3 Brown long-eared bats and Natterer's bats are both tree roosting species and maternity roosts were located on Site in the case of brown long-eared bat, and bordering the Site for both brown long-eared and natterer's bats. It is likely that numerous trees will be used by these species within the Site boundary. These species are relatively common, but maternity populations are of higher conservation status and therefore the regular occurrence of these breeding populations on or adjacent to the Site is considered important at the **District** level.

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Figure 1 Trapping Locations and survey areas (red line)

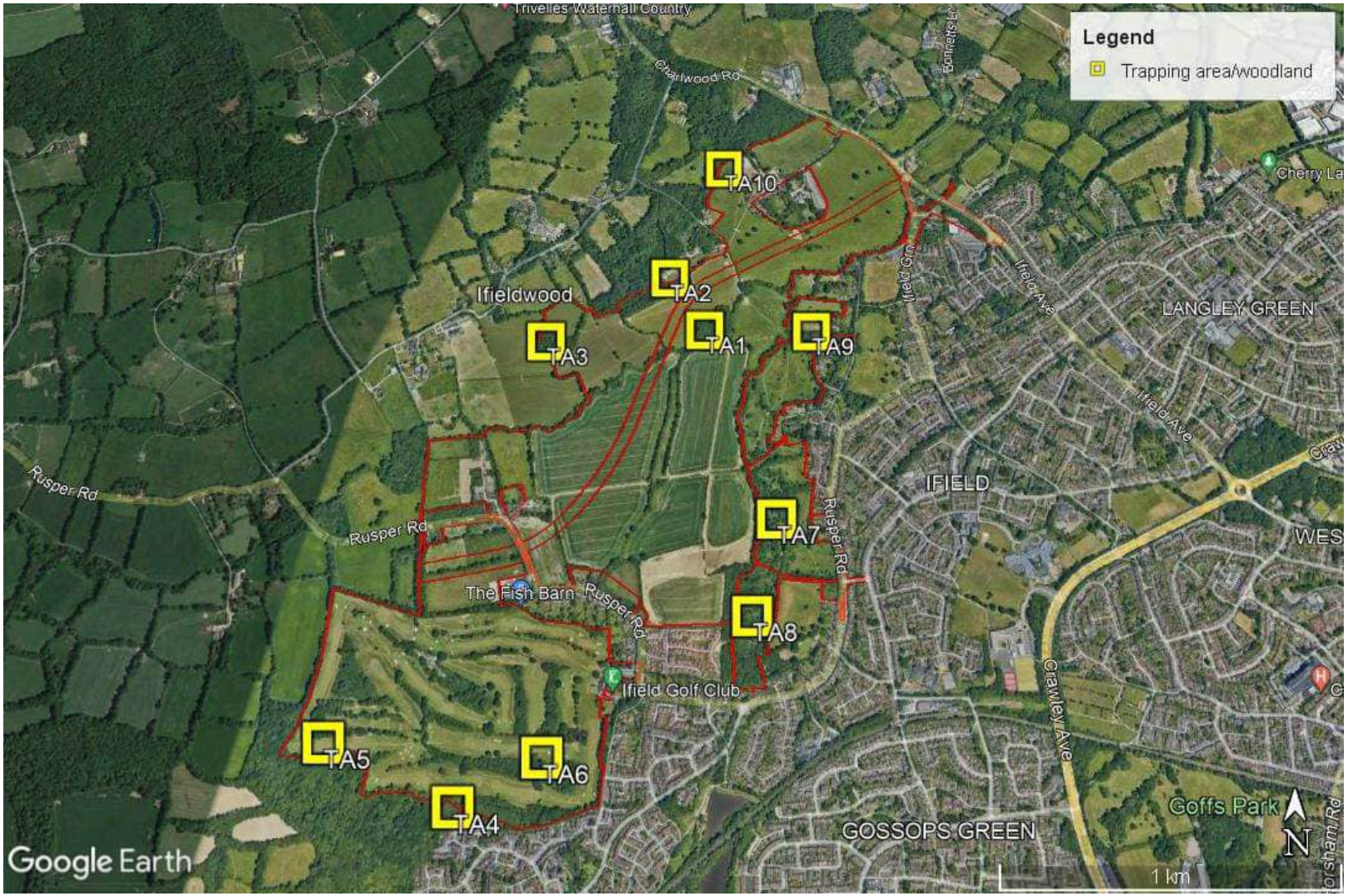

Figure 2 Overview of Home Ranges and Core Areas – All Bats

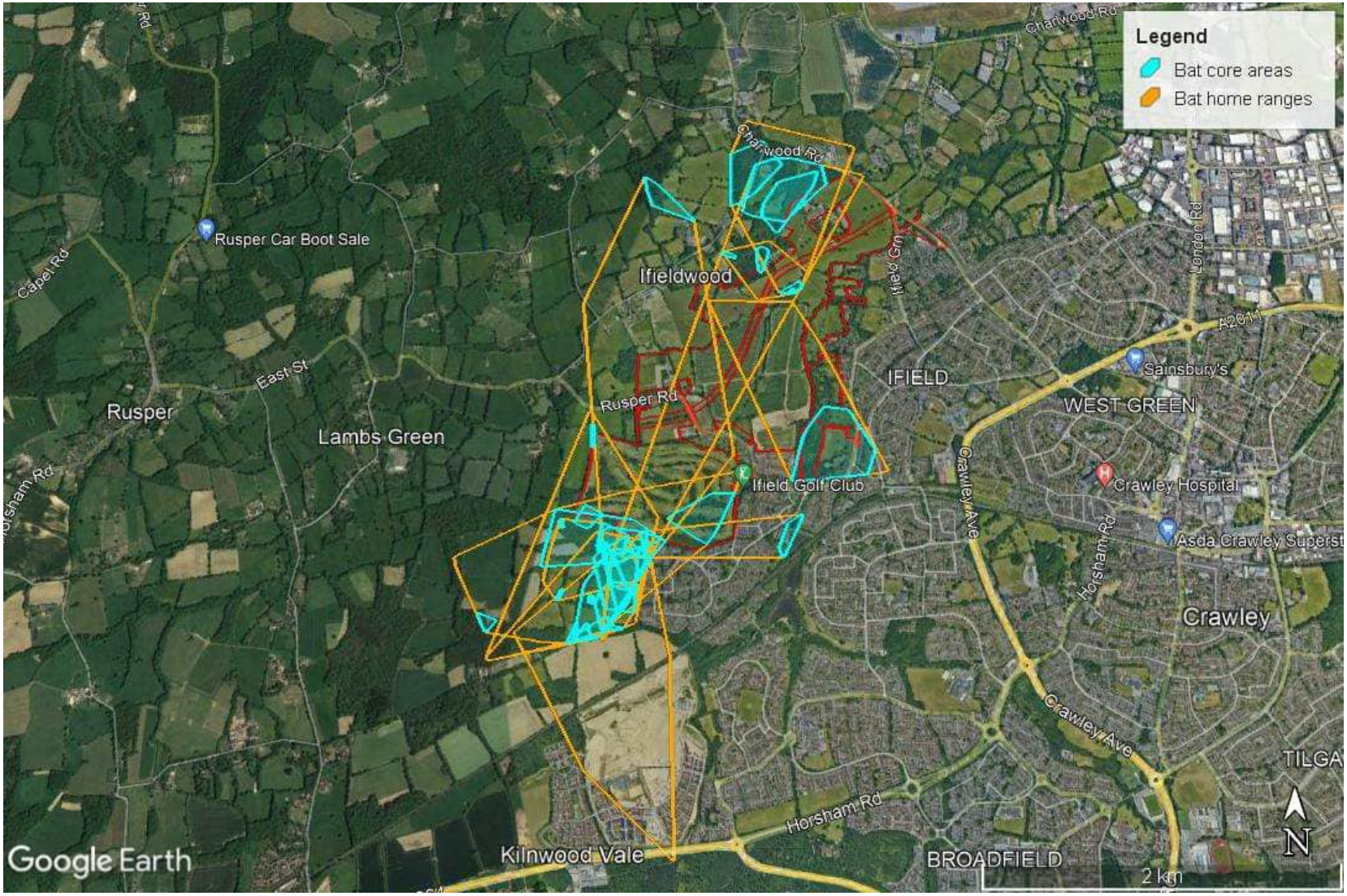

Figure 3 Bechstein's Bat Home Ranges and Core Areas – All Bats

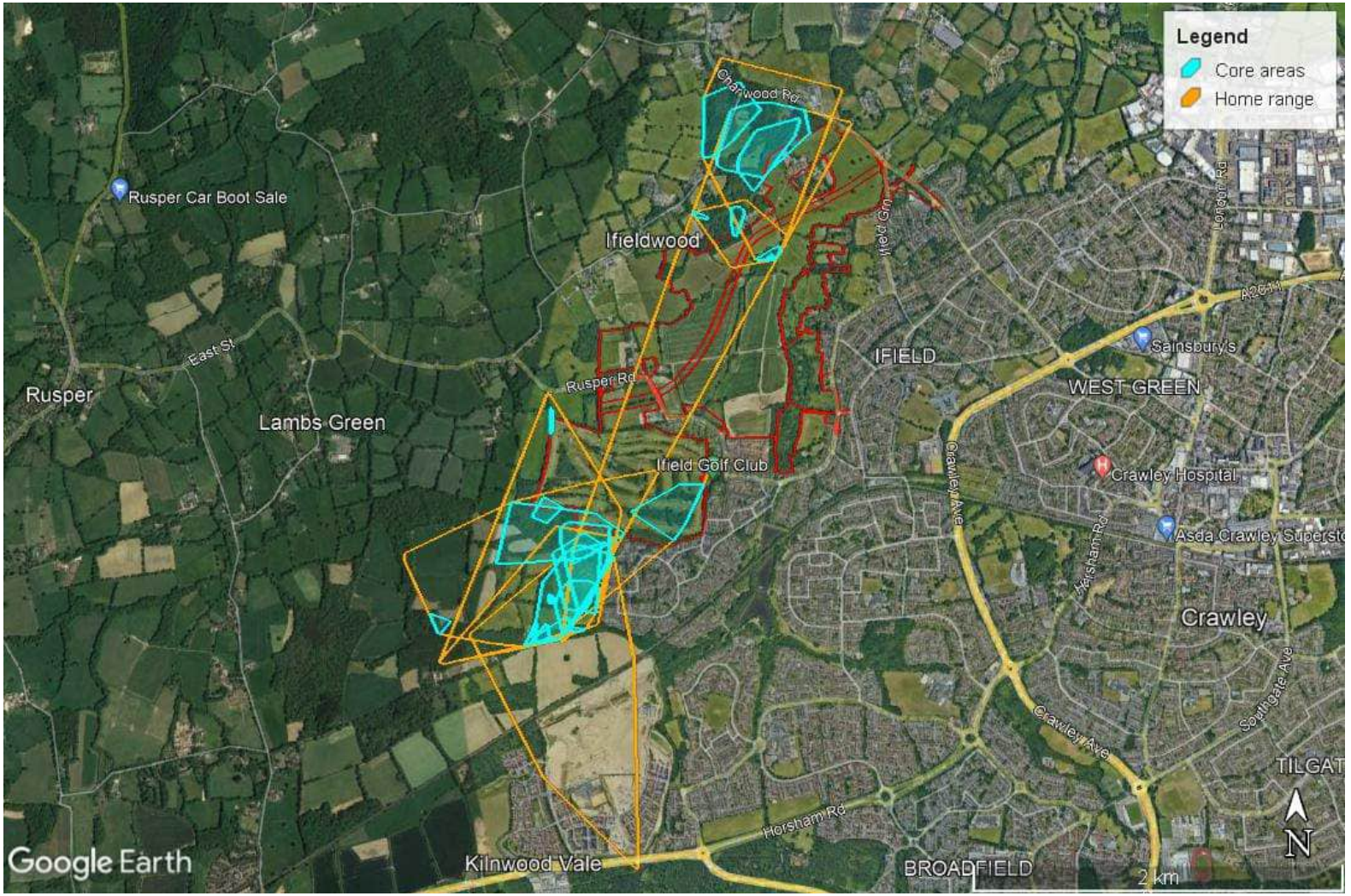

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Figure 4 Roost locations – All Bats

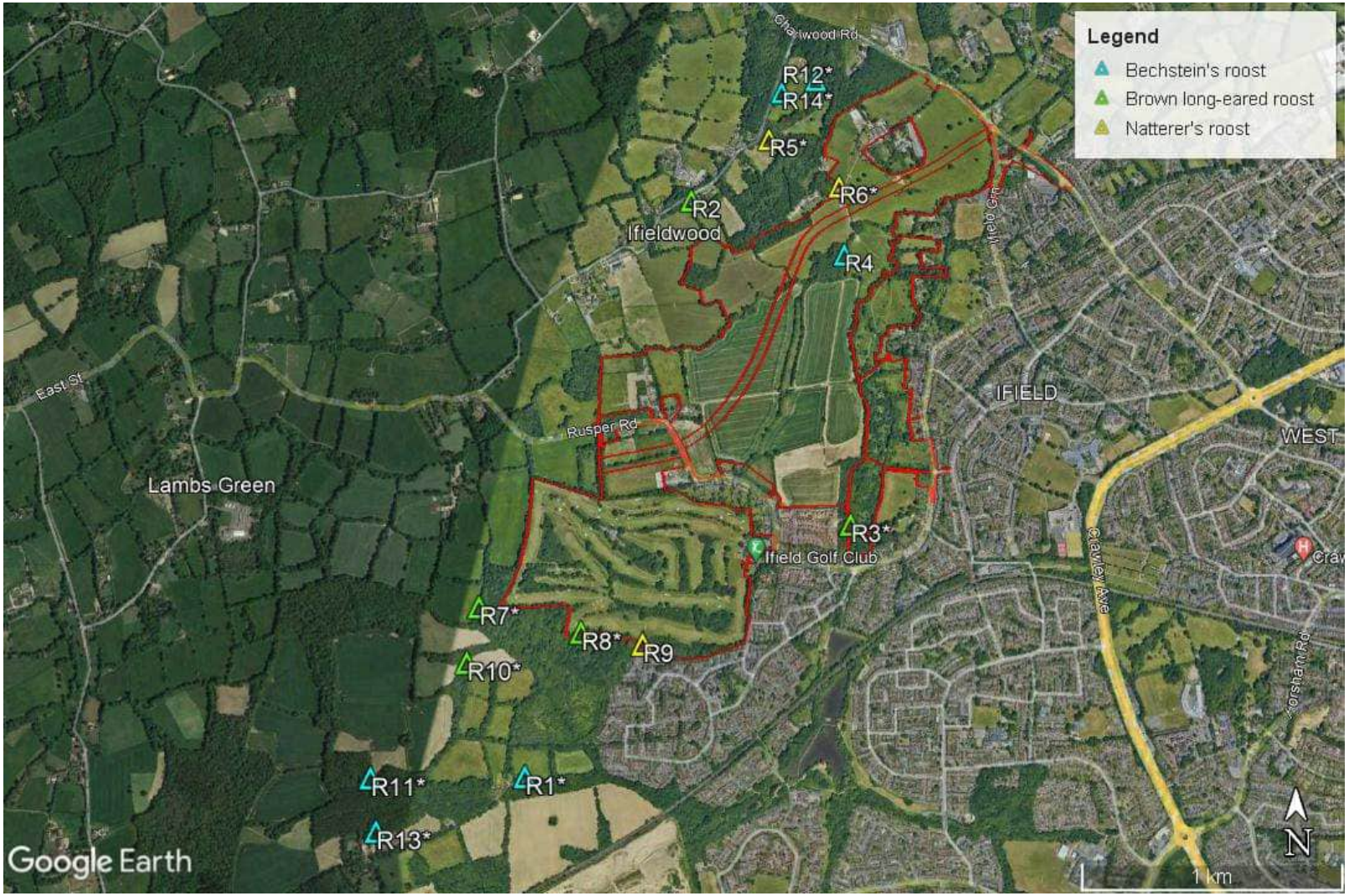

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Figure 5 Roost Locations Hyde Hill Wood Area

Figure 6 Roost Locations Ifield Wood Area

Figure 7 Female Bechstein's bat (124) radio-tracking data June 2022

Figure 8 Male Adult Bechstein's bat (125) radio-tracking data June 2022

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Figure 9 Female Bechstein's bat (287) radio-tracking data July 2022

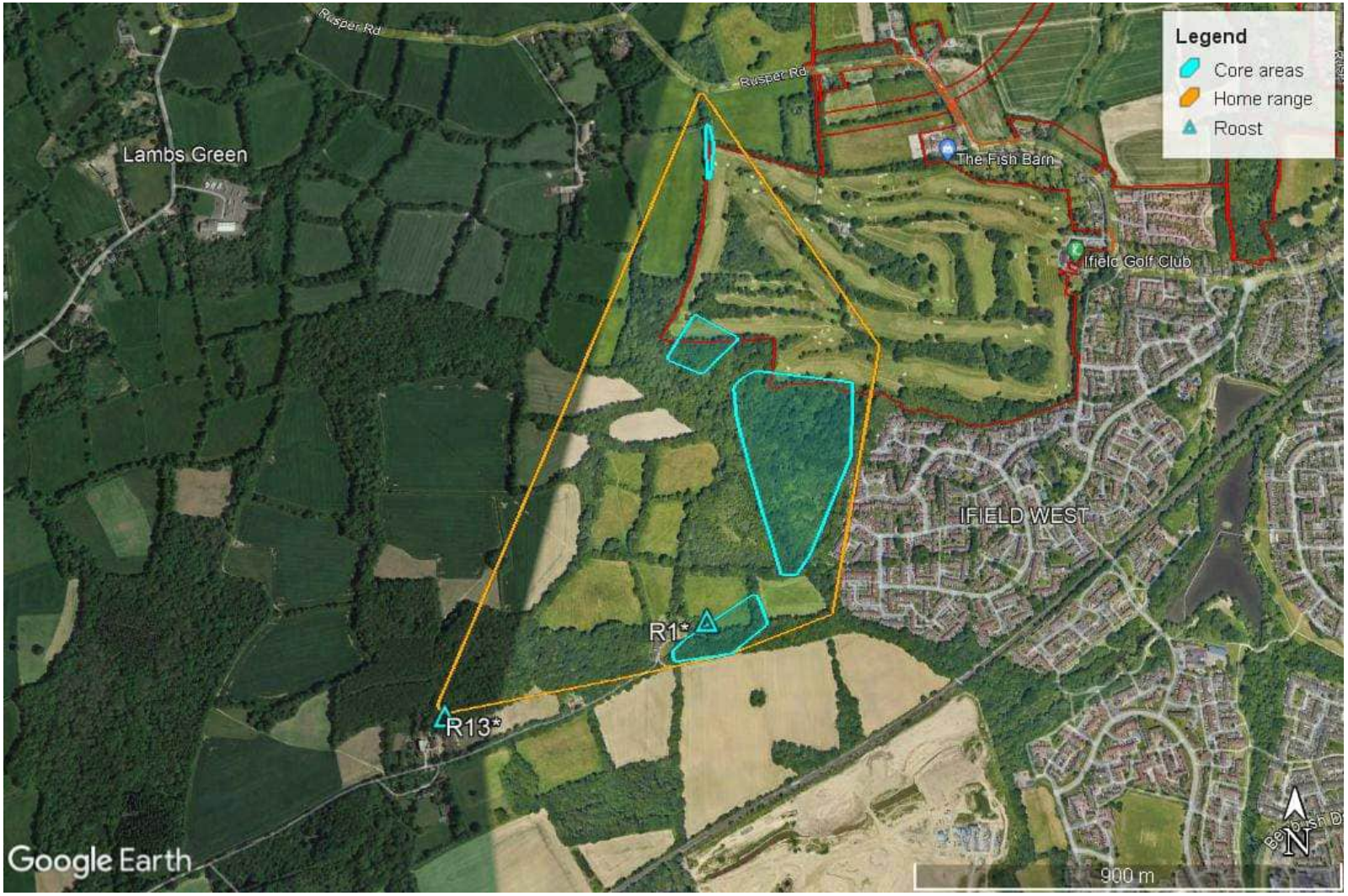

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Figure 10 Female Bechstein's bat (245) radio-tracking data July 2022

Figure 11 Male Juvenile Bechstein's bat (123) radio-tracking data July 2022

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Figure 12 Male Juvenile Bechstein's bat (692) radio-tracking data July 2022

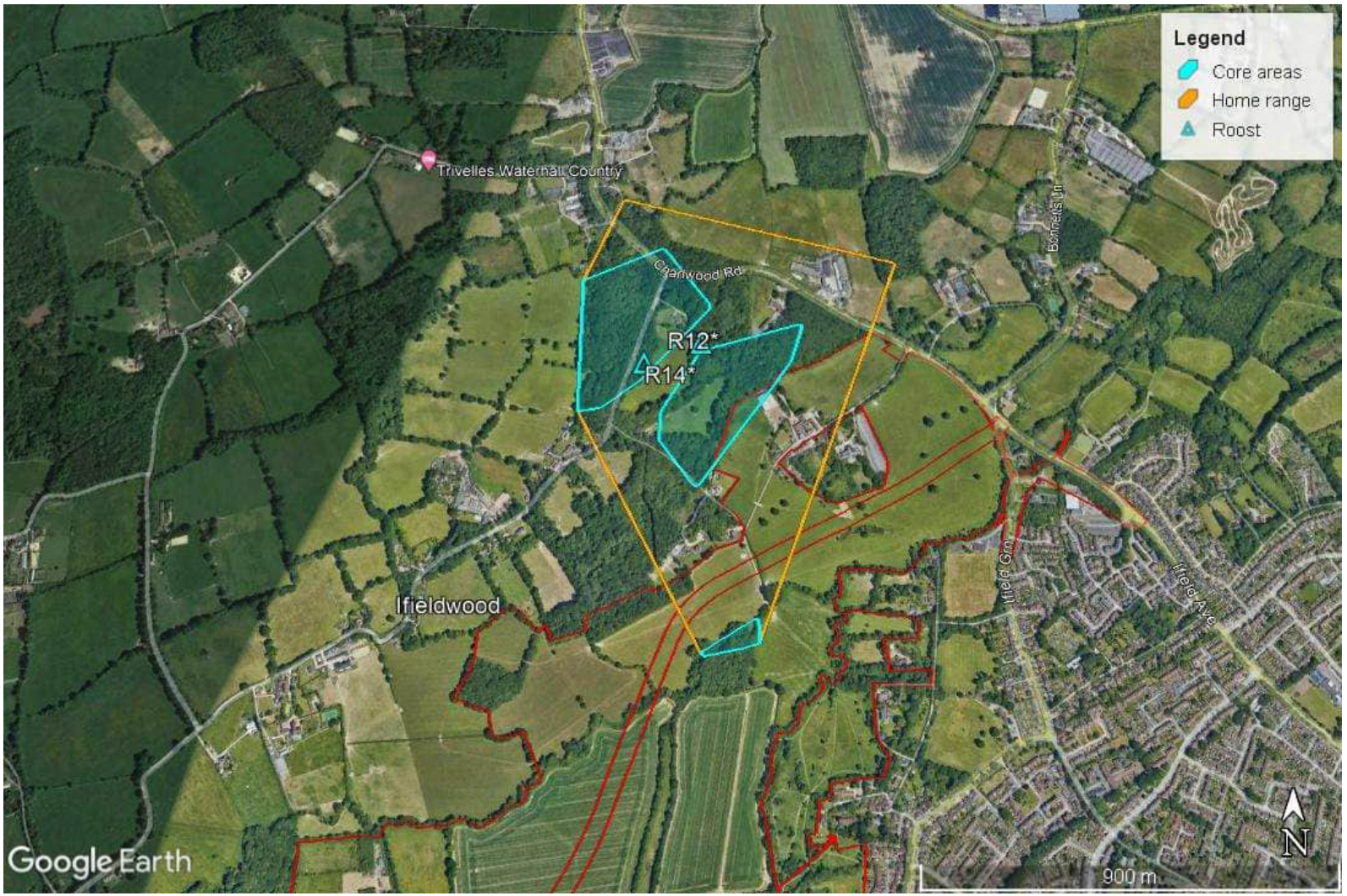

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Figure 13 Male Juvenile Bechstein's bat (687) radio-tracking data July 2022

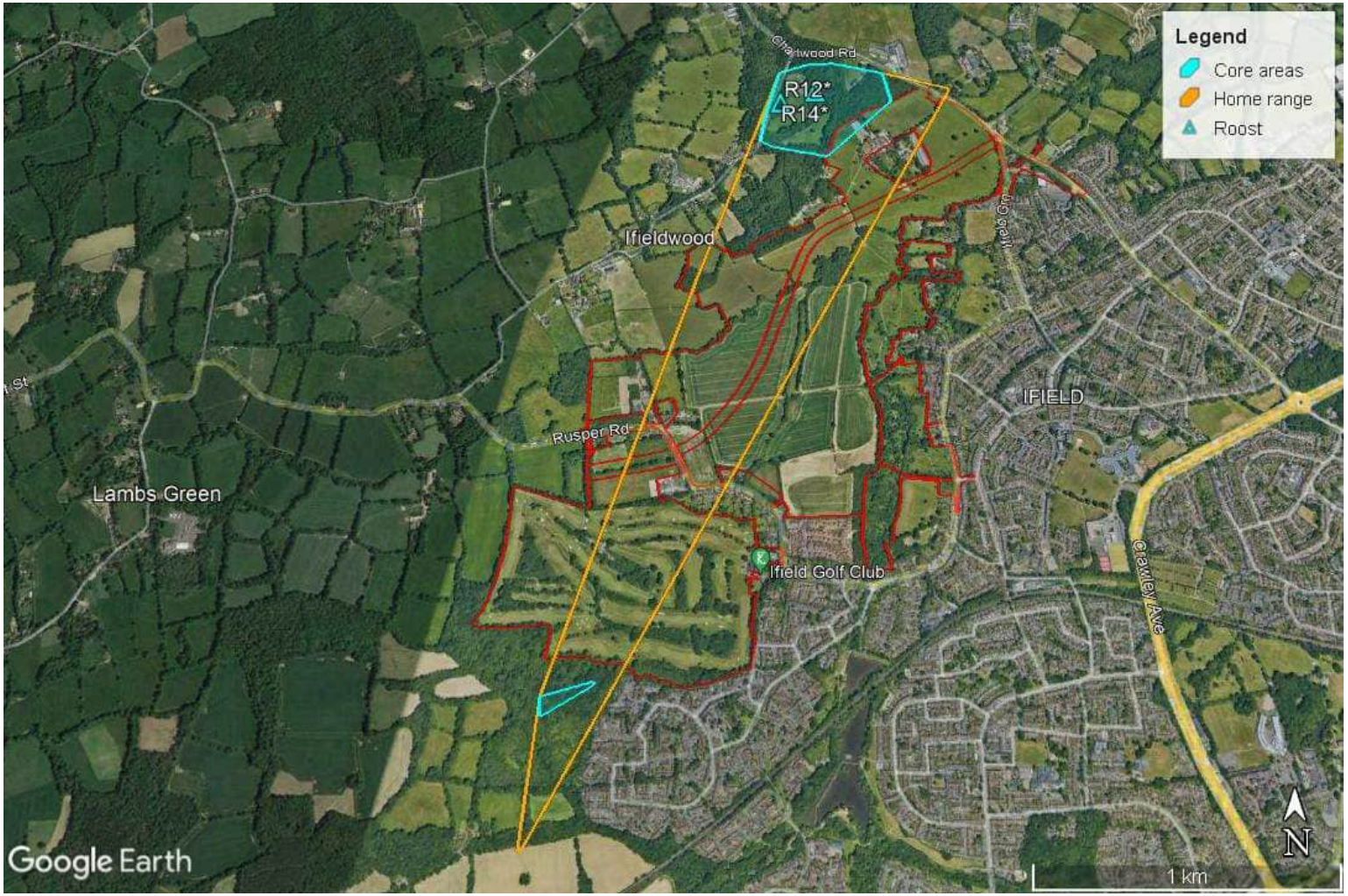
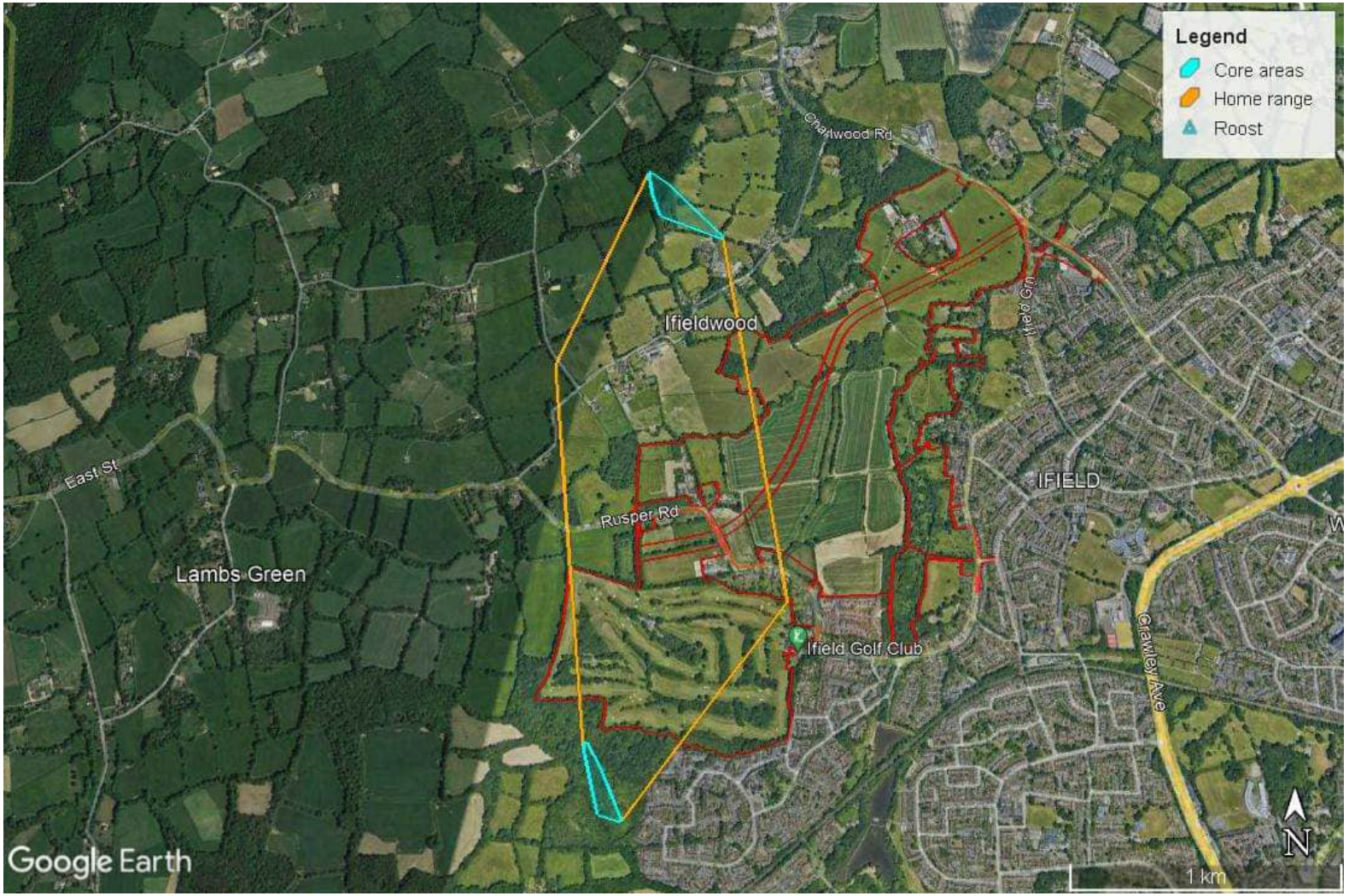


Figure 14 Female Brown Long-Eared Bat (128) radio tracking data June 2022

Land West of Ifield
Advanced bat surveys
Ramboll

Figure 15 Male adult Natterer's Bat (253) radio tracking data July 2022

Figure 16 Male Adult Barbastelle Bat (770) radio tracking data July 2022



Appendix A Bat trapping data

Trap area	Date (at start)	Time	Species	Sex	Age (class)	Breeding status	Bat ref
TA4	06/06/2022	23:13	P. pipistrellus	Female	Adult	Non-breeding	
TA4	06/06/2022	00:30	P. pipistrellus	Male	Adult	Non-breeding	
TA6	06/06/2022	01:15	N. noctula	Male	Adult	Swollen testes pale epids	
TA6	06/06/2022	01:15	P. pipistrellus	Male	Adult	Non-breeding	
TA2	07/06/2022	23:20	P. auritus	Male	Adult	Non-breeding	DD129
TA2	07/06/2022	23:20	P. pipistrellus	Male	Adult	Swollen testes pale epids	
TA9	08/06/2022	23:25	P. auritus	Female	Adult	Pregnant	
TA9	08/06/2022	02:18	M. mystacinus	Male	Adult	Non-breeding	
TA2	09/06/2022	22:42	P. pipistrellus	Female	Adult	Pregnant	
TA2	09/06/2022	23:21	P. pipistrellus	Male	Adult	Swollen testes pale epids	
TA2	09/06/2022	23:43	P. pipistrellus	Female	Adult	Pregnant	
TA2	09/06/2022	00:50	M. bechsteinii	Male	Adult	Non-breeding	DD125
TA2	09/06/2022	01:05	P. auritus	Male	Adult	Non-breeding	
TA2	09/06/2022	02:20	P. pipistrellus	Female	Adult	Pregnant	
TA2	09/06/2022	02:20	P. pygmaeus	Female	Adult	Pregnant	
TA5	06/06/2022	21:35	P. pygmaeus	Male	Adult		

TA5	06/06/2022	02:40	M. nattereri	Male	Adult		
TA3	07/06/2022	22:34	N. noctula	Male	Adult		
TA7	08/06/2022	22:33	M. mystacinus	Male	Adult		
TA7	08/06/2022	22:45	*P. pipistrellus*	Male	Adult		
TA10	09/06/2022	00:54	*M. nattereri*	Female	Adult	Non-breeding	
TA10	09/06/2022	01:31	*P. pipistrellus*	Male	Adult		
TA4	06/06/2022	23:10	P. pipistrellus	Female	Adult	Pregnant	
TA4	06/06/2022	23:20	P. pygmaeus	Female	Adult	Pregnant	
TA4	06/06/2022	23:34	P. pipistrellus	Female	Adult	Non-breeding	
TA4	06/06/2022	00:30	P. pipistrellus	Female	Adult	Non-breeding	
TA4	06/06/2022	00:15	M. bechsteinii	Female	Adult	Pregnant	DD124
TA4	06/06/2022	01:30	M. brandtii	Female	Adult	Pregnant	
TA4	06/06/2022	01:30	P. pipistrellus	Female	Adult	Non-breeding	
TA2	08/06/2022	21:33	P. auritus	Female	Adult	Pregnant	DD128
TA8	08/06/2022	21:40	P. auritus	Female	Adult	Non-breeding	
TA8	08/06/2022	00:10	P. pipistrellus	Male	Adult		
TA8	08/06/2022	00:45	P. pipistrellus	Male	Adult		
TA8	08/06/2022	02:00	P. pipistrellus	Male	Adult		
TA8	08/06/2022	02:45	P. auritus	Male	Adult		

TA5	09/06/2022	21:40	P. auritus	Male	Adult	Pregnant	
TA5	09/06/2022	22:30	P. pipistrellus	Female	Adult	Pregnant	
TA5	09/06/2022	01:35	P. pipistrellus	Female	Adult	Pregnant	
TA4	25/07/2022	23:12	P. pipistrellus	Male	Adult		
TA4	25/07/2022	23:12	M. mystacinus	Male	Adult		
TA4	25/07/2022	23:28	M. bechsteinii	Male	Juvenile		DD123
TA3	27/07/2022	22:21	P. pipistrellus	Male	Juvenile		
TA3	27/07/2022	00:51	M. bechsteinii	Male	Juvenile		DD687
TA4	25/07/2022	23:31	M. nattereri	Male	Adult	Non-breeding	BB253
TA4	25/07/2022	00:10	P. auritus	Male	Adult	Swollen testes pale epids	N/A
TA4	25/07/2022	00:05	P. pipistrellus	Female	Adult	Post Lactating	N/A
TA4	25/07/2022	00:17	P. pipistrellus	Female	Adult	Non-breeding	N/A
TA4	25/07/2022	01:02	P. pipistrellus	Male	Juvenile	Non-breeding	N/A
TA4	25/07/2022	01:19	M. nattereri	Female	Adult	Post Lactating	N/A
TA4	25/07/2022	01:45	P. pipistrellus	Male	Juvenile	Non-breeding	N/A
TA4	25/07/2022	01:55	P. pipistrellus	Female	Adult	Lactating	N/A
TA4	25/07/2022	02:03	M. nattereri	Male	Adult	Swollen testes pale epids	N/A
TA4	25/07/2022	02:06	P. pipistrellus	Female	Juvenile	Non-breeding	N/A
TA4	25/07/2022	02:19	P. pipistrellus	Male	Juvenile	Non-breeding	N/A
TA4	25/07/2022	02:25	P. auritus	Male	Adult	Swollen testes pale epids	N/A
TA4	25/07/2022	02:30	P. pipistrellus	Male	Adult	Non-breeding	N/A
TA4	25/07/2022	02:40	P. pipistrellus	Male	Adult	Non-breeding	N/A
TA4	25/07/2022	23:31	P. auritus	Male	Sub-adult	Non-breeding	
TA4	25/07/2022	23:31	P. auritus	Male	Sub-adult	Non-breeding	
TA4	25/07/2022	23:31	P. auritus	Male	Juvenile	Non-breeding	
TA4	25/07/2022	23:31	P. auritus	Female	Adult	Lactating	BB275
TA4	25/07/2022	23:31	P. auritus	Female	Juvenile	Non-breeding	
TA4	25/07/2022	01:15	M. bechsteinii	Female	Adult	Lactating	DD287
TA4	25/07/2022	01:15	M. bechsteinii	Male	Juvenile	Non-breeding	
TA4	25/07/2022	01:40	M. bechsteinii	Female	Adult	Lactating	BB245
TA4	25/07/2022	02:08	M. daubentonii	Male	Sub-adult	Non-breeding	
TA4	25/07/2022	02:08	B. barbastellus	Male	Adult	Non-breeding	AA770
TA4	25/07/2022	02:25	M. mystacinus	Female	Adult	Lactating	
TA4	25/07/2022	02:25	M. mystacinus	Male	Juvenile	Non-breeding	
TA4	25/07/2022	02:45	P. pipistrellus	Male	Adult		
TA4	25/07/2022	02:48	P. pipistrellus	Male	Adult		

TA4	25/07/2022	02:45	P. pipistrellus	Male	Adult		
TA4	25/07/2022	02:45	M. bechsteinii	Male	Juvenile	Non-breeding	
TA4	25/07/2022	02:45	M. bechsteinii	Male	Juvenile	Non-breeding	
TA4	25/07/2022	03:29	P. pipistrellus	Male	Adult	Swollen testes pale epids	
TA7	26/07/2022	21:14	P. pipistrellus	Female	Adult	Lactating	
TA7	26/07/2022	21:19	P. pygmaeus	Male	Juvenile	Non-breeding	
TA7	26/07/2022	21:35	P. auritus	Male	Adult	Swollen testes pale epids	
TA7	26/07/2022	21:56	P. auritus	Female	Juvenile	Non-breeding	
TA7	26/07/2022	22:00	M. mystacinus	Male	Adult	Swollen testes pale epids	
TA7	26/07/2022	22:33	P. pipistrellus	Female	Juvenile	Non-breeding	
TA7	26/07/2022	22:33	P. pipistrellus	Male	Juvenile	Non-breeding	
TA7	26/07/2022	01:20	P. auritus	Male	Adult	Swollen testes pale epids	
TA7	26/07/2022	02:01	P. pygmaeus	Female	Adult	Post Lactating	
TA7	26/07/2022	03:00	P. pipistrellus	Male	Juvenile	Non-breeding	
TA1	27/07/2022	23:19	M. bechsteinii	Male	Juvenile	Non-breeding	DD692
TA1	27/07/2022	01:23	M. nattereri	Male	Adult	Swollen testes pale epids	
TA1	27/07/2022	02:12	P. auritus	Male	Adult	Non-breeding	

Appendix B DNA results for Brandt's bat (June 2022)

WARWICK
THE UNIVERSITY OF WARWICK

EcoWarwicker
Ecological Forensics

26 July 22

Re: Identification Results for Diane Davidson-Watts, Davidson-Watts Ecology

Job number 18365, received 05 July 2022
Sample labelled: Hyde Hill Wood, Crawley
PCR amplification successful. DNA sequence:
TCTCTACTAGGAATTTGCCTAGCACTACAAATTTTAACAGGACTATTTCTAGCTATACA
CTACACATCAGACACCACAAC

Phylogenetic analysis identification: *Myotis brandtii*

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

Best regards,

Professor Robin Allaby

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

Professor Robin Allaby

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

APPENDIX 8.27: ADVANCED BAT SURVEY REPORT – BASELINE TRAPPING AND RADIOTRACKING SURVEY RESULTS – LAND WEST OF IFIELD

AEWC Ltd

Animal Ecology & Wildlife Consultants

Advanced Bat Survey Report

Baseline Trapping and Radiotracking Survey Results

Land West of Ifield

Daniel Whitby
and Brigitte de Coriolis

20-030
November 2021

AEWC Ltd Birch Walk, Lower Street, Fittleworth, West Sussex, RH20 1JE
Tel:08452 505585, info@aewc.co.uk , www.aewc.co.uk

Registered in England and Wales No. 06527840

Contents

Author	Brigitte de Coriolis & Daniel Whitby
Authorised by	Daniel Whitby
Report and version number	20-030-ABS-v2

Summary

- This bat survey and report has been carried out and prepared by Daniel Whitby and Brigitte de Coriolis of AEWC Ltd, Natural England licensed bat workers, and was commissioned by Ramboll UK Ltd on behalf of their client Homes England to conduct advanced bat surveys at Land west of Ifield to help inform the proposed development of the site.
- Acoustic surveys carried out in 2018-19 identified ten species of bat present on site, including barbastelle, an Annex II species. A data record search identified the presence of Bechstein's bats within 5km of the site, a species not recorded during the acoustic surveys and for which acoustic surveys are not a suitable survey method for this species.
- Further advanced surveys were therefore required to more accurately inform on the species present, diversity and assemblages on site and to ascertain whether Bechstein's bats are using the site and represent a constraint to the proposed development.
- A total of eight trapping sessions were conducted within the survey areas: one in the northern and central survey areas in 2020, and two in each of the three survey areas in 2021. Trapping caught a total of 151 bats of ten species which is believed to represent a good selection and indication of the species present and breeding status on the site.
- Radio tracking of one Natterer's and two brown long-eared bats has confirmed the presence of maternity roosts for these species on and directly adjacent to the site. The proposed development layout is currently unknown. The location of this colony means that development of the site will be within the Core Sustenance Zones (CSZ) for these species, so have potential for impacts on the favourable conservation status of these species.
- The surveys across the site have confirmed the presence of Bechstein's bats, caught in all areas, with a high proportion of the 12 bats captured being females and juveniles, indicative of breeding colonies in close proximity to the site.
- A concurrent trapping and radio tracking project conducted by The Ecology Consultancy around Gatwick Airport has identified a Bechstein's colony north of the site, and one bat caught on site was confirmed by AEWC through radio tracking to be part of this colony.
- Radio tracking of a further five Bechstein's bats and subsequent emergence surveys on identified roosts have identified a southern population, a new record for the area with nine new roosts identified, three of which are within 150m of the site boundary and a further two within 350m of the site, and a combined minimum count of 98 individuals. With the rarity of the species and high population identified the local Bechstein's population is considered to be of **national importance.**
- Only 4% of the southern Bechstein's population has been radio tracked to date. Further trapping, radio tracking and roost-monitoring is required to enable colony radio tracking and more accurately ascertain the status of the population and determine the number of colonies present, and identify colony range and core areas of importance to identify the potential impacts.
- As a landscape-scale project, the proposed development has the potential for notable impacts through habitat loss, reduction in colony range, fragmentation and severance of connectivity for this population resulting in high impact on Bechstein's bats and other species present on site.

1 Introduction

1.1 This bat survey and report has been carried out and prepared by Daniel Whitby and Brigitte de Coriolis of AEWC Ltd, Natural England licensed bat workers, and was commissioned by Ramboll UK Ltd on behalf of their client Homes England to conduct advanced bat surveys at Land West of Ifield to help inform the proposed development of the site (see Figure 1 for the location and extent of 'the site').

1.2 The bat surveys and report writing were carried out in accordance with Bat Surveys: Good Practice Guidelines (Bat Conservation Trust, 2016).

1.3 A data record search has identified the presence of 13 species within 5km of the site including the presence of Bechstein's bats, with one roost recorded, and barbastelle bats. In addition, there are records of Alcathoe bats throughout Sussex and records to the west and south-east of the site.

1.4 Acoustic surveys, including transect surveys, static loggers and emergence surveys, were conducted across the site during 2018/2019 by Arcadis Consulting Ltd, which identified ten species of bat to species level, including a low number of barbastelle passes, however, did not identify any Bechstein's bats present on the site or conduct any species specific surveys as per the bat survey guidelines to identify this species.

1.5 Bechstein's and barbastelle bats are among the UK's rarest mammals. Both species are listed on Annex II of the EC Habitats and Species Directive (JNCC, 2007) and are Species of Principal Importance in England under *Section 41* of the *Natural Environment and Rural Communities Act 2006*. Bechstein's are also listed as near threatened and barbastelle vulnerable on the IUCN global red list (IUCN, 2016).

1.6 Further advanced surveys were therefore required to gather greater information particularly on if Bechstein's bats are present and importantly how Bechstein's bats are using the site and to accurately ascertain whether there are potential impacts on Bechstein's bats from the proposed development.

1.7 This report details the results of the advanced bat surveys and outlines recommendations in relation to bats and the proposed development of the site.

Aims and objectives

1.8 The objectives of the survey were to:

- Confirm the presence and breeding status of all bat species on and adjacent to the site;
- Confirm whether Bechstein's bats are using the site, estimate the size and status of any Bechstein's colonies, and gather information on the colony including roosting areas, colony range and core areas of use;
- Identify the roost sites and colony sizes of selected species to inform an Ecological Impact Assessment (EcIA), any further survey requirements and mitigation;
- Identify roosts or notably important areas within the site potentially subject to direct impacts;
- Determine the potential impacts on bats, notably Bechstein's from the proposed development schedule and identify if any further specific surveys are required; and

- Provide information for use in the design and development of ecological mitigation and enhancement measures where appropriate.

Site Location

1.9 The proposed development, located at central grid reference TQ 24284 37583, lies to the west of Ifield, a former village now a neighbourhood, within the town of Crawley in West Sussex. See Figure 1.

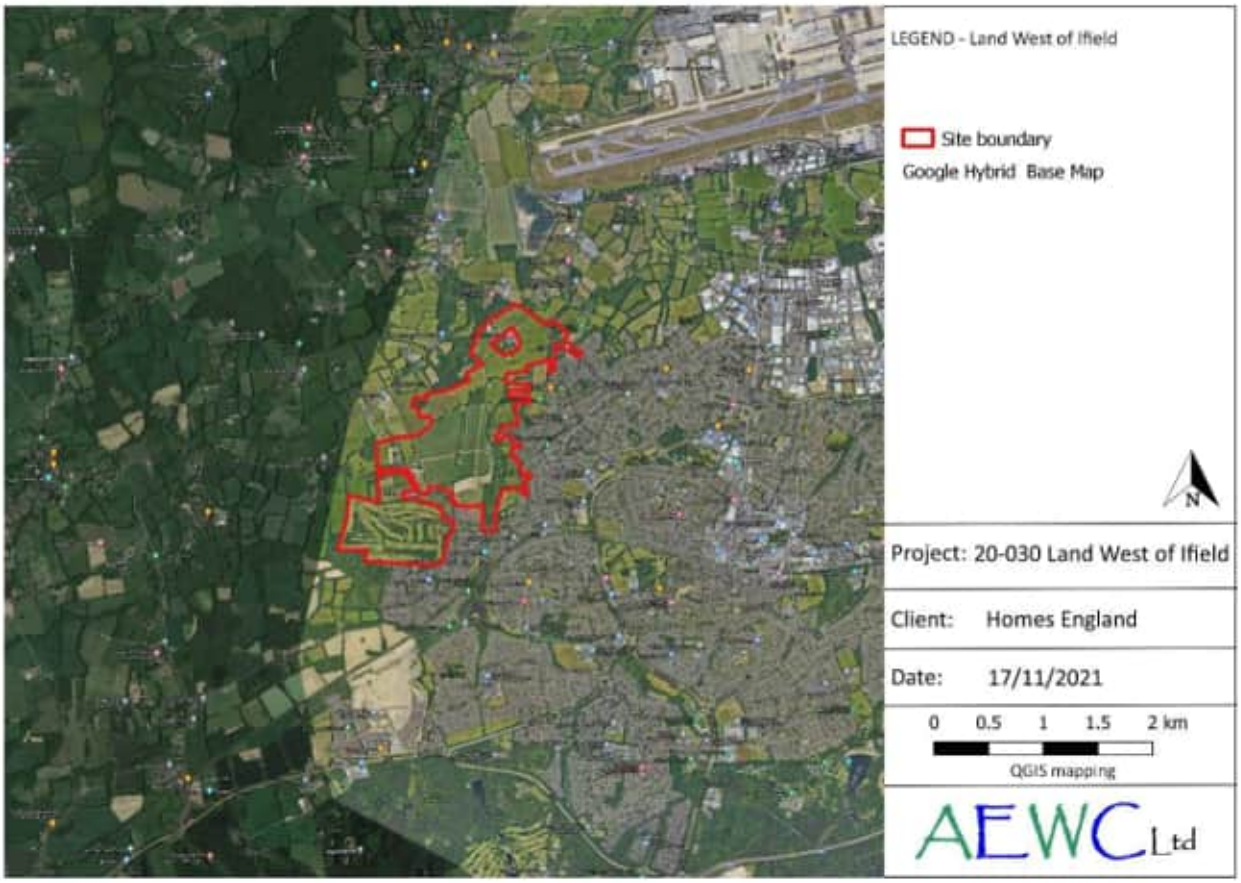

FIGURE 1: SHOWING THE LOCATION OF THE SITE

Legislation

1.10 All species of bats are listed on *Schedule 5* of the *Wildlife and Countryside Act 1981 (as amended)* which affords them protection under *Section 9*, as amended. They are also protected under the *Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019*. In combination, this makes it an offence to:

- intentionally kill, injure or take (capture etc.);
- possess;
- intentionally or recklessly damage, destroy, obstruct access to any structure or place used by a scheduled animal for shelter or protection, or disturb any animal occupying such a structure or place; and
- sell, offer for sale, possess or transport for the purpose of sale (live or dead animal, part or derivative) or advertise for buying or selling such things.

1.11 A roost is defined as 'any structure or place which a bat uses for shelter or protection'. As bats tend to reuse the same roosts, legal opinion is that a roost is protected whether or not bats are present.

1.12 Any disturbance of a bat occupying a roost can lead to prosecution. Disturbance can be caused by noise, vibration and artificial lighting. Penalties for breaking the law can include fines of £5,000 per bat, imprisonment and the seizure of equipment.

1.13 Furthermore, seven bat species (barbastelle, Bechstein's, noctule, soprano pipistrelle, brown long-eared, lesser horseshoe and greater horseshoe) are also Species of Principal Importance in England under *Section 41* of the *Natural Environment and Rural Communities Act 2006*.

Development proposals

1.14 The proposed West of Ifield development is currently in design and at the time of producing this report, development layouts are unknown. It is believed these will comprise creation of three new neighbourhoods over the next 30 years. These neighbourhoods will deliver homes, schools, green spaces and community infrastructure. The applicant is committed to creating a sustainable new community and to ensuring biodiversity net gain. An Environmental Impact Assessment will be undertaken when development plans are known.

2 Methods

2.1 The methodology employed in this study consisted of a range of discrete and separate approaches of gathering data to ascertain the use of the site by bats, specifically Bechstein's bats. These approaches, while separate, are interlinked to form a range of advanced survey methods including trapping; using both harp traps and mist nets in habitats and suitable trapping positions across the northern, central and southern areas of the site, radiotracking; both daytime to identify roosts and night tracking to identify bat movements and foraging throughout the night. Additional non-advanced survey methods were utilised to gather additional information where necessary and available, including emergence surveys.

2.2 The advanced surveys conducted by AEWC Ltd work in conjunction with additional bat surveys by Arcadis Consulting Ltd to inform on bat use of the site including activity transects, static loggers and emergence surveys.

Trapping Surveys

2.3 To accurately identify what potential impacts a proposed development may have on any bats, or population/colony present locally, it is important to identify the sex and breeding status of individuals to inform on the presence, or potential presence, of a breeding population using a site as well as the presence, or proximity, of a local maternity colony that could be impacted.

2.4 In order to identify the species present, as well as the sex and breeding status of individuals, trapping surveys were undertaken, as the only survey method capable of obtaining this information.

2.5 The site was originally assessed during daylight hours in July 2020 for the surveyors to familiarise with the site and identify habitats present, areas of potential high bat activity and suitable access to conduct surveys. At this time access was only possible to the northern and central areas of the site. The southern area of the site was later assessed in June 2021 prior to surveys commencing in this area. Different accessible habitats and features throughout areas of the site were evaluated and assessed for their importance and the potential for different species which could be present to be surveyed for.

2.6 Trapping surveys were conducted across a range of habitats and locations in the northern and central areas in 2020, and throughout the site in 2021, with a total of two nights trapping in 2020, and six nights trapping in 2021 conducted. Trapping was conducted between May and September avoiding the more sensitive late pregnancy period and early birth period when bats can carry dependant young. Exact trapping locations were dependant on species being targeted, ground and weather conditions as well as specific suitable trapping locations available within the survey area.

2.7 Trapping surveys were restricted to arranged survey areas where the highest developmental impacts are considered likely. Trap locations were within the accessible survey areas and concentrated on habitats or features that were considered likely to be important and have potential to be used by a range of species as well as Bechstein's bats to inform on all species using the site. Trapping within suitable habitat for Bechstein's bats was conducted specifically to target this species with the aim of tagging individuals.

2.8 Trapping surveys were conducted using several Harp traps (Austbat two bank and three bank) and Mist nets (Ecotone) to trap bats. Where suitable this was accompanied with a sonic lure (Sussex Autobat or Binary Acoustic Technology AT100) to attract any bats foraging in the area using a range of bat species' social calls. This can increase the detection rate of quiet whispering species, such as Bechstein's bat (*Myotis bechsteinii*), barbastelle (*Barbastella barbastellus*), myotis (*Myotis sp*.) and long-eared bats (*Plecotus sp*.), which can be under-recorded on detector surveys.

2.9 In order to maximise capture of the target species, notably Bechstein's bats, calls were played that predominantly targeted this species, including a range of Bechstein's calls. Lures were usually alternating between a species-specific call, such as a Bechstein's specific call or another species, and then a generalist bat call. This will maximise the capture rate of a full range of species on the site and allow target species of interest to be thoroughly surveyed.

2.10 Trapping was generally conducted from dusk until the early hours of the morning/predawn, all traps were checked regularly, to ensure no bats were trapped for extended periods. All bats caught were identified accurately to species level, sexed, aged and reproductive status ascertained. All bats were released at the capture site shortly after capture. Bechstein's and barbastelle bats were ringed where suitable and licensed with a Porzana bat ring.

2.11 All surveys conducted during 2020 and 2021 followed an AEWC Trapping Protocol methodology following a precautionary approach. This incorporated advice from IUCN, Eurobats and BCT regarding minimising the potential for transmission of Covid-19 to UK bat species during the pandemic. This included disinfecting all equipment to be used, wearing of suitable PPE including face masks, regularly cleaning and hand sanitising and minimising handling and processing of all bats. All trapping surveys and the radio tagging of bats were carried out under licences issued for the site in 2020 and 2021 by Natural England.

Ringing

2.12 Bechstein's and barbastelle bats were ringed to potentially provide additional information on movements of individuals throughout the study area, in addition to ensuring that the same bat was not tagged twice.

2.13 Ringing of bats caught in foraging areas, and then subsequently re-caught foraging/within roosts as part of this project or other wider projects (such as swarming projects), or bats rung as part of other projects at other locations, and then identified on this project can provide information on both movements of bats throughout the site, and local landscape and can help indicate the geographical spread and land use by a colony/population.

2.14 All bats were ringed with Porzana alloy bat rings using sizes 2.9mm as suitable for the species being ringed. Rings were closed manually until <1mm remained between the lipped ends of the ring. Before release each bat and ring were checked so that it did not stick on the wrist, it moved freely along the forearm and the 5th finger did not stick inside the ring.

Radiotracking Surveys

2.15 Individual bats were radio tagged in order to gain the greatest amount of information on an individual bat, primarily to identify the location of any species' roosts, notably maternity roosts and likely colonies, but also to identify potential foraging areas and commuting routes where necessary. Radio tags (Biotrack - UK and Holohil - Canada) were fixed to a bat using a latex-based adhesive (Torbot bonding cement) by carefully attaching to the bat between the shoulder blades at its most suitable centre of gravity.

2.16 All bats were radio tagged following a 5% rule so that no bats were tagged when the combined radio-tag and glue weight was 5% or more of the bat's weight. A range of radio tags weights were used as suitable for the species being tagged.

2.17 One individual Bechstein's bat was tagged in 2020. Five Bechstein's bats, two brown long-eared bats, one Natterer's and one barbastelle bat were tagged in 2021. Bats were trapped and tagged following capture on the site.

2.18 After fitting the radio tags, each aerial was carefully cleaned, and each bat kept for 5-10 minutes to be thoroughly checked before being released. Bats were monitored intermittently upon release, but radio tracking data was not always collected on the first night when the bat was released, as behaviour may be, and is commonly not completely natural behaviour on the first night a bat is radio tagged. The intermittent

tracking on the night of release was used to inform on areas being used, and roosts to help inform the subsequent nights' tracking.

2.19 Bats were radio tracked using Biotrack Sika receivers and different Yagi aerials using a range of radio tracking methods depending on activity, bat location and commuting distances.

2.20 High fixed masts were erected on the site using large 1.8m rigid Yagi aerials to gain the maximum range and accuracy, and flexible three element Yagi aerials were used for mobile surveyors to follow bats on foot where required. Bat positions or fixes were, when possible, triangulated from bearings taken from multiple surveyor locations as the most accurate recording method, and close approach method used when only one team had a bearing or signal from a bat.

2.21 Bats moving over large areas become increasingly difficult to find and/or follow and obtain fixes for. Bats moving large distances can move out of range, have signals blocked by local topography or enter underground sites where signals will be lost.

Emergence surveys

2.22 Once roost locations were identified, where suitable and accessible, emergence surveys were conducted to enable accurate roost counts of visible roosts to indicate colony size and enable roost characterisation.

2.23 Surveyors employed professional night vision video cameras with additional infrared (IR) illuminators or thermal cameras to film identified roost trees, to accurately identify and record emerging bats and confirm roost features.

2.24 Batlogger M bat detectors were used for taking time-expanded recordings of any bats when they may emerge from the buildings. These recordings were analysed on Elekon bat analysis software that facilitates species identification.

2.25 The emergence surveys were carried out between May and August on identified roosts when the tagged bat was confirmed to be present at the roost.

2.26 The emergence surveys began approximately 15 minutes before sunset and finished 1 and a half hours after sunset on each survey.

Radio Tracking Analysis

2.27 The radio tracking fixes obtained for each bat were imported into R Studio which was used to produce visual representations of the estimated ranging areas through the statistical algorithms included within the AdeHabitat HR package.

2.28 The home range of an individual animal is typically constructed from a set of fixes that had been collected over a period of time, identifying the position in space of an individual at many points in time. The 100% Minimum Convex Polygon (100% MCP) was used to estimate the foraging ranges of each of the radio tracked bats. The Minimum Convex Polygon (MCP) simply connects the outermost points on the scatter of mapped locations such that the sum of linkage distances between edge points is

minimised. However, MCPs are very sensitive to outliers and require large data sets for accurate estimations of home range size (Powell, 2000). Furthermore, they give no information about how the animal is using its home range (Harris et al., 1990).

2.29 Probabilistic approaches to home range estimators have also been developed whereby the density of fixes is estimated throughout the area used by the animal. Kernel density estimation (KDE) (Silverman, 1986; Worton, 1987; Worton, 1989) is a nonparametric estimator that describes home ranges by means of hierarchical probabilities for the intensity of habitat utilisation, termed isopleths. Series of isopleths can be plotted around the smallest area where the cumulative probability reaches a particular value. For example, the 95% isopleth encompasses the area where the probability of finding an animal is 95%.

2.30 Studies on various species' home ranges show that, for a number of environment-related reasons, certain portions within the home range are visited more frequently than others (Adams and Davis, 1967; Dixon and Chapman, 1980). The centre(s) of activity can be defined as the area within the home range in which the most fixes occurred during the radio tracking period and can give an indication of which part(s) of the range the bat(s) used more intensively. Areas of more intensive use have been termed as the 'core area of the home range' of the animal and may be related to the greater availability of food resources and refuges (Samuel et al., 1985; Thompson et al., 2007).

2.31 Core areas can be a useful concept when describing patterns of behaviour or identifying particular resources (Harris et al., 1990; Powell, 2000). The 50% isopleth (median value) was adopted as an indicator of core area use.

3 Constraints/Limitations

3.1 Bats are some of the most difficult species to locate, identify and study. They cannot be easily identified in flight and nocturnal activity means that they cannot be easily visually observed to identify behaviours and movements.

3.2 Many species have very similar echolocation calls making accurate species identification from acoustic surveys difficult, especially for cryptic groups like myotis bats. Different amplitude of species' calls dramatically under or over identify the presence of some species, resulting in a very biased survey technique and commonly misidentifying presence or population of some species, notably long-eared bats.

3.3 Trapping surveys can improve data gathering by confirming species identification, sex and breeding status, however, trapping is more difficult and specialist, and trapping success can vary depending on trap suitability in different areas and access to suitable trapping positions. Bats are difficult to locate in foraging habitat and difficult to catch, especially in large, exposed open areas. Different species may also forage in different habitats throughout the year according to the availability of their preferred prey and particular weather conditions, e.g. more sheltered areas can be more highly used during periods of colder weather, wind or light rain than more open, exposed areas.

3.4 Not all of the red line boundary was accessible to conduct surveys due to access restrictions. In 2020 this included the southern section comprising Ifield Golf Course,

although this was made available for the 2021 surveys. Areas that were inaccessible across both years include residential sections along the central western edge of the site and, most notably, a wide section along the eastern side of the site comprising dense and open woodland and parkland with frequent mature tree lines extending along the Ifield Brook. This area provides more woodland than the northern and central survey areas combined and comprises some of the best habitat for bats within the red line site boundary and is considered to have suitability for Bechstein's bats.

3.5 By their nature, rare species are difficult to catch, especially ones that have large, wide-ranging foraging areas. Trapping can be improved via use of an ultrasonic lure to target specific species; however, no surveys can be used as confirmation of absence, but rather an increased improbability of presence.

3.6 Spring 2021 was particularly poor, there were prolonged poor weather conditions and very cold nights well into May. Bat activity was notably lower during the pre-parturition period than expected and the number of grounded bats nationally due to poor weather was high. These prolonged weather conditions will have affected bat behaviour, not only foraging in poor conditions, but likely roost behaviour, many colonies have formed roosts late, notably species like brown long-eared did not form many maternity roosts in May and many individuals were not leaving roosts knowing conditions were poor. Breeding success is likely to be notably lower as commonly recorded in years with poor weather in spring, and this can cause a change in many bats' behaviour.

3.7 As a result of the poor conditions and likely changes in breeding in May, Bechstein's captures were notably low with only one of the six Bechstein's caught in 2021 captured during the pre-parturition period. Additionally, it could be that the roosts at this time were located elsewhere close to individuals' foraging areas, and so bats may not have been present in the same areas if maternity roosts hadn't fully formed.

3.8 Similar results were noted on another site with a known Bechstein's colony, where no Bechstein's were caught during the May pre-parturition surveys, despite additional survey effort. Surveys conducted at other sites have shown reduced breeding with one study having had only around 1/3 of the female Bechstein's having bred successfully, it is assumed that the breeding success here may also be lower than typical.

3.9 Poor weather can affect surveys in different ways, firstly supressing foraging as cold weather means no food, so bats don't spend time foraging, but the loss of breeding success also directly affects trapping.

3.10 Trapping Bechstein's is specifically conducted using an ultrasonic lure which incites a territorial response in bats defending their territory from what they perceive is another bat present. When bats are not breeding, they don't form the territories in the same way, as they don't have the need to feed as much, and hence defend their food resource. It is notable that on very poor breeding years, capture rates drop substantially as bats do not respond to defend their territory.

3.11 The survey results presented in the study represent a snapshot in time, and so should not be extrapolated to predict how bats are likely to use the site at different times of year but used as averages and a guide to behaviours. Where colony radiotracking is conducted this therefore only provides information on the use of a portion of the colony and not the whole colony itself as not every individual will be tracked. The higher the

proportion of a colony tracked, the greater the proportion of data on the colony is collected and the more representative the radiotracking data is for that colony.

3.12 Parts of the site have a high level of footfall and human activity, including the golf course across the southern area of the site, and a network of public footpaths across the central and northern areas of the site including people found camping on the site. This did result in some limit to the use of trap sites.

3.13 A combination of tagged bats moving roosts, land access limitations and non-visible or inaccessible roost features resulted in only one maternity roost able to be roost-trapped, with all captured bats ringed for the purpose of long-term monitoring and determination of colony range overlap. This was not until late summer and so no roost or trapping recaptures have yet been identified. However, future survey work will be able to use this data to inform on the colony structure, movements and behaviours.

4 Results

Trapping

4.1 Access for surveys was restricted to accessible areas and defined survey areas of the site, which concentrated on the central farmland areas most likely to be developed. The 2020 surveys did not include access to the southern golf course area.

4.2 Trapping surveys across the site were divided into three survey areas: northern, central and southern areas. This was to be able to suitably access and survey all of the accessible survey areas of the site and to avoid traps being spread too far apart for ethics and the need to check traps regularly.

4.3 The northern and central areas are farmland, with the northern section predominantly grazing pasture and the central section arable field, separated by the River Mole. Traps were located within the areas of woodland and mature tree and hedge lines within both survey areas.

4.4 The southern section comprises Ifield Golf Course, with multiple small, connected woodland areas and several water bodies, bordered by mature tree lines and more extensive woodland to the south.

4.5 Not all areas of the red line boundary site were accessible for surveys, including residential sections along the central western edge of the site and, most notably, a wide section along the eastern side of the site including areas with dense and open woodland with mature trees along the Ifield Brook. This area provides the largest area of woodland on the site and comprises some of the best habitat for bats within the red line site boundary and is considered to have suitability for Bechstein's bats.

FIGURE 2: SHOWING THE THREE SURVEY AREAS WITHIN THE SITE

4.6 A total of eight trapping sessions were conducted within the survey areas: one each in the northern and central areas in July 2020, and two each in all three survey areas between May and August 2021. Combined, there were 44 trap nights' worth of survey effort which caught a total of 151 captures of ten species. See Table 1.

Pipistrelle, Common – *Pipistrellus pipistrellus*
Pipistrelle, Soprano – *Pipistrellus pygmaeus*
Long-eared bat, Brown – *Plecotus auritus*
Bechstein's bat- Myotis bechsteini
Natterer's bat – *Myotis nattereri*
Daubenton's bat – *Myotis daubentonii*
Whiskered bat - *Myotis mystacinus*
Noctule bat – *Nyctalus noctula*
Serotine bat – *Eptesicus serotinus*
Barbastelle bat – *Barbastella barbastellus*

TABLE 1 – SHOWING SUMMARY RESULTS OF ALL TRAPPING SURVEYS

2020	Trap nights	Total Captures	P.pip	P.pyg	P.aur	M.bech	M.nat	M.daub	M.myst	B.barb	N.noc	E.ser
Ifield North	5	**24**	10	1	3	4	3	1	0	0	1	1
Ifield Central	5	**23**	6	3	1	2	7	0	2	1	1	0
	10	**47**	**16**	**4**	**4**	**6**	**10**	**1**	**2**	**1**	**2**	**1**

2021	Trap nights	Total Captures	P.pip	P.pyg	P.aur	M.bech	M.nat	M.daub	M.myst	B.barb	N.noc	E.ser
Ifield North	12	**36**	11	13	5	1	2	0	3	0	1	0
Ifield Central	11	**30**	6	10	8	0	2	1	3	0	0	0
Ifield South	11	**38**	14	4	4	5	4	2	3	1	1	0
	34	**104**	**31**	**27**	**17**	**6**	**8**	**3**	**9**	**1**	**2**	**0**

4.7 The majority of the northern and central sections of the site, being open farmland, are unsuitable for trapping, therefore trap placement was restricted to the areas of woodland, boundary features and tree lines through the site, which are also the features of highest bat potential.

4.8 The southern section had a higher proportion of woodland overall, although much of this was immature, and was largely less suitable for trapping. Trap placement was therefore restricted to the more mature woodland areas, as well as boundary woodland in the southern and western parts of this section.

4.9 Traps were positioned within habitat likely to be used by a range of bat species and a variety of lure calls were used suitable for the species likely to be present on site. Target species specific calls, such as Bechstein's calls were alternated with a mix of other species' generalist calls, to both target species of interest whilst also sampling all other species likely to use the site.

4.10 Weather conditions were considered suitable on all nights with no highly unsuitable conditions requiring surveys to be cancelled. However, a number of surveys experienced poorer conditions than forecast that were suboptimal, notably during a poor period when there was notably lower than seasonal temperatures and fog present. These were on the 4th June, 3rd August and 14th August 2021 (See Table 2), correspondingly these nights caught the fewest numbers of bats.

TABLE 2 – SHOWING WEATHER CONDITIONS DURING THE TRAPPING SURVEYS

Date	Survey area	Weather conditions
29/07/2020	North	Weather was good, warm, mostly clear (10%cc), light breeze. Becoming cool after dark and then cold later on - 9 degrees
30/07/2020	Central	Weather was good, warm and clear, slight breeze. Becoming cool during night
31/05/2021	North	Weather was good, a calm and hot day with the evening warm, still and clear
01/06/2021	Central	Weather was good with a hot and dry day, and the evening warm, clear, and breezy to start but becoming calmer
04/06/2021	South	There had been rain during the day and un-forecast prolonged spitting/mizzle in early evening making it damp. The evening was calm and warm but became foggy quite quickly after dusk with later dense fog in areas of golf course and woodland
03/08/2021	Central	Weather was good to start, mild, dry and partly cloudy, later becoming less suitable - clear, still and cold with fog from 00:00 and 8 degrees by 01:00 (un-forecast and unsuitable)
14/08/2021	North	Weather was good to start, with a warm, clear and calm evening, but becoming cool and damp
20/08/2021	South	Evening was warm and mostly cloudy with a light breeze, but clearing, becoming cooler and calmer with some mist/fog later on

Northern survey area

4.11 Trapping surveys were conducted on 29th July 2020, and 31st May and 14th August 2021, with a total of 17 trap nights' worth of effort conducted which caught a total of 60 captures of nine species. 2020 had a higher capture rate, with five trap nights capturing 24 bats compared to 36 bats from a total of 12 trap nights in 2021.

4.12 In 2021, soprano pipistrelle bats were the most frequently caught (n13) closely followed by common pipistrelle (n11) which is unsurprising given the common nature of these species and the habitats present on site. Lower numbers of brown long-eared bats (n5), whiskered (n3), Natterer's (n2) and Bechstein's (n1) bats were caught, these are all predominantly woodland species with the majority of the captures in the small woodland along the River Mole and northern boundary woodland. An individual noctule bat was additionally caught on site.

4.13 Captures for 2020 differed significantly, with common pipistrelle being the most frequently caught (n10), and Bechstein's being the second most frequent (n4). Lower numbers of brown long-eared (n3) and Natterer's (n3) were caught, with a single capture each of soprano pipistrelle, Daubenton's and serotine, this being the only serotine caught throughout all surveys. See Table 3.

TABLE 3 – SHOWING TRAP RESULTS FOR IFIELD – NORTHERN SURVEY AREA

Date	Traps	Total Bats	P.pip	P.pyg	P.aur	M.bech	M.nat	M.daub	M.myst	B.barb	N.noc	E.ser
29/07/20	3BHT x 5	**24**	10	1	3	4	3	1	0	0	1	1

31/05/21	3BHT x 6	**26**	9	9	3	0	1	0	3	0	1	0
14/08/21	3BHT x 5, 3m MN x 1	**10**	2	4	2	1	1	0	0	0	0	0
		60	**21**	**14**	**8**	**5**	**5**	**1**	**3**	**0**	**2**	**1**

Central survey area

4.14 Trapping surveys were conducted on 30th July 2020, and 1st June and 3rd August 2021, with a total of 16 trap nights' worth of effort conducted which caught a total of 53 captures of nine species. 2020 again had a higher capture rate, with five trap nights capturing 23 bats compared to 30 bats from a total of 11 trap nights in 2021.

4.15 Soprano pipistrelle bats were the most frequently caught (n10), which is unsurprising given the common nature of this species and the habitats present on site, including the River Mole. The next most frequent capture was brown long-eared bat (n8), with half of these caught on the mature hedgerow through the centre of the site. Lower numbers of common pipistrelle (n6), whiskered (n3), Natterer's (n2) and Daubenton's (n1) bats were caught, these are all predominantly woodland species with the majority of the captures in the small woodland along the river mole and northern boundary woodland.

4.16 Captures in 2020 in the central region notably caught more Myotis bats than pipistrelles, with Natterer's being the most frequently caught (n7) along with two whiskered and two Bechstein's bats, compared with common pipistrelle (n6) and soprano pipistrelle (n3). Captures also included a single brown long-eared, noctule, and barbastelle (one of only two caught throughout the surveys). See Table 4.

TABLE 4 – SHOWING TRAP RESULTS FOR IFIELD – CENTRAL SURVEY AREA

Date	Traps	Total Bats	P.pip	P.pyg	P.aur	M.bech	M.nat	M.daub	M.myst	B.barb	N.noc	E.ser
30/07/20	3BHT x 4, 9m MN x 1	**23**	6	3	1	2	7	0	2	1	1	0
01/06/21	3BHT x 4, 12m MN x 1	**20**	4	8	6	0	1	0	1	0	0	0
03/08/21	3BHT x 5, 6m MN x 1	**10**	2	2	2	0	1	1	2	0	0	0
		53	**12**	**13**	**9**	**2**	**9**	**1**	**5**	**1**	**1**	**0**

Southern survey area

4.17 Trapping surveys were conducted on 4th June and 20th August 2021, with a total of 11 trap nights' worth of effort conducted which caught a total of 38 captures of nine species. Common pipistrelles were most frequently caught (n14), to be expected as a common and widespread species, with the next most frequent capture being Bechstein's bats (n5), notably higher than Bechstein's captures in the other two sections this year. Lower numbers of soprano pipistrelle (n4), brown long-eared (n4), Natterer's (n4), whiskered (n3) and Daubenton's (n2) bats were caught, as well as a single noctule and barbastelle. See Table 5.

TABLE 5 – SHOWING TRAP RESULTS FOR IFIELD – SOUTHERN SURVEY AREA

Date	Traps	Total Bats	P.pip	P.pyg	P.aur	M.bech	M.nat	M.daub	M.myst	B.barb	N.noc	E.ser
04/06/21	3BHT x 5	**14**	6	0	3	1	1	0	3	0	0	0

20/08/21	3BHT x 6	**24**	8	4	1	4	3	2	0	1	1	0
		38	**14**	**4**	**4**	**5**	**4**	**2**	**3**	**1**	**1**	**0**

Ringing

4.18 Throughout the surveys a total of 34 bats were marked by ringing; of these, two barbastelle bats and seven Bechstein's were bats caught during trapping across the site. The remaining 25 were Bechstein's bats roost-trapped out of roost 22 (day roost for bat 7 with a peak count of 57 bats; see Figure 12, Appendix 2) to enable future monitoring and colony classification.

Radio Tracking

4.19 A total of 10 bats have been tagged on the project. This includes one Bechstein's bat in 2020, and five Bechstein's bats, two brown long-eared bats, one barbastelle and one Natterer's bat in 2021 (Table 6).

4.20 All tagged bats were tracked by day to identify roost locations as far as practicable (see Table 7). The five Bechstein's bats tagged in 2021 were additionally subject to full-night radio tracking to inform on foraging areas and commuting routes.

TABLE 6 – RADIO TAGGED BATS

Bat number	Species	Sex	Age	Female breeding status	Date of capture	Capture Location	Grid Reference
1	M.bech	Male	Juvenile		29/07/20	Ifield north	TQ 24364 37892
2	M.nat	Female	Adult	Parous	01/06/21	Ifield central	TQ 23847 37518
3	P.aur	Female	Adult	Parous	01/06/21	Ifield central	TQ 24546 37429
4	M.bech	Female	Adult	Nulliparous	04/06/21	Ifield south	TQ 23260 36617
5	P.aur	Female	Adult	Lactating	03/08/21	Ifield central	TQ24402 37932
6	M.bech	Male	Juvenile		14/08/21	Ifield north	TQ 24150 37993
7	M.bech	Female	Adult	Parous	20/08/21	Ifield south	TQ 23279 37006
8	M.bech	Male	Juvenile		20/08/21	Ifield south	TQ 23295 36509
9	B.barb	Female	Juvenile	Nulliparous	20/08/21	Ifield south	TQ 23295 36509
10	M.bech	Female	Adult	Post-lactating	20/08/21	Ifield south	TQ 23168 36534

Bat 1 – Bechstein's bat – Juvenile male

4.21 Tagged 29th July 2020 following capture in the northern survey area - TQ 24364 37892 - two roosts identified (Figure 13, Appendix 2)

4.22 This bat was caught along the River Mole on the northern edge of the small, central woodland. The bat was not located during a daytime search the next day, therefore following trapping on the 30th July, the bat was relocated before dawn in order to back-

track to the roost. This identified a roost within a mature ash tree approximately 1.8km NW of the site (roost 1). On the 31st July an emergence survey of the tree was carried out with a peak count of 34 Bechstein's bats emerging from two adjacent, west-facing features. On the 2nd August the bat was found to have moved to a mature ash tree approximately 10m along the same tree line (roost 2), where it remained until 3rd August. Thereafter no signal was picked up here, on site or in the surrounding areas and the tag was considered to have died.

Bat 2 – Natterer's bat – Adult female (Parous)

4.23 Tagged 1st June 2021 following capture in the central survey area - TQ 23847 37518 - two roosts identified (Figure 12, Appendix 2)

4.24 This bat was caught along the western site boundary tree line and the following day was identified roosting in a mature oak on the woodland edge along the north-western site boundary (roost 3). An emergence survey carried out on 2nd June identified six Natterer's bats emerging from a south-facing woodpecker hole. No signal was found for the bat on 3rd June, the bat was then relocated on 4th June in another mature oak approximately 300m further north-west in the woodland (roost 5), where it remained until the 6th June, and was also present here during a subsequent check on 9th June. An emergence survey carried out on 4th June recorded 15 Natterer's bats emerging from a west-facing woodpecker hole on this tree.

Bat 3 – Brown long-eared bat – Adult female (Parous)

4.25 Tagged 1st June 2021 following capture in the central survey area - TQ 24546 37429 - three roosts identified (Figure 12, Appendix 2)

4.26 This bat was caught along the tree-lined edge of Ifield brook on the eastern side of the site and was identified roosting in a small oak overhanging the brook (roost 4) on 2nd June. An emergence survey that night identified only the tagged bat emerging from a low woodpecker hole, with several false approaches later recorded. The bat remained present until 4th June, then on 5th June moved to a mature oak further south within the site (roost 6).

4.27 On 6th June the bat moved to another mature oak within the tree and hedge line through the centre of the site (roost 7); a tree the bat had night-roosted in on 1st June post-release after tagging. An emergence survey carried out on both roost 6 and roost 7 trees simultaneously on 6th June did not observe any bats emerging or identify any features suggesting that the roost must be obscured from the ground by foliage.

Bat 4 – Bechstein's bat – Adult female (Nulliparous)

4.28 Tagged 4th June 2021 following capture in the southern survey area - TQ 23260 36617 - four roosts identified (Figure 14, Appendix 2)

4.29 This bat was caught within a small patch of woodland in the south-western area of the golf course and continued to forage in this area following release. On 5th June she was identified roosting in an oak (roost 8) within Dumbrels Copse approximately 2.5km north-west of the site, and through the night the bat foraged exclusively within Dumbrels Copse, coming back to roost in the same tree for 6th June. An emergence survey of the tree recorded a peak count of 23 Bechstein's bats emerging from a west-facing woodpecker hole.

4.30 Tracking through the night of 6th June, the bat moved between Dumbrels Copse and the western side of the golf course, and at dawn on 7th June went to roost in a small ash tree (roost 10) on the western edge of the golf course. Only a single south-facing feature was visible from the ground, however an emergence survey that night did not record any bats emerging indicating that further roost features are present which are obscured from the ground.

4.31 On 9th June the bat was located in a mature ash within a tree line (roost 11) approximately 800m west of the site. Access was only possible to one side of the tree and so a full emergence survey could not be conducted. The bat foraged along the network of tree lines and copses between this roost and the western edge of the golf course, returning to roost in roost 10 at the end of the night.

Bat 5 – Brown long-eared bat – Adult female (Lactating)

4.32 Tagged 3rd August 2021 following capture in the central survey area - TQ 24402 37932 - one roost identified (Figure 12, Appendix 2)

4.33 This bat was caught just south of the River Mole within the small, central woodland. On 4th June the bat was identified roosting within Wood Cottage along Ifield Wood (roost 12), within 250m of the western site boundary. The bat remained present at this roost until 7th June, from 8th June no signal was picked up here, on site or in the surrounding areas and the tag was considered to have died. No access was available to carry out an emergence survey on the property in order to obtain a count and characterise the roost.

Bat 6 – Bechstein's bat – Juvenile male

4.34 Tagged 14th August 2021 following capture in the northern survey area - TQ 24150 37993 - two roosts identified (Figure 15, Appendix 2)

4.35 This bat was caught within woodland along the north-western site boundary and following release, foraged further north through the woodland areas adjacent to the site, before roosting in a mature ash just west of Ifield Wood (roost 13) before dawn. An emergence survey on 15th August recorded 23 Bechstein's bats emerge from an east-facing woodpecker hole, with the bat foraging predominantly in the woodland around the roost and occasionally moving south through connected woodland into the western edge of the site.

4.36 On the 16th and 17th August, the bat followed similar foraging patterns with additional brief exploration further west along mature tree lines to nearby woodland. On 18th August the bat moved east across the road into another mature ash with multiple visible knot and woodpecker holes (roost 14), where it remained until 22nd August. No access was available to carry out an emergence survey on this tree in order to obtain a count for this roost. From 23rd August, no signal was picked up here, on site or in the surrounding areas and the tag was considered to have died.

Bat 7 – Bechstein's bat – Adult female (Parous)

4.37 Tagged 20th August 2021 following capture in the southern survey area - TQ 23279 37006 - two day roosts and two night roosts identified (Figure 16, Appendix 2)

4.38 This bat was caught in the north-western corner of the golf course and following release was found to be foraging in the woodland areas within the golf course, however the bat was not located during a daytime search on 21st August.

4.39 During the first two nights' tracking she foraged predominantly in the north-west area of the golf course and the immediately surrounding tree lines and small woodland patches. Her signal was found to approach early in the night from the north-west and disappear north-west again before dawn using the network of mature tree line field boundaries, however a day roost was not initially located.

4.40 On 23rd August, the bat first appeared early evening within Dumbrels Copse, close to the identified roost 8 used by bat 4 and it is considered likely she was roosting within this woodland. Tracking on 23rd and 24th August found the bat to alternate foraging in the area around the north-west corner of the golf course, and within Dumbrels Copse and adjacent small woodland patch.

4.41 On 24th August the bat was identified roosting in a large oak within a small copse at The Mount (roost 21), approximately 1km north-west of the golf course, however the roost feature was obscured, and a count could not be obtained. On 29th August the bat had moved to a mature ash in the adjacent tree line (roost 11), a roost previously used by bat 4, however access was only possible to one side of the tree and so a full emergence survey could not be conducted. On 30th August the bat had moved again, back into the small copse into a mature ash with a south-facing knot hole (roost 22). An emergence survey of roost 22 on 31st August identified 41 Bechstein's bats emerge, and a roost-trapping exercise of this roost on 2nd September recorded a peak of 57 Bechstein's bats emerging, with 25 of these captured and ringed.

Bat 8 – Bechstein's bat – Juvenile male

4.42 Tagged 20th August 2021 following capture in the southern survey area - TQ 23295 36509 - two day roosts and one night roost identified (Figure 17, Appendix 2)

Bat 10 – Bechstein's bat – Adult female (post-lactating)

4.43 Tagged 20th August 2021 following capture in the southern survey area - TQ 23168 36534 – one day roost and one night roost identified (Figure 19, Appendix 2)

4.44 Bats 8 & 10 were caught in separate traps along the woodland boundary in the south-western part of the golf course, and the following day were identified roosting together in an oak in the large woodland block south of the golf course (roost 15). Both bats continued to roost here until 24th August, with an emergence survey recording a peak count of 41 Bechstein's bats emerging from a woodpecker hole. On 28th August, bat 8 was found to have moved to another oak further north-west within the same woodland (roost 19), a tree he had previously night-roosted in, where he remained until 30th August. During this period there was no signal at either roost or elsewhere on site or surrounding areas for bat 10.

4.45 Both bats foraged within the large woodland along the southern and south-western edge of the golf course; bat 8 foraged predominantly in the area around the roost and occasionally coming north into the small woodland patches within the golf course, while bat 10 mainly foraged further west within this woodland and along connected tree lines to the south and west.

4.46 During the radiotracking survey, both bats were occasionally lost for short periods during the night, in each instance their signals were heading south or south-west away from site and returned from the same direction. The area south-west of the golf course is a large mosaic of woodland and farmland with very little road access from which to

radio track, however bat 10 was located on several occasions foraging in woodland along the railway line south-west of Kilnwood Vale.

Bat 9 – Barbastelle bat – Juvenile female

4.47 Tagged 20th August 2021 following capture in the southern survey area - TQ 23295 36509 - roost not identified (Figure 18, Appendix 2)

4.48 Bat 9 was caught in the same trap as bat 8 on the south-western boundary of the golf course, and following release was located in the large woodland within the eastern area of the site, close to Ifield Mill Stream. During the first night of tracking, the bat was first located approximately 800m south-west of the site, and shortly after was foraging within a woodland patch north of the golf course on the western site boundary, the signal moved north and following this the signal was lost.

4.49 Regular searching through the site and surrounding areas on this and subsequent days and tracking nights did not identify the bat present roosting or foraging on or near the site. While the location of the bat was unknown, it was known that it wasn't on the site. Barbastelle bats are known to be wide-ranging species and can travel large distances between roosts and foraging areas. In addition, as a juvenile this bat may have been exhibiting exploratory behaviour and may not be roosting or regularly foraging in the vicinity of the site.

TABLE 7 8– ROOSTS IDENTIFIED THROUGH RADIO TRACKING

Roost no.	Roost type	Day Roost category	Confirmed roost / feature	Location	Grid ref	Species	Bat no	Dates used	Max Roost Count
1	Day	Maternity	Two knot holes on W aspect of ash tree	Windacres Farm	TQ 23709 40191	M.bech	1	31 July 2020	34
2	Day		Ash tree, feature unknown	Windacres Farm	TQ 23717 40213	M.bech	1	2-3 Aug 2020	
3	Day	Maternity	Woodpecker hole on S apsect of large oak	The Druids, Ifield Wood	TQ 24455 38238	M.nat	2	2nd June 2021	6
4	Day		Small oak at stream with multiple woodpecker and knot holes	Woodland W of Rusper Road Playing Fields	TQ 24529 36914	P.aur	3	2nd-4th June 2021	1
5	Day	Maternity	Woodpecker hole on W aspect of large oak	Woodland NW of The Druids	TQ 24222 38356	M.nat	2	4th-6th, 9th June 2021	15
6	Day		One of two large oaks with multiple features	Land west of Ifield - on site (central farm)	TQ 24484 37095	P.aur	3	5th June 2021	Feature obscured
7	Day		Large oak tree with dense ivy, feature unknown	Land west of Ifield - on site (central farm)	TQ 24242 37338	P.aur	3	2nd (night), 6th (day) June 2021	Feature obscured
8	Day	Maternity	Woodpecker hole in oak	Dumbrels Copse	TQ 21390 38192	M.bech	4	5th-6th June 2021	23
9	Night		Unknown	Woodland at western end of Ifield Golf Course	TQ 23269 36627	M.bech	4	6th June 2021	N/A – night roost
10	Day		Ash tree, roost feature unknown	Woodland west of Ifield Golf Course	TQ 23163 36606	M.bech	4	7th, 10th June 2021	Feature obscured
11	Day		Ash tree, roost feature unknown	Tree line south of The Mount	TQ 22858 37767	M.bech	4, 7	9th June 2021 (Bat 4), 29th Aug 2021 (Bat 7)	No access

12	Day		house exact feature unknown	Wood Cottage, Ifield Wood	TQ 23867 38155	P.aur	5	4th-7th Aug 2021	No access
13	Day	Maternity	Ash, downward woodpecker hole to E aspect	Ifield Wood	TQ 24137 38676	M.bech	6	15th-17th Aug 2021	23
14	Day	Maternity	Unknown feature, likely one of 4 E-facing woodpecker holes	Ifield Wood	TQ 24241 38640	M.bech	6	17th (night), 18th-22nd (day) Aug 2021	No access
15	Day	Maternity	woodpecker hole	Ifield Golf Course southern wood	TQ 23494 36237	M.bech	8, 10	21st-24th Aug 2021	41
16	Night		Oak - feature unknown	Ifield Golf Course at small pond	TQ 23928 36491	M.bech	8	22nd Aug 2021	N/A – night roost
17	Night		Oak - feature unknown	Ifield Golf Course western wood	TQ 23117 36503	M.bech	10	22nd-24th Aug 2021	N/A – night roost
18	Night		Oak - feature unknown	Small wood just north of Ifield Golf Course	TQ 23248 37203	M.bech	7	22nd-24th Aug 2021	N/A – night roost
19	Day		Unknown feature	Ifield Golf Course southern wood	TQ 23349 36428	M.bech	8	23rd-24th (night), 28th-30th (day) Aug 2021	
20	Night		Unknown feature	Small wood east of Dumbrels Copse	TQ 21701 38178	M.bech	7	23rd-24th Aug 2021	N/A – night roost
21	Day		Oak - feature unknown	Copse at Mount Farm to NE of golf course	TQ 22736 37847	M.bech	7	24th Aug 2021	Feature obscured
22	Day	Maternity	S-facing knot hole in ash	Copse at Mount Farm to NE of golf course	TQ 22752 37869	M.bech	7	30th-31 Aug 2021	57

5 Third Party Results

5.1 The single Bechstein's radio tagged in 2020 was identified in a maternity roost approximately 1.9km north in an area closer to Gatwick Airport. During 2019-2021 surveys were being conducted on this Bechstein's population by The Ecology Consultancy (TEC) on behalf of the airport.

5.2 This work had included radio tagging 14 bats consisting of 13 Bechstein's, 11 adult females and juveniles and 3 adult males, and a single juvenile male barbastelle. All bats had been radio tracked and a total of 16 roosts identified (Figure 20, Appendix 2).

5.3 The single juvenile Bechstein's bat tagged in 2020 by AEWC was found to be roosting in the same area as this Gatwick population indicating that the Bechstein's bats in this area are part of this colony. This colony had already had research conducted to indicate the population, core roosts and core foraging areas.

5.4 All of the Bechstein's bats radio tagged and tracked by TEC were found to be using foraging areas well north of the Land at Ifield site and no individuals were found to use any area of the site (Figure 21, Appendix 2). This indicates that the core foraging area for this population is to the north and the land at Ifield site is unlikely to form part of the colony's core foraging area.

5.5 These findings were discussed with NE and agreed that radiotracking effort on this colony could take these findings into account and reduce the radiotracking survey effort. Bats would need to be tagged, but if results remained consistent then full colony

tracking, typically 25% of the colony population, would not be necessary and only tracking odd individuals would be required.

6 Discussion

Trapping

6.1 The trapping surveys conducted on areas of the site have confirmed the presence of ten species using the site. While the acoustic surveys in 2018-2019 also recorded ten species there are a number of issues and limitations with the acoustic surveys and species identification. Acoustic surveys frequently highly under-record quieter whispering species and so do not reflect the true representation of the population present on the site, and it is often difficult to accurately identify calls of cryptic species to species level.

TABLE 9 – PROPORTION OF SPECIES IDENTIFIED THROUGH DIFFERENT SURVEY TYPES

Survey Type		Total	P.pip	P.pyg	P.nat	P.aur	M. bech	M.nat	M. daub	M. myst	B. barb	N.noc	N.lei	E.ser	Pip spp.	Myo spp.	Big bat
Acoustic surveys	Passes	**49638**	46363	517	154	284	0	20	5	0	2	452	24	246	963	379	229
	%		93.40	1.04	0.31	0.57	0.00	0.04	0.01	0.00	0.00	0.91	0.05	0.50	1.94	0.76	0.46
Trapping surveys	Captures	**151**	47	31	0	21	12	18	4	11	2	4	0	1	-	-	-
	%		31.13	20.53	0.00	13.91	7.95	11.92	2.65	7.28	1.32	2.65	0.00	0.66	-	-	-

6.2 Common pipistrelle represented 93.4% of all calls recorded during the acoustic surveys but made up less than a third of all trapping captures across the site, likely a result of the selected locations of detectors placed on the site. Conversely, brown long-eared bats, a very quiet species commonly under-recorded during acoustic surveys, accounted for only 0.6% of calls recorded on the site, indicating they are not common in this area. However, they made up 14% of captures, 23 times higher than the acoustic surveys. Additionally, radiotracking of two individuals identified three new roosts within the site boundary clearly showing they are common and widespread on the site.

6.3 The acoustic surveys did identify the presence of Leisler's bats with a number of calls recorded. This species is very rare in Sussex, and largely absent in this county. This species is also known to have overlapping calls with noctule bats and misidentifications are common. As Leisler's are commonly caught to lures and none were caught during trapping surveys, it is considered unlikely that these identifications are accurate, and the species is not regularly using the site as previously indicated.

6.4 Bechstein's bats were not identified in the previous surveys of the site despite being widely caught across the project area. Bechstein's bats are notably quiet and forage in the upper canopy, as such acoustic surveys are not a suitable survey method for this species, and trapping is the only method considered suitable to survey for the presence of this species (Bat Surveys: Good Practice Guidelines – Bat Conservation Trust, 2016).

6.5 Given the confirmation of the species present on the site, the numbers caught and species assemblages the trapping survey results are considered to provide a much more accurate representation of the species diversity and assemblages present on

the site to enable a more accurate assessment of the importance of the site for various bat speceis.

Radio Tracking Discussion

6.6 A total of ten bats were radio tagged during the project. A juvenile male Bechstein's bat tagged in 2020 and the following year an adult female Natterer's, a juvenile female barbastelle and two adult female brown long-eared bats tagged were all subject to daytime tracking to locate roosts in 2021. Five Bechstein's bats tagged in 2021 were all subject to full night tracking to further inform on foraging areas and flight lines (Figure 11, Appendix 2); these comprised one adult female tagged pre-parturition, and a further two adult females and two juvenile males tagged post-parturition (see Table 10-12, Appendix 1).

6.7 The tagging of the brown long-eared and Natterer's bats has confirmed the presence of maternity roosts for these species on and directly adjacent to the site. While colony tracking has not been conducted for these species, the proximity of the maternity roosts to the proposed developments will mean that this will be within the Core Sustenance Zones (CSZ) for these species, so have potential for impacts on the favourable conservation status through impacts on roosts, loss of and fragmentation of foraging areas through direct loss and change of use, and severance of flight lines.

6.8 Radio tracking of the Bechstein's identified very little foraging activity within the central and northern survey areas, with only a few fixes falling within the western site boundary in the north. This may in part be due to the habitats present within these areas being largely unsuitable for this species, consisting predominantly of open farmland with only small woodland patches present. However, importantly the sample size was low and only juvenile bats were radio tagged in the northern area. No Bechstein's bats were tagged in the central section, which were only caught in 2020, and only one of the two tagged in the north subject to full night tracking. In addition, the eastern wooded corridor that has higher suitability for Bechstein's was not surveyed.

6.9 To date, there has been no overlap between roosts or foraging areas between Bechstein's bats tagged in the northern and southern survey areas. Bat 1, tagged in 2020, was identified roosting approximately 1.9km north of the site and foraging further north in Glovers Wood, falling within the range of the colony studied by TEC from 2019 to 2021, and is considered to be part of this colony. None of the bats tracked by TEC came onto the site or went near any of the roosts or areas identified by the Bechstein's population further south, indicating that this is clearly a separate population.

6.10 Within the southern survey area there was clear foraging activity identified within the site, with all four tagged bats utilising many of the small woodland patches across the golf course to some extent strongly indicating that this forms part of this colonies CSZ. Three of four tagged bats in this area had core ranges covering the western side of the course. Most of the tagged bats' core foraging area was identified in the adjacent woodland as would be likely for this species. Bechstein's bats specialise in mature woodland with a high proportion of oak present; while the woodland patches within

the course have some mature trees (potentially remaining from historic field boundaries), these are mostly in smaller groups with some immature planting.

6.11 The southern boundary woodland and mature tree lines on the western and northern boundaries were strongly favoured for both foraging and commuting between other foraging areas to the south and north-west. These areas comprise a higher proportion of mature trees and offer higher quality foraging habitat sought by females and juveniles.

6.12 Bat 4, a non-breeding female Bechstein's tagged in June 2021, and bat 7, a non-breeding female Bechstein's tagged in August 2021, were both caught in the southern survey area. They have overlapping core foraging areas over the western side of the golf course and at Dumbrels Copse and used similar commuting routes between the two. Through tracking they were identified to share one roost location (roost 11), and bat 7 was suspected to either share another of bat 4's roosts (roost 8) or have been roosting in very close proximity to it within Dumbrels Copse, although the bat emerged before the specific roost location could be confirmed.

6.13 Bats 8 (juvenile male) and 10 (breeding female), both caught in the southern survey area in August on the same night as bat 7, were identified to share a roost (roost 15) south of the golf course. While neither shared any roosts with bats 4 or 7, the bats all have overlapping ranges, with bats 4, 8 and 10 additionally all having day and night roosts within the same woodland and in close proximity to each other.

6.14 The four Bechstein's bats tagged in the southern area were found to be roosting over a wide range, with roosts up to 3km apart, which is considered to be an extremely high range for roosts of the same colony of this species. While bats 4 and 7, and bats 8 and 10 were found to use the same roosts as each other, there was never any overlap in the roosts used by these pairs even though these bats were all tagged at the same time.

6.15 The radiotracking and emergence identified a roost south of the golf course with a minimum count of 41 individuals and a roost at the same time to the north with a minimum count of 57 individuals giving a minimum population of 98 individuals in the southern area. The distances separating these maternity roosts, the roost counts, and absence of any roost sharing would indicate that these may be separate colonies, However, there was some overlap in foraging between individuals which would indicate that this is one larger colony that has fragmented.

6.16 2021 was an unusual year with very poor conditions in spring and early summer which can have a notable effect on breeding and behaviours. There are a number of reasons why a colony may fragment into multiple roosts, however, typically roosts of the same colony for Bechstein's would be much closer together.

6.17 The survey results have identified a high population of Bechstein's in this southern area, however it is not currently clearly defined if this is one single large colony spread out over a wider area that usual, or two separate colonies, or a large colony undergoing separation.

6.18 The trapping and radiotracking has identified at least two Bechstein's colonies using the site, with the southern population possibly being two separate colonies. The northern population has already been partly studied by TEC and full radiotracking to

achieve 25% of this colony will not be necessary, but further individuals from the site, especially breeding females and ones in the central area should be tagged to get a greater understanding on the range of this colony use.

6.19 The southern population has been identified to be a minimum of 98 individuals. The 4 bats radio tagged in this area represent only 4% of the population. The recommended proportion to get a representation of the colony and understanding of the colony range, behaviour and habitat use is to track 25% of the colony population.

6.20 Radiotracking should ideally look to track the minimum number of bats needed to identify the necessary information for ethical and welfare reasons. In this case it was considered that a reduction of the northern population was suitable given the previous research that has already been conducted. However, there has been no previous research on the southern colony and the limited trapping and tracking of 4 individuals does not provide suitable representation of the colony.

Species Discussion

6.21 A total of ten species have been caught on the site across all surveys, with nine species caught during trapping sessions within each of the individual survey areas. Trapping was conducted over eight trapping nights with 44 trap nights' worth of effort and a total of 151 bats were caught, which is believed to represent a good selection and indication of the species present and breeding status using the site and local area.

6.22 Capture rates were notably higher during the 2020 surveys, with almost a third of the total captures (31.12%) in only two nights with 10 trap nights' worth of effort. Within 2021, capture rates were lower during the pre-parturition period than is considered typical, likely a reflection of the very poor spring conditions well into May. Additionally, post-parturition captures within 2021 were lower, this is likely a result of the poor and delayed breeding success with fewer juveniles active later in the year with late breeding, and reduction in responsiveness with non-breeding females.

Common pipistrelle bat

6.23 Common pipistrelle was the most common species trapped (Figure 5, Appendix 1), with a total of 47 bats caught during all surveys, with the highest proportion (21) of these caught in the northern survey area, and the lowest (12) in the central survey area. This is a common widespread species across the UK which is associated with a wide range of habitats, and was the most common recorded species by Arcadis Consulting Ltd during activity surveys carried out on site in 2018-2019.

6.24 Captures of these bats were relatively widespread across the site, with the presence of breeding females and juveniles early in the evening and regularly through the night indicating that the habitats on site provide good commuting and foraging habitat and there are nearby breeding colonies.

Soprano pipistrelle bat

6.25 Soprano pipistrelle was the second most-frequently caught species, with a total of 31 bats caught during all surveys (Figure 5, Appendix 1). This is a common and widespread species across the UK which is frequently associated with water, but is found in a range of habitats.

6.26 Although this species was caught widely across the site, captures were significantly higher in the northern and central survey areas, this is unsurprising given the presence of the River Mole and Ifield Brook through these areas, with 50% of all captures from traps along these features. The presence of breeding females early in the evening and regularly through the night, and juveniles later in the night, indicates that the site, particularly the central and northern areas, provide important commuting and foraging habitat for local breeding colonies of this species.

Brown long-eared bat

6.27 A total of 21 brown long-eared bats were caught throughout all surveys (Figure 6, Appendix 1), this is a common and widespread species across the UK often associated with woodlands. Of the 21 bats caught, 13 of these were within woodland traps, this higher number is expected as this is a woodland species that is also commonly caught to Bechstein's calls.

6.28 Captures were highest in the central and northern survey areas where traps were more located within woodland. Most trap locations caught only individual bats, however the trap location in the double tree line in the middle of the central survey area caught four bats, two adult males, an adult female and a juvenile female. All brown long-eared bat captures tended to be in the mid to late portion of the night, and notably more males than females were caught, however three roosts have been identified within the site, and another roost in close proximity to the west.

Natterer's bat

6.29 A total of 18 Natterer's bats were caught throughout all surveys (Figure 7, Appendix 1), this is a common widespread species across the UK. The majority of captures (13) were within woodland traps which is unsurprising given that this species is largely associated with woodlands.

6.30 Bats were captured across all three survey areas, although captures were notably higher (50%) in the central survey area. Captures were also higher post-parturition, with the presence of breeding females and juveniles early in the evening indicative of breeding colonies in close proximity to the site. The tagging and radio tracking has confirmed the presence of a Natterer's maternity colony using two roosts at the north-western site boundary. In 2020, the majority of bats captured were along the eastern half of the site, with a lactating female and two juveniles caught early in the evening in the same trap along Ifield Brook. Captures in 2021 were lower overall and tended to be in the western half of the site and the variation may be from a seasonal shift in foraging.

Daubenton's bat

6.31 A total of four Daubenton's bats were caught throughout all surveys (Figure 7, Appendix 1). Daubenton's are a common and widespread species throughout the UK, heavily associated with larger open water. The numbers caught on the site is low despite the presence of the River Mole and Ifield Brook and a number of ponds. However, this is to be expected as the river and brook are largely overgrown or narrow with steep banks and little open water suitable for this species.

6.32 All captures were during post-parturition surveys; three of the four were adult males all caught later in the night. The fourth capture was a juvenile female caught in the southern survey area in the earlier part of the evening, however not notably close to emergence time. Juveniles in late August typically exhibit exploratory behaviour, and with no adult females caught at all during the surveys, it is considered unlikely that there is a notable colony on or immediately adjacent to the site.

Whiskered bat

6.33 A total of 11 whiskered bats were caught throughout all surveys (Figure 7, Appendix 1). This is a common and widespread species largely associated with woodlands and scrub habitats, and all captures were within woodland traps. Captures were notably higher during the 2021 surveys (9), with the majority of these (7) during the pre-parturition period, predominantly in the northern and southern survey areas in the larger woodland areas, with four adult females and three adult males caught.

6.34 Bats captured during the post-parturition period were only captured in the central survey area, with three of the four caught within the small woodland patch along the River Mole and the fourth along the Ifield Brook. These included an adult female and juvenile female caught early in the evening, with a juvenile male and an adult male caught slightly later on.

6.35 All captures were before midnight, and the results show a seasonal pattern to foraging behaviour for this species, with the larger woodland areas on the site boundaries important during pre-parturition, with post-parturition activity focused more on the woodland along the River Mole and Ifield Brook. Given the regular presence of breeding females and juveniles it is considered likely that there is a maternity colony in the local area. No bats of this species were radio tagged as this is a small species and some individuals caught were found to be underweight during a period of suboptimal weather conditions in 2021.

Noctule Bat

6.36 A total of four noctule bats were caught in all three survey areas (Figure 8, Appendix 1), three of which were adult males caught at variable times, and the fourth a lactating female caught commuting through the central survey area. This species is common and widespread and is a wide-ranging species that typically travels some distance from maternity roosts. While they were not targeted, this species is easily caught to lures and it is considered unlikely that a colony is present locally on the site. If a colony was present locally or foraged in this area regularly, a higher number of individuals, particularly females, would be expected to be caught.

Serotine Bat

6.37 Only a single serotine was caught throughout the surveys, an adult male caught in 2020, late during the survey in the northern survey area (Figure 9, Appendix 1). This species is widespread in the UK and common and widespread in both Sussex and Surrey.

6.38 This species can forage opportunistically with a seasonal shift to take advantage of insect hatches so populations may only be present periodically. With no females caught it is considered unlikely that this area forms part of the regular core foraging area for any local colony, however as this species was less targeted it may be under recorded.

Barbastelle Bat

6.39 A total of two barbastelles were caught during the surveys, one an adult male caught in 2020 along Ifield Brook in the central survey area, and the other a juvenile female caught in 2021 on the south-western edge of the golf course (Figure 10, Appendix 1). Barbastelle bats forage over a wide range and while the male was caught early, the juvenile female was caught late in the survey in late August, a time of year when juveniles are exhibiting exploratory behaviour.

6.40 Additionally, the radiotracking of this juvenile did not find that she returned to the site or repeated any of her foraging areas. Although the roost was not identified, she was not found to roost near to the site and so it is unlikely that there is a maternity colony on or near to the site, but there is a breeding population in the wider area. A single juvenile male was caught by The Ecology Consultancy towards Gatwick that commuted south and covered similar range to this juvenile female.

6.41 As only very low numbers were identified through the survey work, with only one single juvenile and no roosts identified present on or near the site the population identified using the site is considered to be of local significance. If this was found to be part of the foraging area for a distant colony then this would be of regional significance.

Bechstein's bat

6.42 A total of 12 Bechstein's bats have been caught throughout all trapping surveys, six each in 2020 and 2021 (Figure 4, Appendix 1). Of these, ten were caught in woodland traps, which is to be expected for a rare woodland specialist species. One was caught in the double tree line through the middle of the central survey area, and the other was caught in the north-west corner of the golf course along the boundary tree line, an area that was later shown through radio tracking to be part of her core foraging area.

6.43 The 2020 surveys caught a lactating female and five juveniles, three of which were in the same trap, within woodland along the north-western site boundary. The 2021 post-parturition surveys showed similar capture rates, with an adult male, two adult females

and a juvenile male in the southern survey area, and a juvenile male in the northern survey area.

6.44 Conversely, the 2021 pre-parturition surveys caught only one Bechstein's, an adult female (tagged bat 4) caught late in the night within the southern survey area. Although the early summer conditions in 2021 were notably poor and bat activity in general was highly reduced from normal, the low capture rate is still unusual when compared with the other surveys, especially given the range and effort of trapping conducted. This may be due to delays in colonies forming, or colonies roosting in different areas. Radio tracking of this female showed her colony to be roosting a significant distance away, 2.5km north-west of the site, and initially foraging close to that roost, although she was later found to move foraging closer to the site.

6.45 Although none of the Bechstein's were caught very early after emergence, the proportion of females and juveniles within the total captures is indicative of the presence of colonies in close proximity to the site and use of the site as foraging areas by breeding colonies. The concentration of captures in the post-parturition period (92%) may also point to seasonal shifts in core foraging areas, with bats concentrating in denser and warmer areas during the colder early summer periods.

6.46 The surveys across the site have identified that there are a number of Bechstein's using the site from at least two separate colonies, with Bechstein's caught in all three survey areas and nine new day roosts identified in the local area, five of which are in close proximity to the site. The northern colony has already been partly researched by TEC which didn't identify any individuals commuting or forage south onto the site, however the trapping surveys have clearly shown individuals are using the site and tagging in 2021 has identified two new roosts closer to the site. This is likely to be a satellite roost that had not been previously identified or was not previously used.

6.47 The surveys have shown that the southern population is large, with a minimum combined count in late August of 98 individuals The trapping has clearly shown that there are a number of individuals using the site in the southern area, and while it may not be fully clear if these are two separate colonies or one larger one there are individuals from both populations using the site, indicating that the site forms part of an important resource for these populations. .

6.48 Only one roost (roost 22) was able to be roost-trapped in order to ring the bats present, and this was at the end of the survey season following completion of the trapping and radiotracking surveys. Further work is required in this area to trap, tag and identify roosts to get ring recapture records in order to establish any overlap in ranges and shared roosts, and establish the number of separate colonies present.

6.49 Bechstein's bats are one of the UK's rarest mammals. Bechstein's bat is listed on Annex II of the EC Habitats and Species Directive (JNCC, 2007) and is a Species of Principal Importance in England under Section 41 of the Natural Environment and Rural Communities Act 2006. It is also listed as near threatened on the IUCN global red list (IUCN, 2016).

6.50 Bechstein's have been one of the most researched UK species over the last two decades since the implementation of the national Bechstein's survey which commenced in 2005 and more than doubled the number of known colonies (D. Whitby). This southern population is notably a new record for the local area, is a large

population and above average in size for this species. Given the rarity of the species and the high populations identified present, the local Bechstein's population is considered to be of **national importance.** With individuals from at least two colonies, and possibly three, using the site there is potential for notable impacts through habitat loss, reduction in colony range, fragmentation and severance of connectivity for this population resulting in high impact in this species.

7 Recommendations

7.1 The surveys during 2020 and 2021 have provided a more accurate representation of the species present and proportions of species present on the areas of the site surveyed. However, there have been a number of limitations, notably due to the unsuitable weather conditions in 2021 which were identified as having a notable effect on bat behaviour and breeding success nationally, but also restrictions to the areas surveyed and limited access to all of the site.

7.2 Landscape-scale projects should have surveys designed to identify landscape scale impacts. This should include surveying all areas of the site that are identified as having suitability for bats, especially rarer bats such as Bechstein's where there are potential impacts, either direct or indirect, such as fragmentation or severance of flight lines. Some areas of the site have had no surveys where there are highly suitable habitats, notably the eastern part of the site with woodland and Ifield Brook.

7.3 It is strongly recommended that access where feasible is gained to adjacent suitable habitats where Bechstein's have been identified present either foraging or also roosting notably the eastern part of the site and the southern woodland adjacent to the golf course.

7.4 Surveying adjacent habitats can provide greater localised information on the population and allow for comparison for a local assessment of importance. Local adjacent habitats may be more suitable for Bechstein's and so catch/identify higher numbers of individuals, showing that these are more/less important than the habitats present on the site. This can be important in being able to do the Favourable Conservation Status test in identifying the local distribution and comparative importance of the site to local areas.

7.5 Further trapping and tagging of Bechstein's is required to be conducted from the northern survey area to tag Bechstein's, notably breeding females to ascertain the level of use of this area by breeding females, or to provide additional negative surveys to support low levels of use by this species. The poor conditions in 2021 means that the absence of captures cannot rule out the presence of breeding females, as these were caught in 2020.

7.6 Greater research and radio tracking of the Bechstein's population in the south is required to both conduct additional trapping, radio tagging and roost monitoring to aim to ascertain the status of the population in this area and if this is one large or two smaller colonies. This will be assisted by the ringed bats that have already been rung in 2021. Additionally greater numbers of bats need to be tagged and tracked to create a suitable representative proportion of the colony behaviour including population,

range of roosts and foraging, important habitats for flight lines and commuting to enable the impacts of the site to be correctly identified and mitigated.

7.7 Trapping and tagging of other species should also continue, to include any notably rare species caught, but also individuals and species not covered in 2021 due to poor weather, underweight bats and shortage of radio tags.

8 Appendix 1 Trapping

TABLE 10 – SHOWING TRAP RESULTS FOR IFIELD – NORTHERN SURVEY AREA

Date 2020	Trap	Grid Ref	Trap and lure	Total Bats	P.pip	P.pyg	P.aur	M.bech	M.nat	M.daub	M.myst	B.barb	N.noc	E.ser
29/07/20	1	TQ 23930 37847	3BHT Autobat	**2**	1	0	1	0	0	0	0	0	0	0
29/07/20	2	TQ 24136 37995	3BHT Autobat	**8**	3	0	1	3	0	0	0	0	1	0
29/07/20	3	TQ 24351 38090	3BHT and AT100	**4**	2	0	1	0	1	0	0	0	0	0
29/07/20	4	TQ 24364 37892	3BHT AT100	**4**	1	1	0	1	0	1	0	0	0	0
29/07/20	5	TQ 24900 38178	3BHT Autobat	**6**	3	0	0	0	2	0	0	0	0	1
				24	**10**	**1**	**3**	**4**	**3**	**1**	**0**	**0**	**1**	**1**

Date 2021	Trap	Grid Ref	Trap and lure	Total Bats	P.pip	P.pyg	P.aur	M.bech	M.nat	M.daub	M.myst	B.barb	N.noc	E.ser
31/05/21	1	TQ 23926 37840	3BHT Autobat	**3**	1	1	1	0	0	0	0	0	0	0
31/05/21	2	TQ 24117 37995	3BHT Autobat	**3**	0	0	1	0	0	0	1	0	1	0
31/05/21	3	TQ 24221 38025	3BHT Autobat	**1**	0	1	0	0	0	0	0	0	0	0
31/05/21	4	TQ 24370 37899	3BHT AT100	**14**	8	4	0	0	1	0	1	0	0	0
31/05/21	5	TQ 24435 38479	3BHT Autobat	**2**	0	0	1	0	0	0	1	0	0	0
31/05/21	6	TQ 24754 38138	3BHT Autobat	**3**	0	3	0	0	0	0	0	0	0	0
14/08/21	1	TQ 23918 37838	3BHT Autobat	**1**	1	0	0	0	0	0	0	0	0	0
14/08/21	2	TQ 24150 37993	3BHT Autobat	**4**	0	1	1	1	1	0	0	0	0	0
14/08/21	3	TQ 24367 37894	3BHT AT100	**1**	0	1	0	0	0	0	0	0	0	0
14/08/21	4	TQ 24540 38043	3m MN	**0**	0	0	0	0	0	0	0	0	0	0
14/08/21	5	TQ 24866 38150	3BHT Autobat	**4**	1	2	1	0	0	0	0	0	0	0
14/08/21	6	TQ 24397 38421	3BHT Autobat	**0**	0	0	0	0	0	0	0	0	0	0
				36	**11**	**13**	**5**	**1**	**2**	**0**	**3**	**0**	**1**	**0**

TABLE 11 – SHOWING TRAP RESULTS FOR IFIELD – CENTRAL SURVEY AREA

Date 2020	Trap	Grid Ref	Trap and lure	Total Bats	P.pip	P.pyg	P.aur	M.bech	M.nat	M.daub	M.myst	B.barb	N.noc	E.ser
30/07/20	1	TQ 23855 37501	3BHT AT100	**4**	3	0	0	0	1	0	0	0	0	0
30/07/20	2	TQ 24284 37385	9m MN Autobat	**5**	1	0	1	1	1	0	0	0	1	0
30/07/20	3	TQ 24494 37850	3BHT Autobat	**7**	2	1	0	0	2	0	2	0	0	0
30/07/20	4	TQ 24546 37429	3BHT Autobat	**5**	0	2	0	0	3	0	0	0	0	0
30/07/20	5	TQ 24577 37124	3BHT AT100	**2**	0	0	0	1	0	0	0	1	0	0
				23	**6**	**3**	**1**	**2**	**7**	**0**	**2**	**1**	**1**	**0**

Date 2021	Trap	Grid Ref	Trap and lure	Total Bats	P.pip	P.pyg	P.aur	M.bech	M.nat	M.daub	M.myst	B.barb	N.noc	E.ser
01/06/21	1	TQ 24394 37856	3BHT AT100	**1**	0	0	1	0	0	0	0	0	0	0
01/06/21	3	TQ 23847 37518	3BHT Autobat	**5**	1	2	1	0	1	0	0	0	0	0
01/06/21	4	TQ 24281 37400	12m MN Autobat	**10**	3	4	3	0	0	0	0	0	0	0
01/06/21	5	TQ 24546 37429	3BHT Autobat	**2**	0	1	1	0	0	0	0	0	0	0
01/06/21	6	TQ 24577 37124	3BHT AT100	**2**	0	1	0	0	0	0	1	0	0	0
03/08/21	1	TQ 23847 37518	3BHT Autobat	**1**	1	0	0	0	0	0	0	0	0	0
03/08/21	2	TQ 24289 37400	6m MN no lure	**0**	0	0	0	0	0	0	0	0	0	0
03/08/21	4	TQ 24394 37856	3BHT Autobat	**3**	1	1	0	0	0	0	1	0	0	0
03/08/21	5	TQ 24402 37932	3BHT Autobat	**4**	0	1	2	0	1	0	0	0	0	0
03/08/21	6	TQ 24546 37429	3BHT Autobat	**1**	0	0	0	0	0	0	1	0	0	0
03/08/21	7	TQ 24577 37124	3BHT AT100	**1**	0	0	0	0	0	1	0	0	0	0
				30	**6**	**10**	**8**	**0**	**2**	**1**	**3**	**0**	**0**	**0**

TABLE 12 – SHOWING TRAP RESULTS FOR IFIELD – SOUTHERN SURVEY AREA

Date	Trap	Grid Ref	Trap and lure	Total Bats	P.pip	P.pyg	P.aur	M.bech	M.nat	M.daub	M.myst	B.barb	N.noc	E.ser
04/06/21	1	TQ23284 37001	3BHT Autobat	**1**	0	0	1	0	0	0	0	0	0	0
04/06/21	2	TQ23260 36617	3BHT Autobat	**4**	1	0	0	1	1	0	1	0	0	0
04/06/21	3	TQ23378 36516	3BHT Autobat	**2**	0	0	1	0	0	0	1	0	0	0
04/06/21	4	TQ23579 36401	3BHT Autobat	**4**	2	0	1	0	0	0	1	0	0	0
04/06/21	5	TQ24026 36570	3BHT Autobat	**3**	3	0	0	0	0	0	0	0	0	0
20/08/21	1	TQ 23279 37006	3BHT Autobat	**4**	2	0	1	1	0	0	0	0	0	0
20/08/21	2	TQ 23276 36619	3BHT Autobat	**2**	0	2	0	0	0	0	0	0	0	0
20/08/21	3	TQ 23168 36534	3BHT Autobat	**4**	1	1	0	1	0	0	0	0	1	0
20/08/21	4	TQ 23295 36495	3BHT Autobat	**8**	2	1	0	2	2	0	0	1	0	0
20/08/21	5	TQ 23487 36385	3BHT Autobat	**3**	0	0	0	0	1	2	0	0	0	0
20/08/21	6	TQ 23935 36453	3BHT AT100	**3**	3	0	0	0	0	0	0	0	0	0
				38	**14**	**4**	**4**	**5**	**4**	**2**	**3**	**1**	**1**	**0**

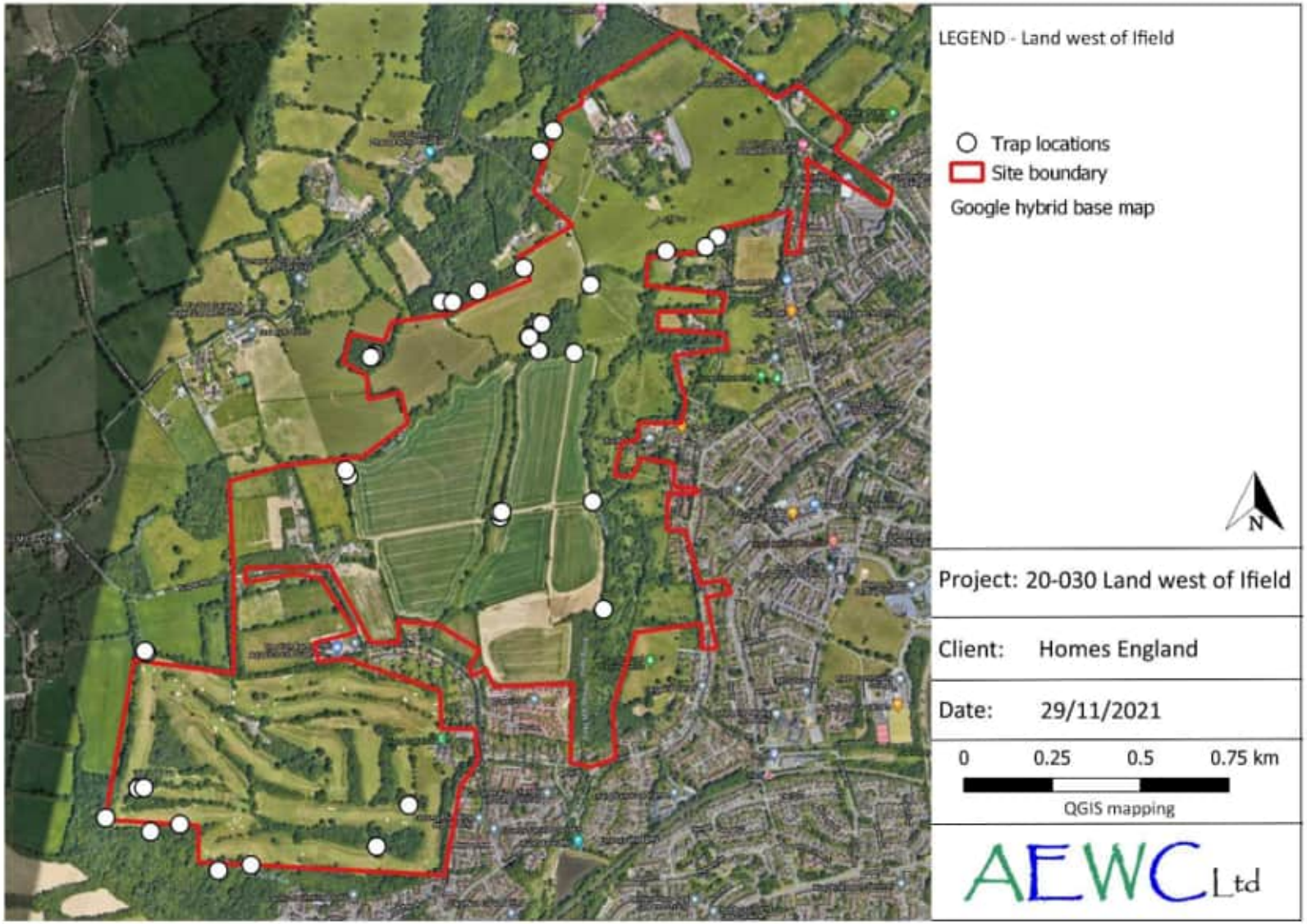

Figure 3: Showing the trap locations across the site

Figure 4: Showing the location of Bechstein's bat captures across the site

Figure 5: Showing the location of common and soprano pipistrelle bat captures across the site

Figure 6: Showing the location of brown long-eared bat captures across the site

Figure 7: Showing the location of Natterer's, Daubenton's and whiskered bat captures across the site

Figure 8: Showing the location of noctule bat captures across the site

Figure 9: Showing the location of serotine bat captures across the site

Figure 10: Showing the location of barbastelle bat captures across the site

9 Appendix 2 Radio Tracking

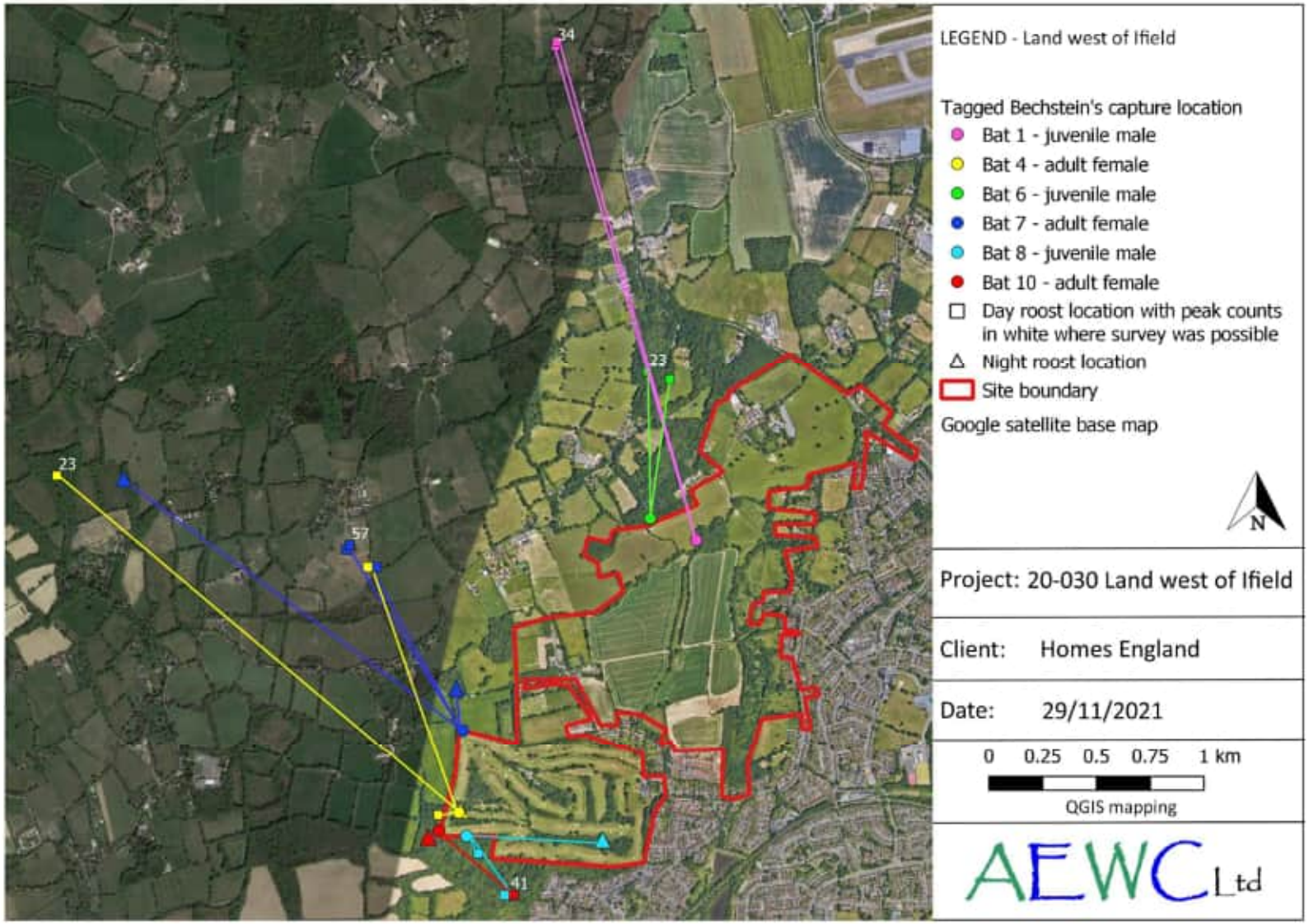

Figure 11: Showing the trap and corresponding roost locations for radio tagged Bechstein's bats

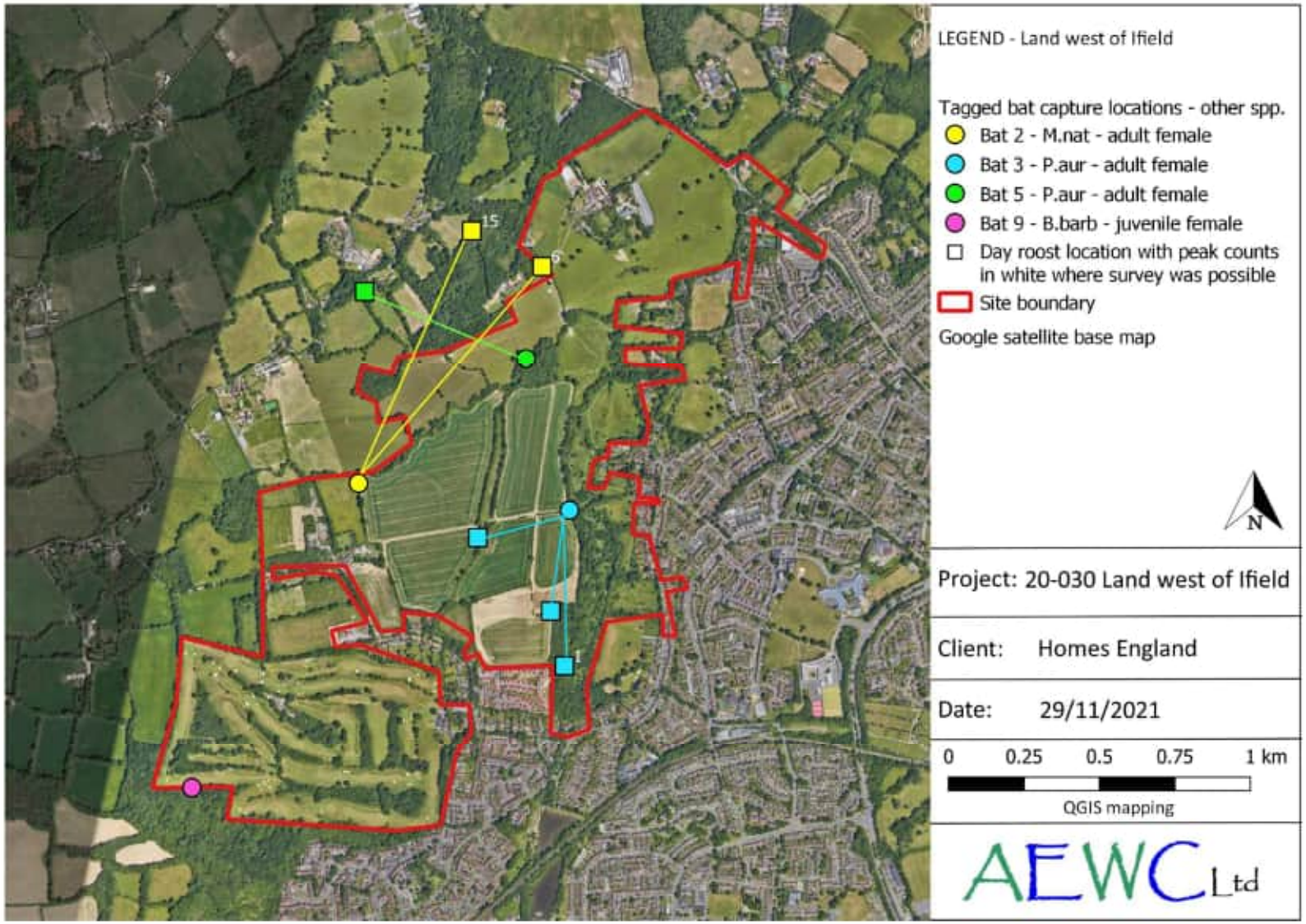

Figure 12: Showing the trap and corresponding roost locations for radio tagged bats of all other species

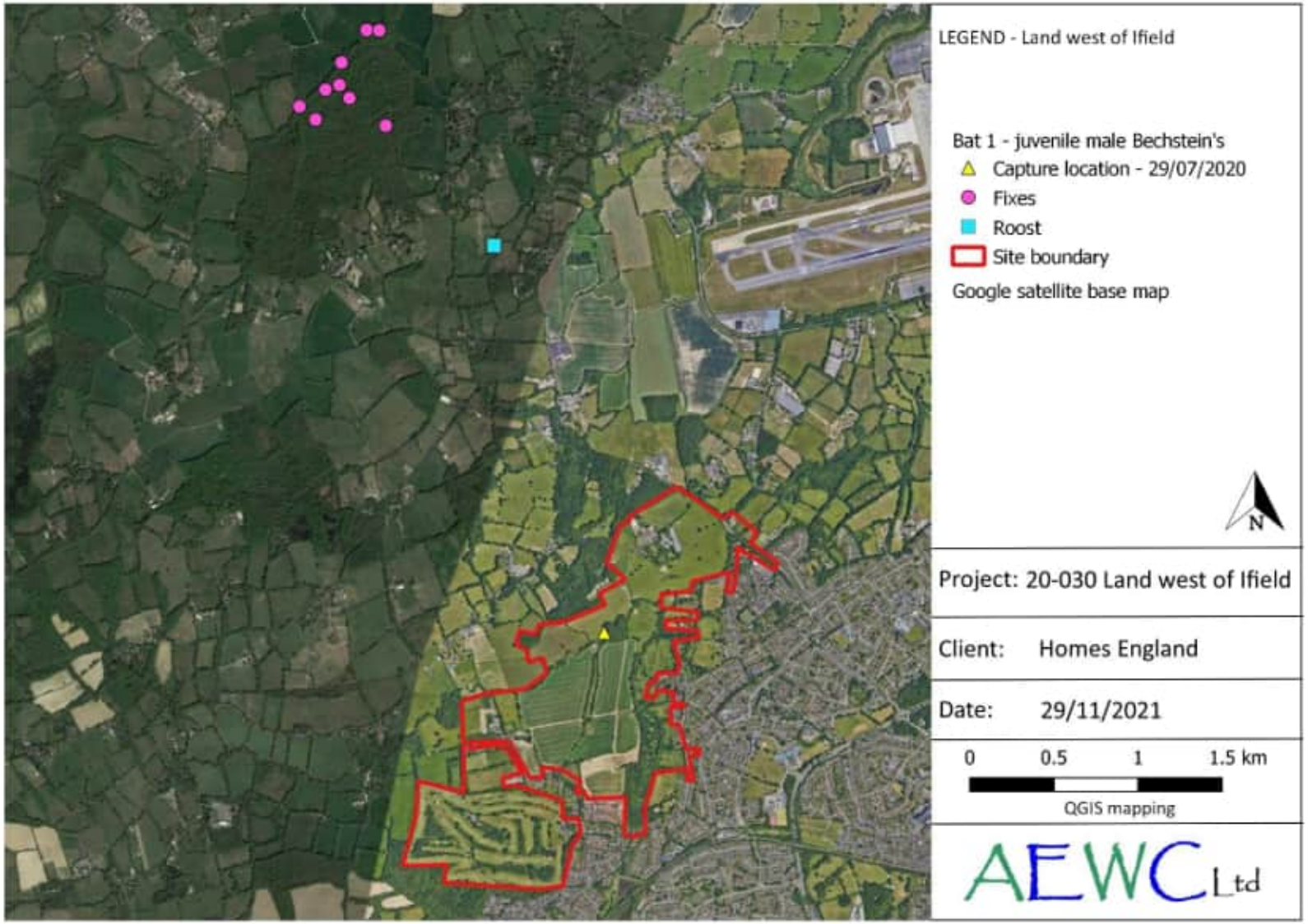

Figure 13: Showing the capture location, fixes and roost location for bat 1 tracked during 2020

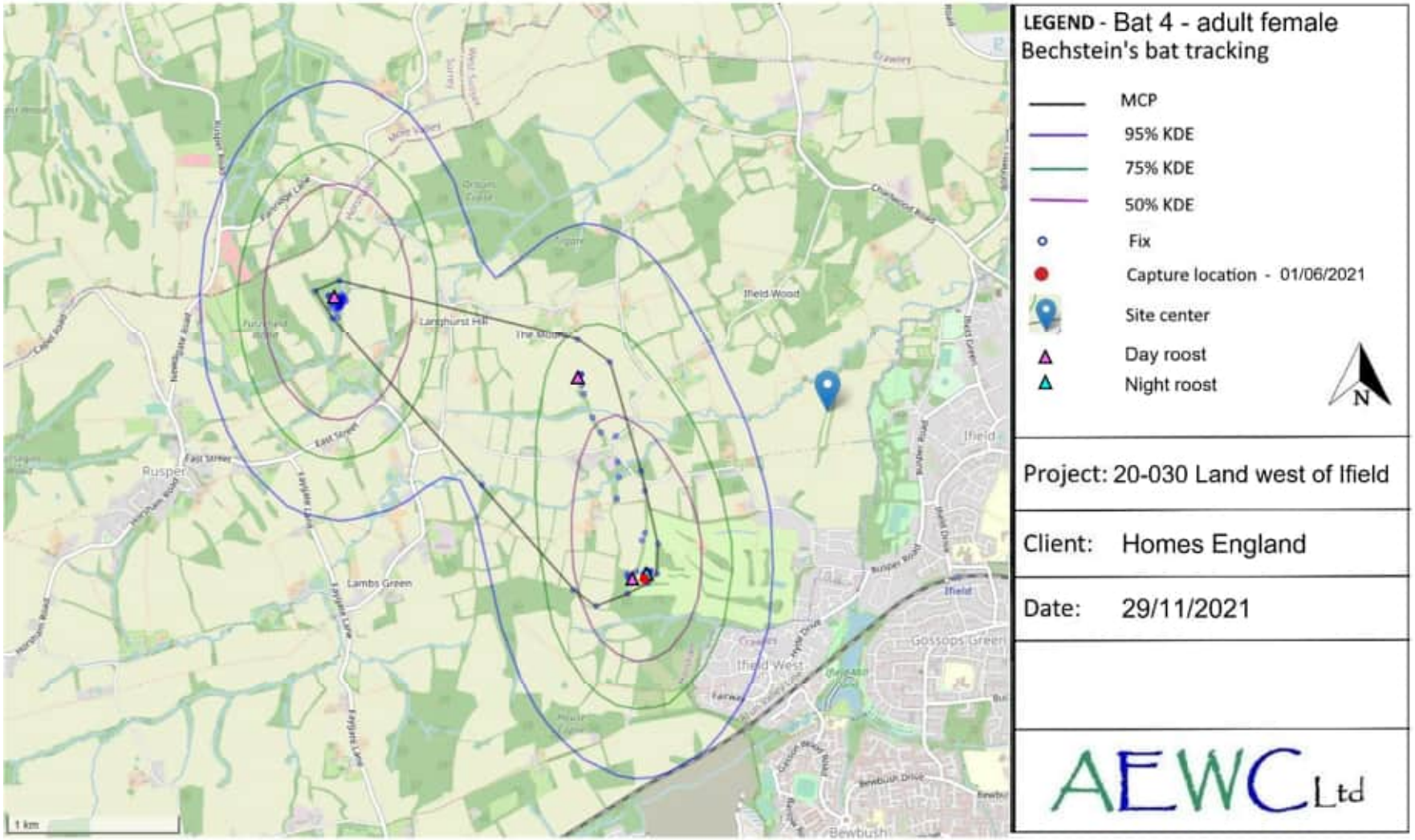

Figure 14: Showing the fixes, MCP and KDEs for bat 4

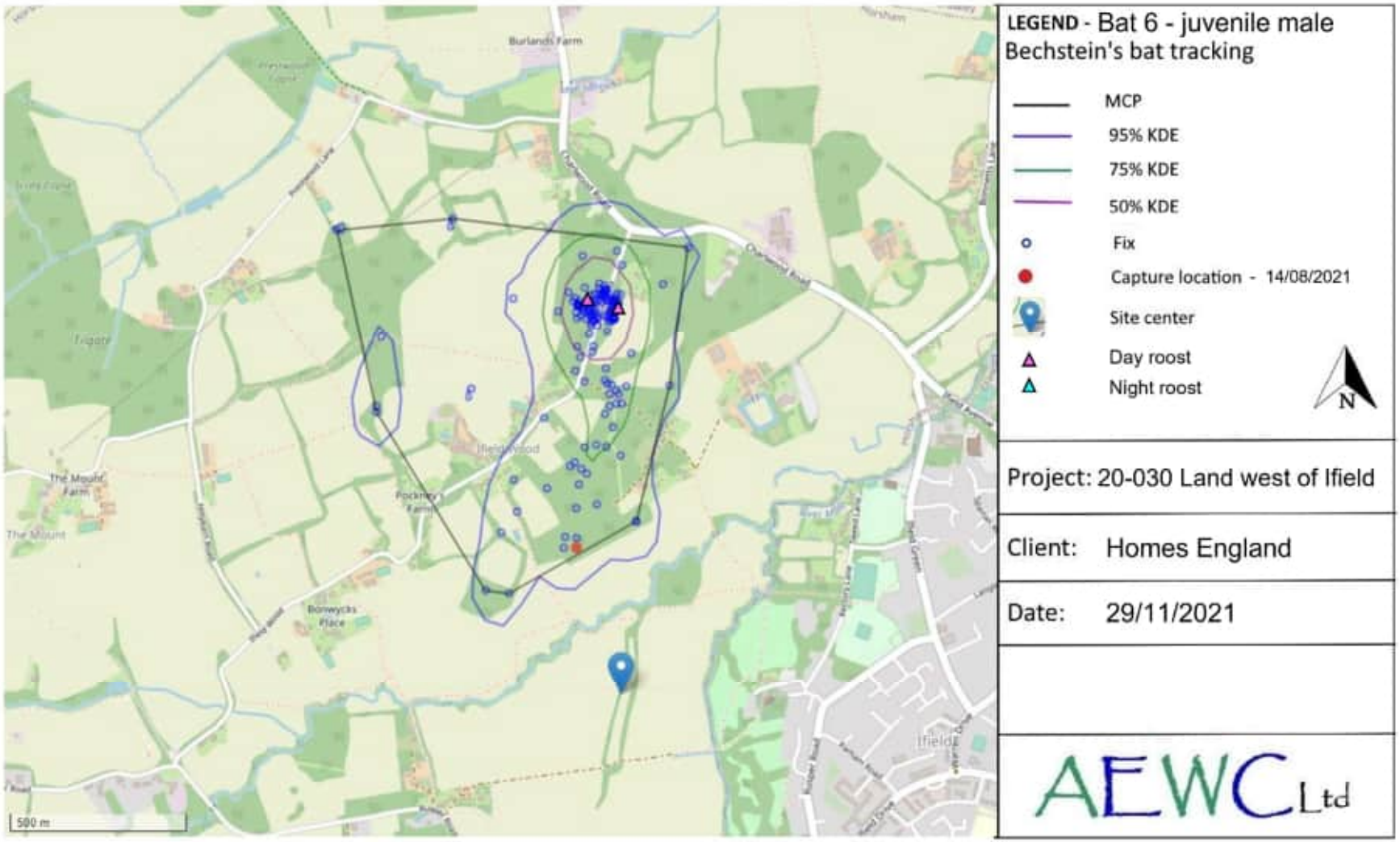

Figure 15: Showing the fixes, MCP and KDEs for bat 6

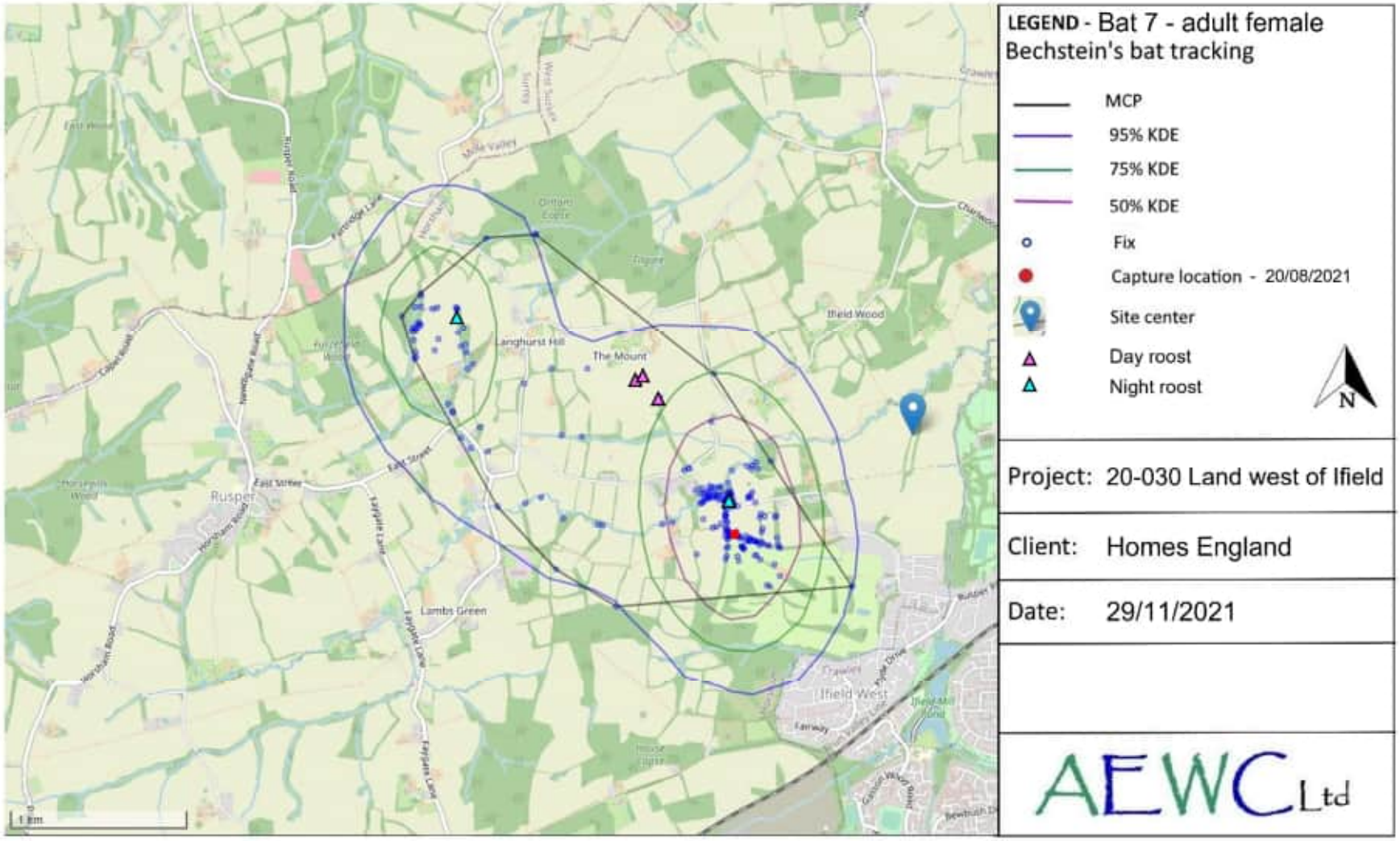

Figure 16: Showing the fixes, MCP and KDEs for bat 7

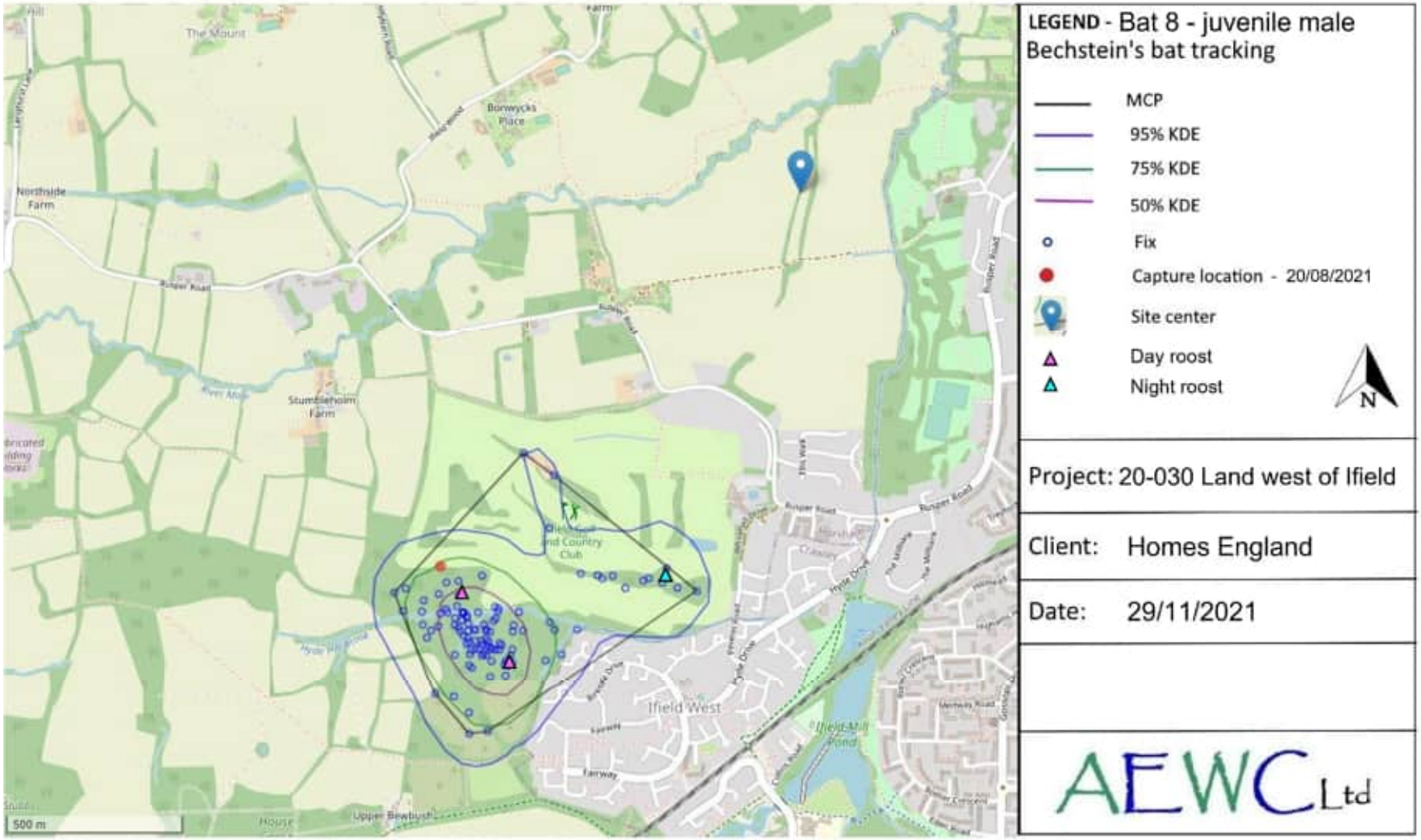

Figure 17: Showing the fixes, MCP and KDEs for bat 8

Figure 18: Showing the capture location and fixes for bat 9

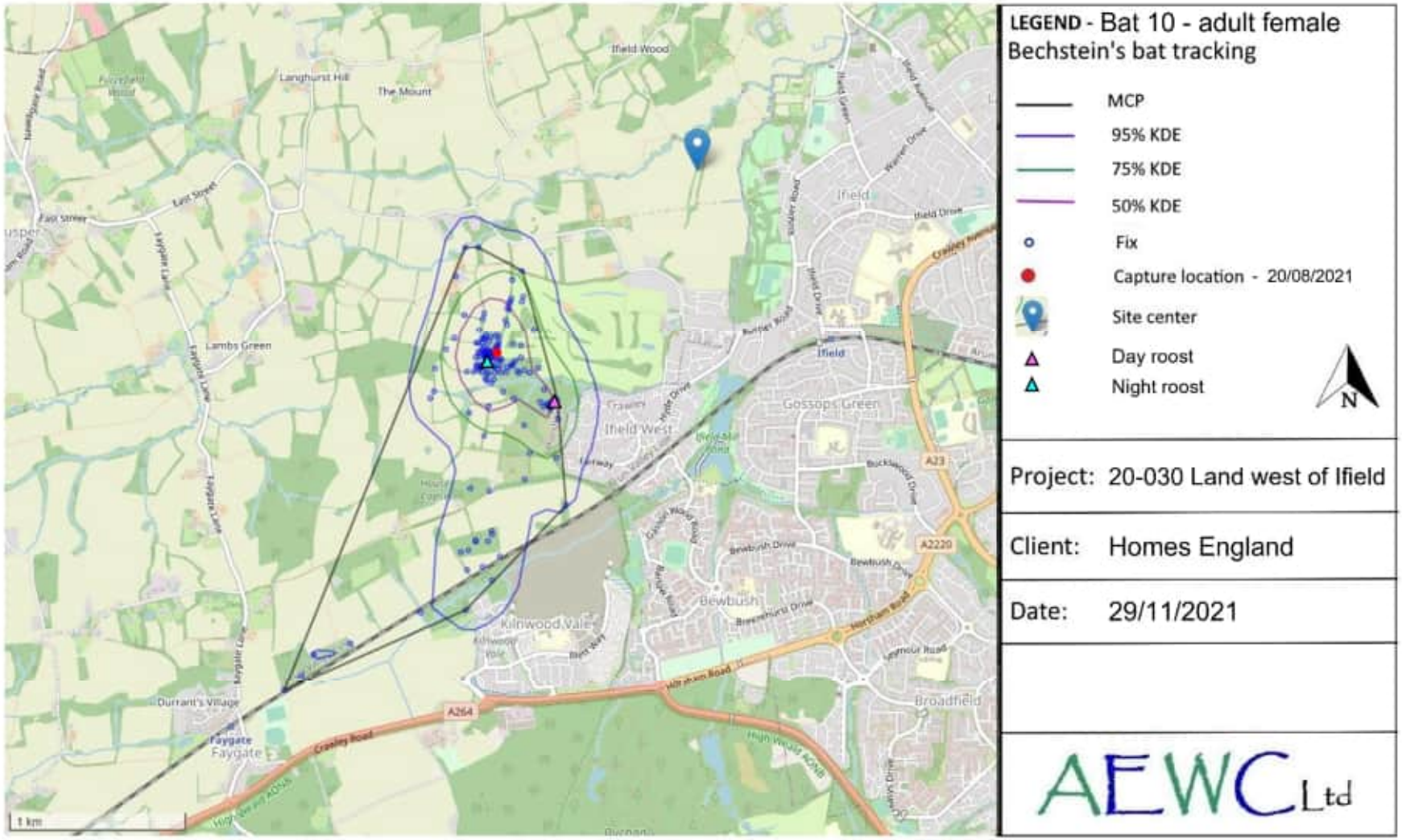

Figure 19: Showing the fixes, MCP and KDEs for bat 10

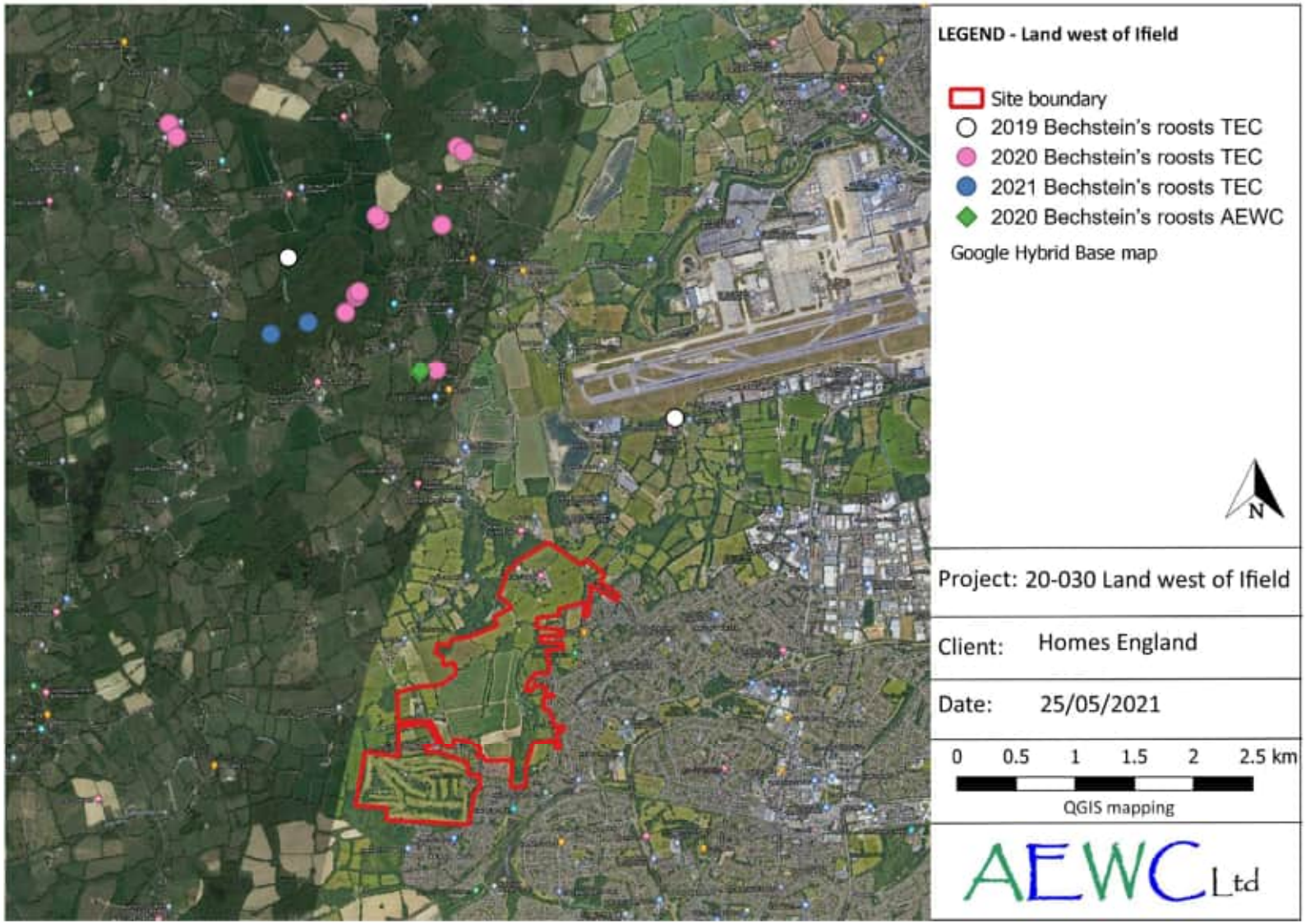

Figure 20: Showing the Bechstein's roosts identified by TEC from 2019 to 2021, and those identified by AEWC in 2020

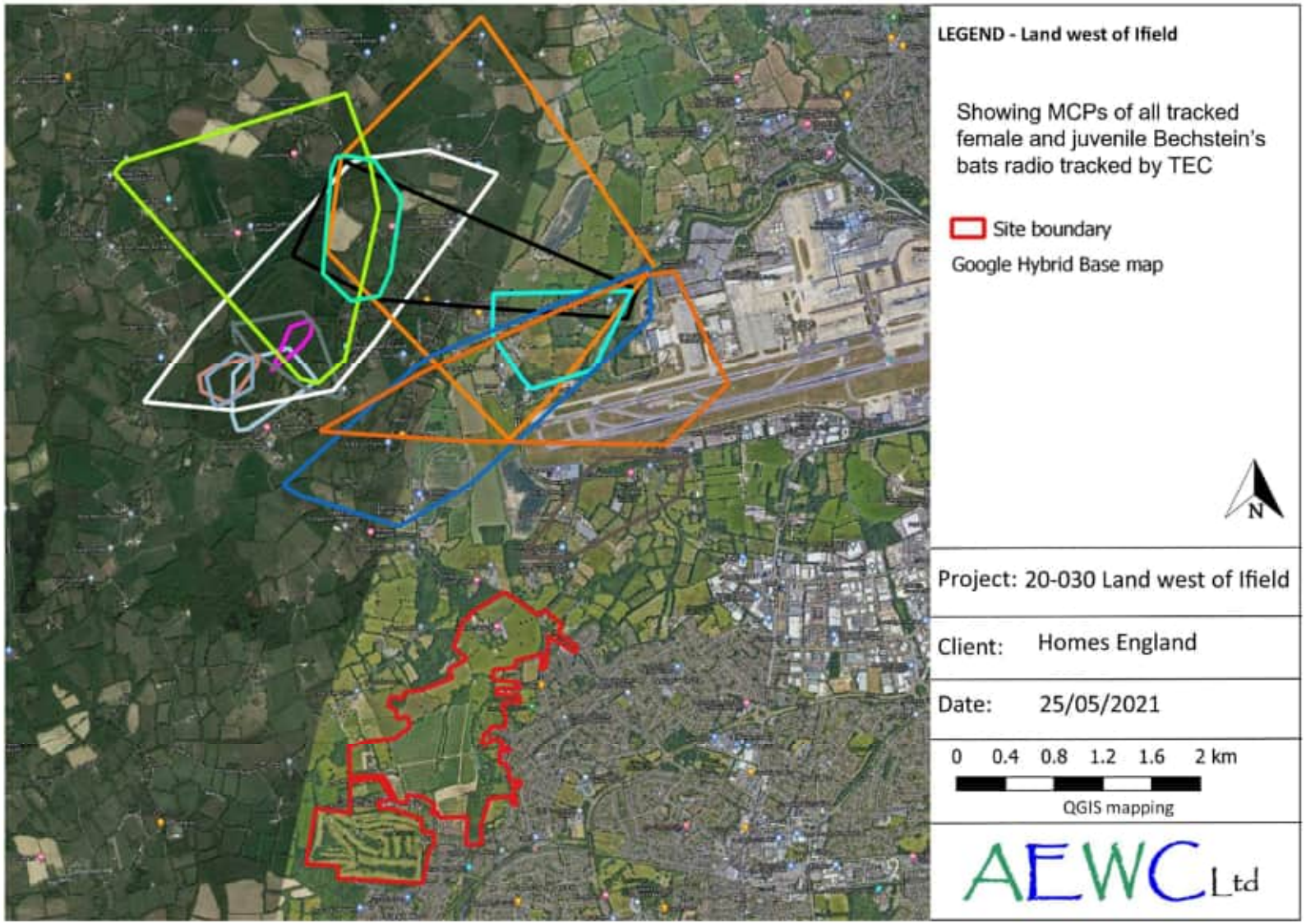

Figure 21: Showing the MCPs of all female and juvenile Bechstein's bats radio tracked by TEC from 2019 to 2020

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APPENDIX 8.28: LAND WEST OF IFIELD – NON-TECHNICAL ADVICE NOTE (BATS)

RAMBOLL

ENVIRONMENT
& HEALTH

Non-Technical Advice Note

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Project name **West of Ifield**
Project no. **1620007949**
Client **Homes England**
Version **3.0**

Prepared by **Ramboll UK Ltd**

Date **13th May 2024**

1 Introduction

Homes England (the 'Applicant') are aware of a meta-population[1] of Bechstein's bat (*Myotis bechsteinii*) occurring west of Crawley and Gatwick, which has led to the requirement for advanced techniques (trapping and radio-tracking) to be employed during bat surveys to inform the Environmental Statement (ES) for the proposed development at Land West of Ifield (the 'Site', refer to appended figure illustrating the approximate Site Boundary).

Ramboll UK Ltd (Ramboll) has subsequently been instructed by the Applicant to provide a non-technical advice note to summarise the work to date, consider potential impacts on the Bechstein bat population, and set out steps that have been taken through the preparation of the hybrid application to mitigate impacts, and identify further opportunities to consider and implement mitigation as the scheme is built out.

It is not intended that this note will supersede the future environmental reporting as part of the Environmental Impact Assessment (EIA) accompanying the future planning application, but provide a suitably detailed overview, which supports the EIA Scoping Opinion Request Report (April 2024).

This advice note covers the following:

- Summary of survey effort and data collected to date in relation to development at Land West of Ifield (note further surveys are programmed to be undertaken during 2024 – the scope of these surveys have been shared with Natural England and Horsham District Council (HDC));
- Summary survey effort and data collected to date in relation to development at Gatwick Airport (Gatwick Airport Northern Runway project, application for Development Consent Order)[2];
- How the draft emerging masterplan for Land West of Ifield has reacted to survey findings and proposed bat mitigation;
- Opportunities to further consider potential impacts and mitigate these as part of potential future reserved matters applications and at the construction stage; and
- Discussion in relation to points raised by local experts and HDC ecology officers.

The following surveys have been used to inform the detail and conclusions provided within this advice note:

[1] Meta-population = landscape level population with individual populations that do not habitually share roost sites or foraging grounds but may interact for the purposes of breeding and ensuring genetic variety is maintained.
[2] Gatwick Airport Northern Runway Project – Environmental Statement (Book 5) (2023) Appendix 9.6.3 Bat Trapping and Radio Tracking Surveys

- Bat Surveys (including Radio Tracking Surveys) undertaken at the Site between 2018 and 2022. The full data from these surveys will be included in the ES; and
- Gatwick Airport Northern Runway Project: Environmental Statement (2023) – Appendix 9.6.3: Bat Trapping and Radio Tracking Surveys.

2 Summary of Survey Effort to Date

Land West of Ifield

Arcadis originally undertook a series of bat transect and static surveys at the Site, from May to October 2018.

Internal and external inspections of existing buildings, Ground Level Tree Assessments (GLTAs), and tree climbing / endoscope surveys of trees with potential for use by bats have been carried out by Ramboll between 2020 and 2023.

Bat emergence / re-entry surveys of buildings and trees were undertaken by Ramboll between June and October 2022.

Bat activity transect surveys and automated detector surveys were conducted by Ramboll between May and October 2022.

Bat trapping and radiotracking surveys were undertaken in 2020 / 2021 by Animal Ecology and Wildlife Consultants (AEWC) Ltd, and Davidson-Watts Ecology (DWE) Ltd in 2022, on behalf of Ramboll.

A total of 151 bats of 10 species were captured during trapping surveys in 2020 / 2021. One individual Bechstein's bat (*Myotis bechsteini*) bat was subsequently radio-tracked in 2020, with five Bechstein's bats, two brown long-eared bats (*Plecotus auritus*), one Natterer's (*Myotis nattereri*) and one barbastelle (*Barbastella barbastellus*) bat radio-tracked in 2021.

Three radiotracking survey sessions were undertaken 2022, during which 13 bats were tracked, comprising seven Bechstein's, two Natterer's and three brown long-eared bats.

Gatwick Airport

A study undertaken by the University of Sussex trapped bats at Glover's Wood to the west of the airport, which launched the Bat Conservation Trust (BCT) Bechstein's Bat Project in 2008. The Mole Valley Bat Project was subsequently established in 2012 to carry on the work of the 2008 and project, and a five-year monitoring programme of bat boxes was undertaken at the airport by Surrey Bat Group, between 2012 and 2017.

Trapping and radio-tracking surveys were conducted by RPS (reported within the Gatwick Airport Northern Runway Project ES) in 2019, to inform the development of potential masterplan scenarios.

Subsequent trapping, radio-tracking, and emergence surveys at tree roosts, was conducted by The Ecology Consultancy in 2020 / 2021 (reported within the Gatwick Airport Northern Runway Project ES), to inform a proposal to make best use of the airport's existing runways and infrastructure.

Additional radio-tracking surveys are programmed to be undertaken during 2024.

3 Summary of Existing Bat Survey Data

West of Ifield

Building and Tree Surveys

During surveys conducted in 2018 / 2019, 18 roost locations were confirmed in 13 buildings within and adjacent to the Site, comprising predominantly common pipistrelle (*Pipistrellus pipistrellus*) and soprano pipistrelle day (*Pipistrellus pygmaeus*) roosts, with one exception of a brown long-eared bat maternity roost at an attic space above the single-storey porch extension of a building within a collection of ancillary buildings north of the Site within an area that is not within the red line boundary (and will not be demolished as part of the proposals), but is surrounded by the Site (and may therefore be subject to indirect impacts).

During building inspections (including assessment of hibernation potential) in 2020, hundreds of scattered droppings were recorded at the first floor conversion at the same off-Site building previously identified as supporting a brown long-eared bat maternity roost, although the internal area was well-lit and consistently subject to human disturbance, making it less suitable for roosting bats.

In total, six buildings were identified as having bat roosting potential and were subject to subsequent emergence /re-entry surveys. Buildings with hibernation potential provided roosting suitability for crevice-dwelling species or long-eared bats (known to remain in small numbers in roosts year-round) only, with no cellars or basement-style hibernation potential recorded.

During update GLTAs throughout the Site in 2022, six trees were classified as having bat roosting potential.

During updated emergence / re-entry surveys conducted in 2022, several common pipistrelle day roosts were recorded at eight off-Site buildings adjacent to the northern section of the Site, and at one tree on-Site within the north of the golf course.

Site visits in 2023 recorded a brown long-eared bat roosting in a mortise and tenon joint within an off-Site barn adjacent to the Site on consecutive surveys, during the transitional / early spring activity period. On the second of these building inspections, tens of scattered droppings (likely brown long-eared and common pipistrelle) were recorded at the attic space above the single-storey porch extension at the same off-Site building previously identified as a brown long-eared maternity roost. An adult common pipistrelle (deceased) was also recorded at the first floor conversion above the warehouse at this off-Site building.

In summary, emergence / re-entry surveys since 2018 have consistently recorded several day roosts of common and soprano pipistrelles at buildings and trees within and adjacent to the Site (although not in the numbers or exhibiting behaviour indicative of maternity roosts). In addition, a small maternity roost of brown long-eared bats has been recorded using at an attic space of an off-Site building adjacent to the northern section of the Site, with an individual brown long-eared bat using roosting features within a barn in the same complex of ancillary buildings (outside but adjacent to the Site), during the spring / transitional period (potentially part of the same maternity colony). As anticipated, given the species exclusive preference for tree roosting, no Bechstein's bats were recorded roosting at buildings during any survey season.

See "Radio Tracking and Trapping Surveys" results for Bechstein's roost results recorded using advanced survey techniques.

Activity Surveys

Surveys in 2018 / 2019 recorded "medium to high" bat activity levels throughout the Site, when compared to similar sites in the local context.

The areas of highest activity comprised hedgerow corridors, ditches, watercourse (including Ifield Brook and the River Mole corridor), areas of woodland at the north (Ifield Wood), centre and south-east of the Site, and around the farm buildings adjacent to the northern section of the Site, with activity around buildings comprising almost exclusively common bat species. There was notably lower bat activity at intensively farmed areas and isolated hedgerows within the Site. The majority of activity recorded comprised common and soprano pipistrelles, with lower levels of myotis (*Myotis* sp.) and "big bats", comprising noctule (*Nyctalus noctula*), Leisler's (*Nyctalus leisleri*) and serotines *Eptesicus serotinus*), and only two barbastelle passes recorded.

The highest proportion of "rarer" bats (as categorised by Wray *et al.* 2010[3]), was recorded at the south of the Site, around the golf course.

Activity surveys conducted in 2022 confirmed that bat activity throughout the Site continued to comprise predominantly common pipistrelles, with fewer brown long-eared bats, myotis, noctules and soprano pipistrelles recorded. Very occasional Nathusius' pipistrelle (*Pipistrellus nathusii*), serotine, grey long-eared bat (*Plecotus austriacus*) and Leisler's bat were also recorded during these surveys. There was no significant spatial variation in activity across transect routes, although the highest overall activity recorded during static detector surveys was recorded at the north-west of the Site (within close proximity to Ifield Wood), the western edge of the Site (adjacent to The Grove), around the golf course and at the very south end of the Site (adjacent to ancient woodland at Hyde Hill Wood).

Activity was highest during the summer months, although there were some peaks in pipistrelle activity at specific static locations during the autumn period. Brown long-eared bats were also recorded swarming around off-Site buildings to the north of the Site during activity surveys.

Static detector recordings of barbastelles indicate infrequent activity at hedgerows and tree canopies at the River Mole corridor, the western boundary of the Site adjacent to The Grove, and hedgerows between two agricultural fields in the west of the Site and south of the golf course. Similar results were recorded for grey long-eared bats, which were also recorded in low numbers of passes at the green corridor running north-south at the centre of the Site.

Radio-Tracking and Trapping Surveys

During radio-tracking and trapping surveys in 2020 / 2021, maternity colonies of brown long-eared bats and Natterer's bats (categorised as "common" and "rarer" species respectively[4]) were recorded directly adjacent to the Site, with suitable habitat within the Site considered likely to comprise part, but not all, of these colonies' Core Sustenance Zones (CSZ).

A single barbastelle day roost was also recorded during the 2020 / 2021 survey season, at the north-east edge of Hyde Hill Wood on the boundary with the golf course. Bechstein's bats were recorded throughout the Site, with a high proportion of the Bechstein's caught during trapping exercises comprising females and juvenile bats. At least one individual recorded at the Site was confirmed (via subsequent radio-tracking) to be part of a maternity colony previously recorded to the north of the Site (with the maternity roost location off-Site), during radio-tracking and trapping surveys to inform various planning applications

[3] Wray S, Wells D, Long E, Mitchell-Jones T, 2010. Valuing Bats in Ecological Impact Assessment, CIEEM In-Practice. 23-25.
[4] Wray *et al* (2010) Valuing Bats in Ecological Impact Assessment. In Practice, CIEEM.

for Gatwick Airport.

The surveys in 2020 / 2021 confirmed the presence of a second "southern" population[5] of Bechstein's bat, with nine roosts recorded and comprising at least 98 individuals. All day roosts recorded were located off-Site, with only two night roosts recorded at trees within the Site (at the golf course), although three of these day roosts (including one roost with a count of 41 individuals during an emergence survey) were recorded within the woodland directly to the south of Site (Hyde Hill Wood).

Surveys in 2022 support the previous findings of radio-tracking and trapping surveys at the Site, although these update surveys did not record Bechstein's using the centre of the Site. This is considered likely to be as a result of low survey frequency in combination with low numbers of individuals captured, rather than complete absence of this species from suitable habitat at the centre of the Site. Trapping confirmed breeding Bechstein's continuing to use the Site, although all maternity roost trees were again located off-Site. Only one day roost (used by a single individual) was recorded within the Site itself, at a patch of woodland in the centre of the Site.

Radio-tracking surveys between 2020 and 2023 concluded that the areas of importance for the local population of Bechstein's bats comprise Hyde Hill Wood (directly adjacent to the south of the Site), the golf course within the Site itself and the areas adjacent to and within Ifield Wood (to the north-west of the Site). Radio-tracking survey results demonstrate that the majority of the core areas for foraging are outside of the Site, focusing on extensive woodland habitat adjacent to the Site (where the maternity roost trees are also located). Although non-breeding individuals are likely to use suitable habitat within the Site (such as tree lines and copses), these are likely to be of less importance to the local breeding population than surrounding woodland habitats and unlikely to comprise significant portions of the populations' CSZ, with the Site likely to be at the fringes of the local populations' home ranges.

Gatwick Airport

The first Bechstein's bat to be recorded within close proximity of Gatwick Airport was trapped at Glover's Wood in 2005, with the first Bechstein's bat trapped at Brockley Wood (directly adjacent to the airport) in 2014.

During the five year monitoring programme of bat boxes undertaken by Surrey Bat Group from 2012 to 2017, Bechstein's, Natterer's, soprano pipistrelles and brown long-eared bats were recorded using boxes.

A trapping and radio-tracking project conducted in 2014 recorded Bechstein's bat roosts within the Gatwick project area (although the exact location is confidential) at several dead ash (*Fraxinus excelsior*) trees.

During surveys in 2019, a total of 154 bats were trapped including Bechstein's, Brandt's (*Myotis brandtii*), Daubenton's (*Myotis daubentonii*), Natterer's, whiskered (*Myotis mystacinus*), brown long-eared, common pipistrelle, soprano pipistrelle and noctule. No breeding female Bechstein's were captured, although juveniles of both sexes were captured, indicating a colony of breeding females in the wider landscape.

Radio-tracking of 20 bats in 2019 (including Bechstein's, Brandt's, Daubenton's, Natterer's, whiskered and brown long-eared) identified 19 roosts, including seven Bechstein's roosts. Emergence surveys at four of these roosts did not record particularly high numbers (counts between one and six individuals), indicating predominantly day roosts and the occasional small maternity / satellite roosts.

During surveys in 2020 / 2021 a total of 98 bats were trapped, including barbastelle, Bechstein's, Daubenton's, whiskered / Brandt's, Natterer's, noctule, brown long-eared, common pipistrelle and

[5] Population = localised collection of individuals that share roost sites and foraging grounds, with a high level of genetic similarity due to interbreeding.

soprano pipistrelle.

Radio-tracking of 14 Bechstein's bats, including breeding females, adult males and both juvenile males and females, identified 17 Bechstein's roosts. Of these, four were confirmed as maternity roosts, with an additional five considered likely to be maternity roosts. Radio-tracking of barbastelles confirmed two roosts (characterisation unknown although adult males only recorded within the Gatwick project area).

Surveys results indicate that several areas of surrounding woodland are of most significance to the Bechstein's population recorded during surveys in relation to the Gatwick project, including Glover's Wood, Mountnoddy Wood, and Greening's Wood to the west, Edolph's Copse to the north-west, to the west of Ifield Road, Brockley Wood directly adjacent to the north of the airport, the River Mole corridor to the north of the airport, Riverside Garden Park to the east, north of Charlwood Road to the south of the airport, and Horleyland Wood to the south-east. Movement data indicates that the majority of core foraging areas for these colonies are at areas of substantial woodland surrounding the airport, with the exception of Riverside Park and a small block of woodland to the north of Charlwood Road and robust hedgerow networks to the west of Ifield Road.

Several barbastelle radio-tracking fixes were recorded to the south of Land West of Ifield (within Hyde Hill wood and further south) during surveys undertaken in relation to the Gatwick project. No Bechstein's trapped during surveys in relation to the Gatwick project were recorded using Land West of Ifield or areas to the south (i.e., no indication that these populations forage within, or commute through, Land West of Ifield).

Summary of Combined Survey Results (Land West of Ifield and Gatwick Airport)

Surveys in relation to Land West of Ifield indicate that the off-Site Hyde Hill Wood and the golf course area within the south of Land West of Ifield are of importance to the Bechstein's population recorded during surveys in relation to Land West of Ifield, with maternity roosts recorded at Hyde Hill Wood (off-Site to the south) and Ifield Wood (off-Site to the north-west). Movement data indicates that the majority of core foraging areas for these colonies is outside of the Land West of Ifield, with the exception of tracked bats using the scrub / grassland complex within the south-east corner of the golf course, and areas adjacent to Ifield Wood within the north-west of the Site. Movement of an individual male between the Hyde Hill Wood to the south, and Ifield Wood to the north-west, demonstrates that these two colonies are linked and can be considered two sub-populations[6]. It is considered likely that individuals from the Hyde Hill / Ifield Wood colonies will use suitable habitat within Land West of Ifield (such as tree lines and copses), although these are likely to be of lower importance to the local population than surrounding woodland habitats and are unlikely to comprise significant portions of the populations' CSZ.

There is limited radio-tracking data, considering the period of time over which tracking data has been gathered and the various purposes for which data has been gathered, to support the hypothesis that the population of Bechstein's surrounding Gatwick Airport is functionally linked to the population surrounding Land West of Ifield, although given the nature of this species fission-fusion[7] activity and presence of suitable landscape level commuting features in the wider landscape, it must be considered possible that the two populations interact, albeit to a limited extent. The only data overlap between the two project areas comprised a single juvenile male, trapped at Land West of Ifield and subsequently radio-tracked to a roost in the hedgerow network to the west of Ifield Road (west of Gatwick Airport). This individual was then recorded primarily foraging at Glover's Wood to the northwest of the airport.

[6] Sub-population = Members of one population that favour specific roosting sites and foraging grounds but readily interact.

[7] Fission-fusion = Change in size and composition of social groups, with members splitting from the group (fission) and joining other groups (fusion).

Overall, the data demonstrates that whilst the two populations of Bechstein's may be linked by occasional individuals (specifically juvenile males dispersing throughout the landscape), core foraging areas are centred around maternity roosts (and likely maternity roosts) in characteristic optimal habitat (closed canopy woodland and robust hedgerow and river networks with mature trees). The Bechstein's populations do not appear to spend substantial time foraging in sub-optimal habitat within the Site, but may commute through this habitat whilst moving between roost locations (expected as part of the fission-fusion nature of this species roosting tendencies).

Maintaining connectivity around the western edge of Land West of Ifield to retain connectivity between colonies is therefore considered to be a key consideration in relation to maintaining the viability of the overall meta-population, although the majority of the area within Land West of Ifield itself is not being used as core foraging habitat.

Land West of Ifield is not considered to be of importance for barbastelles, with low encounters of this species throughout trapping surveys, and no roosts within the Site recorded, although a single day roost was recorded at the boundary of Hyde Hill Wood and the golf course during the 2020 / 2021 survey season. Movement data indicates that individuals from the population to the west of Gatwick may occasionally travel south to off-Site Hyde Hill Wood and beyond.

Suitable habitat within Land West of Ifield is likely to comprise core foraging habitat for a maternity colony of brown long-eared bats, considered likely to be roosting at an off-Site dwelling adjacent to Ifield Wood, and with additional roosts recorded at the boundary with Hyde Hill Wood to the south of the Site.

Similarly, a maternity colony of Natterer's bats recorded at Ifield Wood are likely to use suitable habitat within the Site (specifically adjacent to Ifield Wood) as core foraging habitat.

4 Masterplan and Bat Mitigation

The emerging Land West of Ifield Masterplan design has been developed through an iterative process, using the mitigation hierarchy with respect to ecological receptors (including Bechstein's bats), and incorporating embedded mitigation wherever possible. Due to the presence of Bechstein's, the developing design of the Masterplan has drawn on best practice and accepted mitigation practices used to consider the presence of the species elsewhere, such as in Wiltshire[8] and Hampshire[9].

At the very early stages of master planning, Ramboll provided input to support a 'landscape-led' approach. Whereby key ecological corridors were identified to be retained and protected early on, as part of the emerging masterplan.

The emerging masterplan is still being refined following consultation with Natural England and in response to the latest assessment data. Finalised parameter plans will be included in the ES.

The following key design concepts have been incorporated into the on-going development of the Land West of Ifield Masterplan, which are to be embedded into the draft parameter plans and have been incorporated at an early stage considering general ecological enhancement, however are mentioned here as they are relevant to bats (these elements are highlighted in the appended figures):

- Provision of strategic open space to alleviate recreational pressure on designated sites and habitats of ecological value, with more vulnerable areas protected from recreational pressure in the completed

[8] Johns Associates (2020) Trowbridge Bat Mitigation Strategy Supplementary Planning Document [online] www.wiltshire.gov.uk/media/3928/Trowbridge-Bat-Mitigation-Strategy-SPD/pdf/whsap-trowbridge-bat-mitigation-strategy.pdf?m=1591742224963 [Jan 2024]

[9] Davidson-Watts Ecology (2021) Long Copse Lane Ecological Impact Assessment [Planning Ref: App/21/00893]

development stage.

- Landscape-led design to ensure ecologically valuable habitats are retained, protected, enhanced, and created as a component of the Land West of Ifield development (e.g., woodlands, hedgerows, ecological corridors, and aquatic features), with as much of the mature hedgerow and scrub / woodland, and associated grassy margins (of importance for terrestrial invertebrates, and subsequently bats) retained as possible.
- Retention and enhancement of key ecological corridors through the Site to retain and improve connectivity for wildlife, including commuting routes for bats. These have been designed with north-south and east-west corridors, to connect to valuable habitats adjacent to the study area such as Local Wildlife Sites (LWSs) and ancient woodlands.
- General ecological buffers of between 25m to 30m (width) around areas of sensitive habitat, such as river corridors, woodlands, hedgerows, and water bodies, including at the south-east of the Site (buffering Ifield Brook Wood and Meadows LWS), and a 35 m general ecological buffer at the south of the Site (buffering ancient woodland at Hyde Hill Wood LWS).
- Narrowing of roads at key bat crossing points in residential areas to maintain fly routes (subject to detailed design).

Additional mitigation requirements have also been identified to reduce impacts to local bat populations, comprising:

- Control of impacts during the construction phase through industry good practice measures within an Outline Construction Environmental Management Plan (OCEMP) to limit noise / visual disturbance (including lighting), and habitat degradation. The OCEMP will be submitted with the hybrid planning application. Detailed Construction Environmental Management Plans (DCEMP) will be submitted for each phase of the development (to be secured via planning conditions for each phase of the development).
- Creation of new ecologically rich habitat at the north of the Site adjacent to Ifield Wood, via enhancement of the existing modified grassland to approximately 36 hectares (ha) of Priority Habitat grassland, with restricted access areas managed for wildlife. This mitigation will be detailed in the Landscape and Ecological Management Plan LEMP and Biodiversity Net Gain (BNG) Habitat Management and Monitoring Plan (HMMP) (to be secured via planning conditions for each phase of the development).
- Provision of ecological beneficial green infrastructure throughout the Land West of Ifield development, include Sustainable Drainage Systems (SuDs), urban trees, biodiverse roofs, living walls, new native species-hedgerows and rain gardens, and replacement ponds, maximised for their biodiversity value via design, location, and connectivity. These details will be included in the Design Code for the development and detailed in the LEMP and HMMP (to be secured via planning conditions for each phase of the development).
- Where appropriate, artificial veteranisation of existing mid-age trees in retained habitat, and planting of new trees in open areas. Trees to be managed in this manner will be identified in the LEMP, with appropriate management measures detailed (to be secured via planning conditions for each phase of the development).
- Appropriate management of new habitats, undertaken in accordance with the LEMP and HMMP spanning a 30-year period, (to be secured via planning conditions for each phase of the development).

Sensitive lighting design and operation following guidance and principles provided in the BCT and Institution of Lighting Professionals (ILP) Guidance Note 08/23 'Bats and artificial lighting at night', with lux limits in retained habitat buffers based on the best available science and practice for the key species affected (to be secured via planning conditions for each phase of the development). A lighting impact assessment will be submitted with the hybrid planning application.

- Maintenance of the integrity of the Site's existing wetland habitats (including adjacent vegetation) wherever possible, including the Ifield Brook and River Mole and ponds occurring within Ifield Golf Course and elsewhere on Site. These details will be included in the Design Code for the development and detailed in the LEMP (to be secured via planning conditions for each phase of the development).
- Woodland and / or hedgerow planting to be planted at the hard development edge (outside of residential curtilages), to enhance the effectiveness of buffers adjacent to off-Site woodland. These details will be included in the Design Code for the development and detailed in the LEMP and HMMP (to be secured via planning conditions for each phase of the development).
- Retained and enhanced habitats at the north of the Site, within neighbourhood parks throughout the Site, and at the retained habitat buffer at the south of the Site, will be managed appropriately to encourage habitats of value for target species, specifically focusing on Bechstein's bats and their prey species (predominantly noctuid moths). These details will be included in the LEMP and HMMP (to be secured via planning conditions for each phase of the development).
- A suitable licence will need to be obtained from Natural England (NE) where felling, demolition or significant works will result in the modification or destruction of, or damage to, confirmed bat roosts, although it is considered unlikely that impacts to the only known Bechstein's roost within the Site will occur, as the block of woodland in which it is located will be retained and protected, with new habitats created around it (comprising lowland meadow and a new tree planting shelter belt to the south) and connectivity to off-Site habitat (including Ifield Wood) retained (if applicable, to be secured via statutory wildlife legislation).
- A Bat Mitigation Strategy to be developed, detailing the appropriate additional mitigation required for each phase of the Land West of Ifield development, secured through planning conditions for each phase of the development, and submitted with the European Protected Species (EPS) mitigation licence application to NE (in the event that roosts will be damaged or destroyed), including details of how the following key objectives are achieved:
    - Retention of key roosting areas, applying the roost resource approach (i.e., areas containing not only confirmed roosts but trees with bat roosting potential);
    - Retention of identified foraging and key bat commuting habitat adjacent to roosts and foraging areas;
    - Buffering of key roosting habitats, commuting habitat, and foraging areas, to ensure that noise, lighting, and other indirect activities are appropriately managed; and
    - Enhancement of retained open space habitats to maximise roosting, commuting and foraging areas for bats.
- Creation of new roosting opportunities at new buildings and retained trees throughout the Site would enhance the value of the Site for bat species currently using the foraging and commuting habitats within the Site. These details will be included in the LEMP (to be secured via planning conditions for each phase of the development).

- As a variety of species have been recorded using the Site, a variety of enhancement features will be provided, including features built into new buildings (such as ridge tiles features, integrated bat boxes or bat lofts) and features on mature retained trees (such as bat boxes and veteranisation features). A variety of bat boxes, including different materials (woodcrete, wood, etc.) and designs (domed, coned, flat, etc.) will provide a variety of different roosting opportunities for different species requirements. An appropriate number / type of new roosting features will be installed throughout the Site, in the context of known roosts, and buildings / trees with bat roosting potential. These details will be included in the LEMP (to be secured via planning conditions for each phase of the development).

5 Discussion

Concern has been raised over the proposed development at Land West of Ifield due to its potential importance for the local Bechstein's bat population. However, based on the existing survey data presented within this advice note (which spans a period of 10 years) this does not particularly support the categorisation of habitats within the Site as "important" for this species. However, further surveys are proposed in order to evaluate this conclusion.

The Bat Conservation Trust (BCT) outlines that an increase in the CSZ from reported data of 1 km[10], in cases where Annex II species are involved and due to the fact that they have "very specific habitat requirements", may be required. In the absence of survey information, and taking a precautionary approach, consideration of a 3 km CSZ from all known roosts has previously been considered appropriate. This precautionary approach results in the entirety of Land West of Ifield (as well as a substantial part of the east edge of Crawley, which comprises unsuitable habitat) being required for consideration within a potential 3 km CSZ. The very specific habitat requirements of these species must be considered, however, when assessing whether habitat within the 3 km potential CSZ radius (in combination with survey data) comprises important foraging habitat for this species.

Bechstein's bats have traditionally been associated with ancient broadleaved woodlands[11], with numerous studies recording foraging under a closed canopy and more open habitats being less preferable. Use of hedgerows for flightpaths have been recorded, where they are present as part of a larger mosaic of linked broadleaved woodland blocks[12], as well as tree-lined river margins[13]. The majority of the existing data for both populations of Bechstein's (the one surrounding Gatwick Airport and the one at Land West of Ifield), appear to support this characteristic habitat usage, with suitable habitat (woodland, hedgerows, and tree-lined river margins) within Land West of Ifield considered likely to be used by this species to a limited extent, but unlikely to comprise significant portions of the populations CSZ. There is currently no evidence of use of open habitat areas within the Land West of Ifield Site by Bechstein's.

On a landscape level, it would appear that, whilst off-Site woodlands to the south, west and north-west of Land West of Ifield provide core foraging areas for breeding female Bechstein's bats, habitats within the Site itself are not of specific importance for breeding members of these colonies. The Site is unlikely to be important to the Bechstein's breeding population, however, survey results demonstrate that it may have some function to non-breeding males and juveniles, which do play a role in sustaining the meta-population as a whole.

The emerging Land West of Ifield masterplan has responded to the importance of off-Site woodlands

[10] Colins (ed.) (2023) *Bat Surveys for Professional Ecologists – Good Practice Guidelines (4th Edition).* The Bat Conservation Trust, London.

[11] Greenaway and Hill (2004) *Woodland Management Advice for Bechstein's bat and barbastelle bat.* English Nature Research Report No. 658. English Nature, Peterborough.

[12] Davidson-Watts (2014b) *Barbastelle bat surveys and tracking at Nocton Wood, Lincolnshire* [available from the author] www.dwecology.co.uk

[13] Davidson-Watts (2013) *Briddlesford Copse Bechstein's and Barbastelle Bat Project 2013-2016 YEAR 1* [available from the author] www.dwecology.co.uk

directly adjacent to the south and north-west of the Site with appropriate buffers and has identified the need to retain connectivity around the Site at its south-western edge, and through the Site at its northern end (adjacent to Ifield Wood). The emerging masterplan has also responded to the potential importance of specific habitats within the Site for non-breeding Bechstein's, by retaining, protecting and enhancing habitats within the Site where Bechstein's have specifically been recorded or, where suitable habitat (such as woodland blocks, robust hedgerows with trees, and the River Mole corridor) is present. Retention of connectivity to these habitats (where they lie within the Site interior) to the wider surrounding landscape and optimal habitats within it (such as Ifield Wood and Hyde Hill Wood) has also been key to the development of the masterplan. Figure 5 provides a visual representation of the key design concepts integrated into the emerging masterplan as a direct response to the bat survey results to date[14].

In rare cases where habitats used by Bechstein's will be lost through the delivery of the current draft of the masterplan (i.e., at the south-east corner of the golf course), the creation of new habitat at the north of the Site adjacent to Ifield Wood, and specifically designed to meet the foraging requirements of Bechstein's bats, will more than compensate for the loss of foraging habitat currently utilised by juvenile males and not considered a significant foraging resource for breeding females.

It has also been suggested by some parties that the Site may meet published selection criteria for Special Area of Conservation (SAC) designation. SAC designation (due to the presence of Annex II species) depends on the percentage of the national population present at a site, the degree of conservation of the features of the habitat which are important for the species and the restoration possibilities (determined by assessing the condition of important habitat elements and future restoration possibilities), the degree of isolation of the population present at the site in relation to the natural range of the species, and the global assessment of the value of the site for conservation of the species concerned.

Whilst it is considered highly unlikely that Land West of Ifield itself meets the criteria for SAC selection, considering survey results that indicate habitats within the Site are not important for breeding females of any of the surrounding colonies, and that the number of individuals using habitats within the Site does not comprise a significant percentage of the national population (estimated minimum of 10,300 in 2019), this has been used to guide the assessment of importance of the specific population using habitats within the Site.

The population using habitats specifically within Land West of Ifield has been categorised as of "Regional" importance, with the relevant weight subsequently given to the requirement of the emerging masterplan to respond to the key needs of populations using habitats within and adjacent to the Site (including retention, protection, and enhancement of habitats), which will in turn have beneficial effects for the wider meta-population.

6 Overall Conclusions

A significant amount of bat survey effort has been employed over the last two decades at Gatwick Airport, and now supplemented by the bat survey effort employed to inform proposals for Land West of Ifield. The current data demonstrates a very limited overlap between the Gatwick and Land West of Ifield populations, with only a single individual (juvenile male) recorded moving on only one occasions between the two project survey areas. The data also demonstrates that Land West of Ifield doesn't comprise a significant proportion of the known maternity colony CSZs, although it may provide some limited habitat for non-breeding individuals (males and juveniles). The data does not indicate that Land West of Ifield meets

[14] Landscape parameter plans are indicative only at this stage and may be subject to change.

selection criteria for SAC designation.

Mitigation outlined within the emerging masterplan, including protection of key off-Site roosting areas through buffers and retention of on-Site foraging habitat and integration into the green infrastructure of the Site, has responded to specific survey data and information known about the optimal foraging habitat types for Bechstein's bats. In addition, enhancement, and newly created habitat (specifically at the north and north-west of the Site, adjacent to known Bechstein's roosts on-Site and off-Site) has been tailored to meet the specific habitat requirements of this rare bat species. The retention of connectivity around the Site, between Hyde Hill Wood and Ifield Wood, and the wider landscape towards Gatwick to the north and Rusper to the west, and the provision of new habitats of high quality surrounding known maternity roost woodlands, is considered likely to provide benefits not only for the local population surrounding Land West of Ifield, but also for the wider meta-population.

Appendices – Figures 1 to 5