

An aerial photograph of Gatwick Airport's northern runway and taxiway. The runway is a long, straight concrete strip with white markings, including the number '26' and the letter 'L'. Several aircraft are visible on the taxiway and runway. In the foreground, a large white Airbus A380 is taxiing. To its left, a smaller white aircraft is also taxiing. Further up the runway, a red and white easyJet aircraft is visible. In the background, the airport's terminal building, control tower, and other infrastructure are visible. The surrounding area is a mix of green grass and paved surfaces.

YOUR LONDON AIRPORT  
*Gatwick*

*Our northern runway: making best use of Gatwick*

Preliminary Environmental Information Report  
Appendix 9.6.3: Bat Trapping and Radio Tracking Surveys  
September 2021

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## 1 Executive Summary

- 1.1.1 This document forms Appendix 9.6.3 of the Preliminary Environmental Information Report (PEIR) prepared on behalf of Gatwick Airport Limited (GAL). The PEIR presents the preliminary findings of the Environmental Impact Assessment (EIA) process for the proposal to make best use of Gatwick Airport's existing runways (referred to within this report as 'the Project'). The Project proposes alterations to the existing northern runway which, together with the lifting of the current restrictions on its use, would enable dual runway operations. The Project includes the development of a range of infrastructure and facilities which, with the alterations to the northern runway, would enable the airport passenger and aircraft operations to increase. Further details regarding the components of the Project can be found in Chapter 5: Project Description.
- 1.1.2 RPS were commissioned by Gatwick Airport to undertake advanced bat survey techniques in the form of bat trapping and a follow up radio-tracking survey, to inform the development of potential masterplan scenarios.
- 1.1.3 The purpose of the surveys was to determine the importance of the 'Project Area' for bat populations in relation to the wider landscape. The Project Area comprises land within the redline boundary of Gatwick Airport.
- 1.1.4 Trapping and radio-tracking surveys undertaken within the Project Area in 2019 identified the presence of a number of bat species including Annex II Bechstein's bat *Myotis bechsteinii* that utilise the project area, predominately male and juvenile bats. However, due to restrictions to access of the wider landscape in 2019, it was considered that the evaluation of the importance of the Project Area was constrained.
- 1.1.5 Trapping, and subsequent radio-tracking of target species from the woodland assemblage of bats, was undertaken across three locations within the Project Area and in five woodlands in the wider landscape over three survey periods in July 2020, September 2020 and May 2021 which were aligned with key stages of the annual bat life cycle.
- 1.1.6 A total of 98 bats from a minimum of nine species were captured over nine nights between 13<sup>th</sup> July 2020 and 7<sup>th</sup> May 2021. The species captured included barbastelle *Barbastellus barbastella* Bechstein's bat *Myotis bechsteinii*, whiskered/Brandt's/Alcathoe bat *Myotis mystacinus/brandtii/alcathoe*, brown long-eared bat

*Plecotus auritus*, common pipistrelle *Pipistrellus*, Natterer's bat *Myotis nattereri*, noctule *Nyctalus noctula*, soprano pipistrelle *Pipistrellus pygmaeus*, and whiskered bat *Myotis mystacinus*.

- 1.1.7 Breeding females of a minimum of six species were trapped during the survey. These species comprised Bechstein's bat, brown long-eared, common pipistrelle, Natterer's bat, soprano pipistrelle and whiskered/Brandt's bat and whiskered bat. No female breeding Bechstein's were captured within the Project Area, but six breeding Bechstein's were captured in the wider landscape.
- 1.1.8 Radio-transmitter tags were fitted to 13 Bechstein's bats and one barbastelle bat. As a result, 19 roosting locations were subsequently identified; three of nineteen roosts were located within the Project Area, all within Brockley Wood.
- 1.1.9 Core foraging areas for Bechstein's bats were identified in Glover's Wood, Mountnoddy Wood, Edolphs Copse, woodlands around Toogoolawah and Beam Brook, woodlands and waterbodies adjacent to Biltam Farm Nurseries, with core foraging areas within the Project Area identified at Man's Brook and the River Mole.
- 1.1.10 Bechstein's bats were also recorded foraging around Beggars Gill, Pagewood, Charlwood, woodland blocks and hedgerows north east of Charlwood, Man's Brook and adjacent arable fields to the west of the Project Area. Peripheral foraging areas within the Project Area were recorded along Man's Brook and River Mole in the north west of the Project Area
- 1.1.11 Core foraging areas for barbastelles were identified to the south east of Glovers Wood, around Russ Hill Farm and adjacent to Man's Brook to the west of Prestwood Copse. No core foraging areas were recorded within the Project Area.
- 1.1.12 Barbastelles were also recorded foraging within Faygate Forest, Prestwood Copse and adjacent watercourses, and a block of woodland and Bewbush Brook in Bewbush, west of Crawley. No peripheral foraging areas were recorded within the Project Area.
- 1.1.13 Due to the lack of breeding females recorded with the Project Area over the surveys in 2019, 2020 and 2021, it is considered that the habitats within the Project Area provide resource primarily for foraging Bechstein's and roosting resource for predominantly male Bechsteins.
- 1.1.14 The Project has the potential to result in interactions with bat roosts, home ranges and foraging areas and therefore, in the

absence of mitigation, the favourable conservation status of bats could be negatively impacted. Therefore, further assessment to inform appropriate mitigation and/or compensation measures will be required and will be reported in the ES.

## 2 Introduction

### 2.1 Overview

- 2.1.1 From 18<sup>th</sup> October 2018 to 10<sup>th</sup> January 2019 Gatwick Airport consulted on its Draft Masterplan. This consultation set out three scenarios for the airport's longer-term future which if either used separately, or in combination, could enable Gatwick to grow to meet the increasing demand for air travel.
- 2.1.2 In considering the potential masterplan scenarios where best to make use of existing airport capacity, Gatwick is now collating a range of environmental information within the airport estate and in areas adjacent to the airport.
- 2.1.3 Part of the scope of the data collection includes survey work for a range of protected/notable species and habitats, including bats. RPS contracted The Ecology Consultancy/Temple to provide specialist bat consultancy services, of which included Advanced Bat Survey Techniques for the project, including trapping and subsequent and radio-tracking of target bat species.
- 2.1.4 Surveys undertaken in 2019 identified individuals from a population of Bechstein's bats that utilise the Project Area. Due to restrictions to access within the wider landscape surrounding the Project Area during the surveys undertaken in 2019, it was considered likely that the evaluation of the importance of the site for bats was constrained by the lack of knowledge of the status of the Bechstein's bat population in the landscape surrounding the Project Area. Therefore, it was recommended that a landscape level population assessment of Bechstein's bats was undertaken in and adjacent to the Project Area to inform any mitigation proposals. The results of this assessment are detailed in this report.

### 2.2 The Project

- 2.2.1 The Project includes the following key components:
- alterations to the existing northern runway, including repositioning its centreline 12 metres further north to enable dual runway operations;
  - reconfiguration of taxiways;

|   |       |  |  |
|---|-------|--|--|
| <ul style="list-style-type: none"> <li>▪ pier and stand amendments (including a proposed new pier);</li> <li>▪ reconfiguration of other airfield facilities;</li> <li>▪ extensions to the North and South Terminals;</li> <li>▪ provision of additional hotel and office space;</li> <li>▪ provision of reconfigured car parking, including new surface and multi-storey car parks;</li> <li>▪ surface access (highway) improvements;</li> <li>▪ reconfiguration of existing utilities, including surface water, foul drainage and power; and</li> <li>▪ landscape/ecological planting and environmental mitigation.</li> </ul> | 2.3.4 | <p>In addition, certain rarer species of bat including Bechstein's bat <i>Myotis bechsteinii</i> and barbastelle <i>Barbastella barbastellus</i> are listed on Annex II of the EC Habitats Directive (Council Directive 92/43/EEC).</p>  | <p>limited to land owned by GAL and within the Project Area and therefore not undertaken in the wider landscape. Trapping, and subsequent radio-tracking of target species from the woodland assemblage of bats (including Bechstein's bat, Brandt's bat, brown long-eared bat, Daubenton's bat, Natterer's bat and whiskered bat), was undertaken across 22 locations within the Project Area over three survey periods between May and September 2019 which were aligned with key stages of the annual bat life cycle.</p> |
| <p>2.2.2 The redline boundary of Gatwick Airport is shown in Figure 2.2.1. Further details of the existing airport operation are provided in PEIR Chapter 4: Existing Site and Operation, while a description of the Project is provided in PEIR Chapter 5: Project Description.</p>  | 2.3.5 | <p>In accordance with Section 41 of the Natural Environment and Rural Communities Act (2006), several bat species are also identified on the England Biodiversity List as Species of Principal Importance. The presence of bats represents a material consideration in the planning process.</p>   | <p>2.4.7 A total of 154 bats of nine species were captured over nine nights between 28 May 2019 and 04 September 2019. The species captured included Bechstein's bat, Brandt's bat, brown long-eared bat, common pipistrelle, Daubenton's bat, Natterer's bat, noctule, soprano pipistrelle, and whiskered bat.</p>  |
| <p>2.3 Relevant legislation and planning policy</p>   | 2.4   | <p>2.4 Biological records</p>  | <p>2.4.8 Breeding females of seven species were trapped during the survey. These species comprised Brandt's bat, brown long-eared bat, common pipistrelle, Daubenton's bat, Natterer's bat, soprano pipistrelle, and whiskered bat. No female breeding Bechstein's bats were captured within the Project Area, but the presence of juvenile males and females indicated there was likely to be a colony of breeding females in the wider landscape that was functionally connected to the Project Area.</p>                  |
| <p>2.3.1 The following key pieces of nature conservation legislation are relevant to this assessment:</p> <ul style="list-style-type: none"> <li>▪ The Conservation of Habitats and Species Regulations 2017 (as amended);</li> <li>▪ The Wildlife and Countryside Act 1981 (as amended); and</li> <li>▪ Natural Environment and Rural Communities Act 2006.</li> </ul>   | 2.4.1 | <p>Biological records were obtained from the Gatwick Biodiversity Action Plan Five Year Review 2012-2017 (Gatwick Airport, 2018b).</p>   | <p>2.4.9 Radio-tags were fitted to 20 bats of six species of woodland bat including Bechstein's bat, Brandt's bat, brown long-eared bat, Daubenton's bat, Natterer's bat and whiskered bat. The radio-tracking survey identified roosting locations for all species. As a result, 19 roosting locations were subsequently identified; nine of which were located within the Project Area.</p>  |
| <p>2.3.2 All native UK bat species are protected under Schedule 5 of the Wildlife and Countryside Act 1981 (as amended) and the Conservation of Habitats and Species Regulations 2017 (as amended). Under this combined legislation it is an offence to:</p> <ul style="list-style-type: none"> <li>▪ deliberately capture, injure or kill a bat;</li> <li>▪ intentionally or recklessly disturb a bat whilst occupying a place of shelter or protection;</li> <li>▪ possess or advertise/sell/exchange a bat (dead or alive) or any part of a bat;</li> <li>▪ deliberately disturb a bat species;</li> </ul>                   | 2.4.2 | <p>A total of 12 species of bat have been recorded within the Project Area including Bechstein's bats, Brandt's bat <i>Myotis brandtii</i>, brown long-eared bat <i>Plecotus auritus</i>, common pipistrelle <i>Pipistrellus</i>, Daubenton's bat <i>Myotis daubentonii</i>, Leisler's bat <i>Nyctalus leisleri</i>, Nathusius' pipistrelle <i>Pipistrellus nathusii</i>, Natterer's bat <i>Myotis nattereri</i>, noctule <i>Nyctalus noctula</i>, serotine <i>Eptesicus serotinus</i>, soprano pipistrelle <i>Pipistrellus pygmaeus</i> and whiskered bats <i>Myotis mystacinus</i> (Gatwick Airport, 2018b).</p> | <p>2.4.10 Core foraging areas for Bechstein's bats were identified within and adjacent to the Project Area including the Aviation Museum, Charlwood Place Farm, woodland strip to the west of Brockley Wood, River Mole, woodland to the east of Shangri-La and south of Brook Farm, woodland strip to the south-west of the Project Area north of Charlwood Road, Riverside Park, Upper Pickett's Wood, and woodland to the north of sewage works.</p>  |
| <p>2.3.3 Disturbance of the species includes in particular any disturbance which is likely to impair their ability to survive, to breed or reproduce, or to rear or nurture their young, or in the case of animals of a hibernating or migratory species, to hibernate or migrate. Under the legislation it is therefore an offence to;</p> <ul style="list-style-type: none"> <li>▪ damage or destroy a bat breeding site or resting place of a bat;</li> <li>▪ intentionally or recklessly obstruct access to any structure or place used by a bat for shelter or protection.</li> </ul>                                      | 2.4.3 | <p>During a five-year monitoring programme of bat boxes on site undertaken by Surrey Bat Group (2012-2017) the species recorded occupying boxes included Bechstein's bat, Natterer's bat, soprano pipistrelle and brown long-eared bat (Gatwick Airport, 2018b).</p>   | <p>2.4.11 Bechstein's bats were also recorded foraging in woodland to the east of Bonnett's Lane and Hyder's Farm, River Mole to the south of Charlwood Road, land to the east of Charlwood, Horleyland Wood, Lower Pickett's Wood, woodland strip to the south of Povey Cross Road and River Mole, Man's Brook, Great Burlands woodland, Prestwood Copse, and Gatwick Airport runway.</p>   |
|   | 2.4.4 | <p>A whiskered bat maternity roost was recorded at Charlwood Park Farmhouse in 2016 and 2017. This building was also previously occupied by common and soprano pipistrelles (Gatwick Airport, 2018b).</p>  |  |
|   | 2.4.5 | <p>A previous trapping and radio-tracking project undertaken in 2014 identified Bechstein's bat roosts in several dead trees in the northern part of Brockley Wood including ash <i>Fraxinus excelsior</i>, alder <i>Alnus glutinosa</i> and pedunculate oak <i>Quercus robur</i> (Gatwick Airport, 2018b).</p>  |  |
|   | 2.4.6 | <p>Previous surveys undertaken in the Project Area</p> <p>RPS were commissioned by Gatwick Airport to undertake advanced bat survey techniques in the form of bat trapping and a follow up radio-tracking survey in 2019, to inform the development of potential masterplan scenarios. Surveys were</p>  |  |

## 2.5 Requirement for surveys

2.5.1 Bat survey work is required within and adjacent to the Project Area to help inform any future changes to the airport. Surveys undertaken in the area include automated static bat detector surveys and walked activity surveys. However, advanced bat surveys were required because the data on woodland species including Bechstein's bats, which are a cryptic species, cannot be reliably obtained using standard survey techniques (such as activity surveys and/or automated surveys) alone due to overlapping call parameters within the genus *Myotis*. The advanced bat surveys detailed in this report were undertaken under Natural England Project Licence (Dr Stephanie Murphy: 2020-47826-SCI-SCI) and involved trapping, attaching radio-transmitter tags and ringing target species.

2.5.2 Surveys were required to develop a more comprehensive understanding of how Bechstein's bats are using the Project Area and surrounding landscape, and how they may be affected by the Project.

2.5.3 The surveys were required to provide information on roost locations, status of identified roosts (based on the number of bats in roost), flightlines and foraging areas for target species (Annex II Bechstein's and barbastelle bats).

## 2.6 Project purpose

2.6.1 The purpose of the surveys was to gather information on the bat assemblage in the area within and adjacent to the Project Area.

2.6.2 The surveys encompassed a range of techniques including:

- Trapping bats using harp traps with the assistance of an acoustic lure within area land permitted accessible by Gatwick Airport Limited (GAL), Woodland Trust and private landowners, and radio-tagging target species including barbastelle and Bechstein's bat;
- Non-invasive DNA analysis on small *Myotis* bats (*Alcathoe*/Brandt's bat/whiskered bat) in order to differentiate and confirm the presence of these species in and adjacent to the Project Area;

- Radio-tracking of barbastelle and Bechstein's bats to determine foraging areas, commuting routes and roost locations and counts;
- Emergence surveys and roost counts undertaken on roosts of all radio-tagged bats (access permitting).

2.6.3 It was proposed to radio-tag and radio-track up to a maximum of 30 barbastelle and Bechstein's bat over the survey period.

2.6.4 This comprised adult females (both parous and non-parous), males and juveniles (providing they are of an appropriate weight and in good health condition).

2.6.5 In order to obtain a robust assessment of the bats' movements and roosts during pre-maternity, post-maternity and autumnal dispersal seasons and across the Project Area it was considered necessary to radio-tag the numbers of bats prescribed above.

## 3 Methodology

3.1.1 The methods will generally follow the standard best practice (Collins, 2016 and Natural England, 2013). Any specific deviations due to objectives of the surveys will be detailed where necessary.

### 3.2 Trapping surveys

3.2.1 Trapping surveys were undertaken during three key periods which corresponded with key stages of the annual life cycle of a bat and included surveys between 13<sup>th</sup> 16<sup>th</sup> July 2020 (post-maternity), 7<sup>th</sup> and 10<sup>th</sup> September 2020 (autumnal dispersal) and 3<sup>rd</sup> and 6<sup>th</sup> May 2021 (maternity).

3.2.2 Trapping focused more on parts of the Project Area and adjacent wider landscape that may be of particular importance to bats, such as locations of known roosts and areas of high suitability foraging/commuting habitat. Trapping locations are shown in Figure 3.2.1 and Table 3.2.1.

3.2.3 Trapping surveys were carried out using a combination of triple and double bank harp traps including woodland habitat,

hedgerows and watercourses, which are likely to be habitat features used by commuting and / or foraging bats.

3.2.4 At each of the locations, one harp trap (Austbat) was set up. Each trap was fitted with an acoustic lure (Model: Sussex Autobot) to increase the likelihood of catching bats present within the vicinity of the traps.

3.2.5 Trapping commenced at sunset and continued for a maximum of six to eight hours per night dependant on the conditions, weather, capture success and general bat activity. If the weather became unsuitable during a survey (ie temperatures fell below 8°C and/or heavy rain and/or strong wind), the survey was terminated to avoid captured bats becoming torpid. Where unseasonably cold or poor conditions completely curtailed a survey, the survey was rescheduled where possible.

3.2.6 When bats were captured in a harp trap they were removed by a suitably experienced and qualified person (under the direction of the licence holder or accredited agent) and transferred to a clean calico cloth bag. Biometric data was recorded for each bat including weight, sex, breeding status and forearm measurements. Droppings from small *Myotis* species were collected and transferred to a sterile tube for possible DNA analysis. Bats not selected for radio-tracking were released at the site of capture immediately after biometric data was recorded.

Table 3.2.1: Trapping Locations

| Trapping location <sup>1</sup> | Easting | Northing | Description   |
|--------------------------------|---------|----------|---|
| 1                              | 522591  | 140332   | Glover's Wood south – Beside large oak. Hazel understory              |
| 2                              | 522442  | 140472   | Glover's Wood south – Beside large oak on narrow footpath             |
| 3                              | 522522  | 140542   | Glover's Wood south – Beside large oak, path overlooking small valley |
| 4                              | 522815  | 140731   | Glover's Wood north – By pond   |
| 5                              | 523077  | 141047   | Glover's Wood north – Ancient deciduous woodland                      |

<sup>1</sup> Trapping locations were surveyed during each session with the following exclusions: Orltons Copse was not surveyed in September 2020 or May 2021, Scragg Copse was not surveyed in July 2020, Mount Wood was not surveyed in July 2020 or September 2020. Trapping locations

within woodlands varied slightly between sessions due to the condition of the woodland and suitability for trapping. More details are provided in Section 3.5.

| Trapping location <sup>1</sup> | Easting | Northing | Description  |
|--------------------------------|---------|----------|--|
| 6                              | 523034  | 140711   | Glover's Wood north – Ancient deciduous woodland   |
| 7                              | 523544  | 142326   | Edolphs Copse – Under large oak at pond edge   |
| 8                              | 523461  | 142376   | Edolphs Copse – Beside footpath next to large oak  |
| 9                              | 523579  | 142520   | Edolphs Copse – Woodland interior next to med/large oak                                    |
| 10                             | 523713  | 142145   | Edolphs Copse – Close to open meadow area  |
| 11                             | 523754  | 142294   | Edolphs Copse – Woodland interior next to med oak  |
| 12                             | 525744  | 140813   | Brockley Wood - Next to med/large oak  |
| 13                             | 525776  | 140837   | Brockley Wood - Next to med/large oak  |
| 14                             | 525809  | 140892   | Brockley Wood - Next to med/large oak  |
| 15                             | 525457  | 140631   | Strip west of Brockley Wood  |
| 16                             | 525492  | 140681   | Strip west of Brockley Wood  |
| 17                             | 525600  | 139752   | Strip of woodland to the south west of the Project Area, north of Charlwood Road – west    |
| 18                             | 525862  | 139810   | Strip of woodland to the south west of the Project Area, north of Charlwood Road – central |
| 19                             | 525928  | 139818   | Strip of woodland to the south west of the Project Area, north of Charlwood Road – east    |
| 20                             | 521870  | 138624   | Orltons Copse - Gulley with some standing water  |
| 21                             | 521898  | 138831   | Orltons Copse - Woodland edge beside large oak   |
| 22                             | 522184  | 138752   | Orltons Copse - Beside med/large oak woodland interior                                     |
| 23                             | 522673  | 138816   | Scragg Copse   |
| 24                             | 522610  | 139058   | Scragg Copse   |

| Trapping location <sup>1</sup> | Easting | Northing | Description  |
|--------------------------------|---------|----------|--|
| 25                             | 522716  | 138986   | Scragg Copse   |
| 26                             | 522669  | 138383   | Mount Wood - Ancient deciduous woodland; located in uncluttered western section                                  |
| 27                             | 522788  | 138370   | Mount Wood - Ancient deciduous woodland; 6m mist net located in shrub-layer gap at boundary                      |
| 28                             | 522899  | 138298   | Mount Wood - Ancient deciduous woodland; triple bank located in more cluttered southern section near mature oaks |

### 3.3 Radio-tracking survey

- 3.3.1 Bechstein's bats were selected for radio-tagging on the basis of their species and apparent health and body condition. No underweight bats were selected for radio-tagging. The weight of the radio-tag was always less than 5% of the bat's weight. Female bats, and in particular reproductive females (avoiding heavily pregnant bats), were radio-tagged in preference to male bats to enable the location of breeding colonies.
- 3.3.2 Lotek radio-tags were attached to the focal bat using Skin-Bond® (Pfizer Inc) to the area between the shoulder blades from which fur has been clipped.
- 3.3.3 The bats that were fitted with radio-tags were released on the night of capture at the location of capture and held only for the minimum time necessary to obtain the required data and to be fitted with rings and radio-tags as necessary.
- 3.3.4 The roost locations of radio-tagged bats were located by teams of a minimum of two surveyors using radio-tracking equipment. The radio-tracking equipment comprised of a Biotrack Sika radio-receiver unit coupled with a Biotrack Yagi radio-antenna which allowed the surveyors to tune into the frequency of the radio-tag on each radio-tagged bat. Through moving through the landscape on foot or by vehicle, surveyors were able to locate radio-tagged bat roost locations by following the direction and strength of the radio signal emitted by the radio-tag.
- 3.3.5 The movements of active bats at dusk, night and at dawn, were ascertained by multiple teams of surveyors using the radio-

tracking equipment described above. Each team was positioned in separate locations within the landscape with their exact location recorded (eastings, northings recorded with GPS unit). Each team was in constant communication with each other via handheld two-way radios or mobile telephones. When bats commenced emergence from their roost location and / or their radio-tag was picked up whilst in flight, the surveyor teams took close approach estimates of location (if the bat was in the immediate vicinity). If bats were located some distance between the surveyors and / or surveyors' access was not permitted to the area in which the bat was situated simultaneous compass bearings on the direction of the strongest radio signal were taken. Through triangulating simultaneous bearings (using LOAS software; version 2.12, Ecological Software Solutions), surveyor teams were able to record 'fixes' (the point at which two or more separate team's bearings cross) of the bats' locations within the landscape, (ie locations at which simultaneous bearings crossed)

- 3.3.6 The positions of the radio-tagged bats were received at intervals after leaving the roost and were used to identify flightlines, which are important connectivity features between the roosting locations and foraging areas and between separate foraging areas.
- 3.3.7 The cumulative home range size was plotted against the number of successive locations for all bats radio-tracked in order to determine the point at which the foraging area reached an asymptote, indicating that sufficient data has been gathered from each bat. Estimates of range size for this analysis will be based on 100% minimum convex polygons, 95% kernels and 50% kernels, obtained using BIOTAS software (version 2.0 Alpha, Ecological Software Solutions).
- 3.3.8 Each bat fitted with a radio-tag was followed for a minimum of three nights and a maximum of seven nights, depending on the results obtained from the estimates of home range analysis (ie whether sufficient data had been collected). Bats were radio-tracked concurrently.

### 3.4 Roost count surveys

- 3.4.1 Roosts were identified by locating the radio-tagged bats during the day (as detailed above) and subsequent counts of the number of bats emerging was carried out, where access was permitted by GAL.
- 3.4.2 The surveys were carried out in appropriate weather conditions following standard guidelines (Collins, 2016) and when bats are likely to be active. The dusk surveys commenced approximately

15 minutes before sunset and continued for a minimum of at least 90 minutes; the optimum time for bats to emerge from a roost.

3.4.3 An infra-red camera (such as the Canon XA-20) equipped with infra-red lamps (such as the IR Lab Outdoor IR Illuminator LIR-IC88) was used to aid accurate counts of bats emerging from the roost. Full spectrum bat detectors, such as Elekon Batlogger M were used to detect bat echolocation calls of any emerging bats and identify species where possible. Both video and ultrasonic audio recordings were subsequently analysed to ensure accurate species identification and roost count. Flightlines from roosts were determined by roost count survey teams taking bearings on emerging bats.

### 3.5 Data validity and limitations

3.5.1 It is important to note that even where data are held, a lack of records for a defined geographical area does not necessarily mean that there is a lack of ecological interest; the area may be simply under-recorded. Bats are highly mobile animals and can move roost sites both within and between years.

3.5.2 Data from bat surveys should be considered to be valid for a period of 18 months, unless there are any meaningful changes to the buildings or other habitats within the site.

#### Trapping surveys

3.5.3 Where identification to species level was not possible in the field, particularly for cryptic species such as the small Myotis genera, droppings of trapped bats were collected and sent for DNA analysis. As bats were captured for the minimum amount of time necessary, it was not always possible to collect a sample from each bat had they not provided a dropping in the calico cloth bag after one hour. Due to animal welfare priorities, bat droppings collected for DNA analysis was therefore not possible with all captured target species.

3.5.4 The species of three whiskered/Brandt's/Alcathoe bats were not confirmed in July 2020 and one in May 2021 due to lack of droppings.

3.5.5 Precise trapping locations varied slightly over the trapping survey period. The locations varied slightly as the condition of the woodland differed between seasons due to vegetation growth. This was not considered to be a significant limitation to the findings of the study as the woodland was thoroughly surveyed during each session.

3.5.6 Orltons Copse was not surveyed in September 2020 or May 2021. This was due to access restrictions in September 2020. The decision was made to not survey this area in May 2021 due to higher quality habitats for target species (Bechstein's bats and barbastelles) being available. Scragg Copse was not surveyed in July 2020 or May 2021 due to access restrictions. Mount Wood was not surveyed in July 2020 or September 2020 due to access restrictions. This was not considered to be a significant limitation to the findings of the study as the wider area around the Project Area was covered thoroughly.

3.5.7 Bechsteins radio-tagged in May 2021 were inactive for part of the radio-tracking study period due to sub-optimal temperatures after they were radio-tagged. The Surrey bat group continued to monitor these roosts after the radio-transmitters were no longer active and once the weather conditions improved and provided the data of emergence counts to the project.

#### Radio-tracking survey (including roost count and emergence surveys)

3.5.8 The positions of the radio-tagged bats are received at intervals after leaving the roost and used to identify flightlines between the roost and foraging areas. Therefore, flightlines are partially estimated based on best available data. This is considered as an acceptable limitation as assumptions on direction and use of landscape features can be made based on known bat behavioural ecology.

3.5.9 It was not GAL policy to obtain ad-hoc access for roost counts outside the Project Area or in private properties. Therefore, roost counts were not possible in these areas.

3.5.10 All radio-tracking was carried out from land where access was permitted, public roads and public rights of way. Restricted access to land affected the accuracy of the bearings taken during radio-tracking. If a radio-tagged bat was foraging in an area of land where the strength of the signal was weak (as a consequence of topography) and/or had disappeared, then it was not possible to ascertain the precise location of the bat. These constraints were overcome using the following methods:

- If the bat was likely to be roosting in land where access was prohibited, multiple bearings were taken from a variety of different locations to get a better estimate of likely roosting locations;

- Where radio-tracking data on bats was deficient, subsequent radio-tracking night(s) concentrated effort on those bats for which data was limited.

3.5.11 Fast moving traffic on roads within and adjacent to the Project Area meant that surveyors could not survey from the most appropriate areas due to health and safety concerns.

3.5.12 Surrey Bat Group were also involved in data collection as information was shared on radio-transmitter frequencies.

3.5.13 Due to the limited access to areas outside the Project Area, radio-tracking data was difficult to obtain. As mentioned above, multiple bearings were taken from a variety of different locations when bats were recorded in inaccessible land. However, when bats moved between locations, surveyors moved to locate the bat but due to the access restrictions, the signal was often lost by the time they had got to a suitable surveying location.

3.5.14 Radio-tracking data can include outliers, especially with fast moving animals such as bats.

3.5.15 Radio-tracking data on Bats 3J, 4J and 1S was obtained for two nights. Surveyors searched the Project Area for these bats over at least three nights, but the bats were not found, indicating that they were likely foraging outside the Project Area or the tag had failed.

3.5.16 Bat 5S was not found during the radio-tracking period. It is considered likely that the radio-tag failed on this bat or the bat were outside the Project Area. Bats are highly mobile species and consequently any bats trapped and tagged within the survey area may not always be identified roosting or in flight in the survey area on subsequent survey days.

## 4 Results

### 4.1 Trapping surveys

4.1.1 A total of 98 bats of nine species were captured over nine trapping nights between 13<sup>th</sup> July 2020 and 7<sup>th</sup> May 2021 in 28 different locations. Figure 3.2.1 shows the trapping locations, detailed trapping data is shown in Annex 1 and trapping results by species which is summarised in Table 4.1.1 below.

**Table 4.1.1: Trapping results by species**

| Species                                 | Number of bats |
|---|----------------|
| Barbastelle                             | 1              |
| Bechstein's bat                         | 16             |
| Daubenton's bat                         | 1              |
| Whiskered bat                           | 10             |
| Whiskered bat/Brandt's bat <sup>2</sup> | 4              |
| Natterer's bat                          | 14             |
| Noctule                                 | 1              |
| Brown long-eared bat                    | 45             |
| Common pipistrelle                      | 4              |
| Soprano pipistrelle                     | 2              |

4.1.2 The average number of bats caught across each trapping area is shown in Table 4.1.2 below.

**Table 4.1.2: Trapping results by location**

| Location  | Number of bats | Number of nights | Number of bats per night |
|---|----------------|------------------|--------------------------|
| Glovers Wood  | 32             | 4                | 8                        |
| Edolphins Copse   | 29             | 4                | 7.25                     |
| Brockley Wood   | 15             | 3                | 5                        |
| Strip west of Brockley Wood   | 5              | 3                | 1.67                     |
| Strip of woodland to the south west of the Project Area, north of Charlwood | 0              | 3                | 0                        |

<sup>2</sup> DNA analysis not possible

| Location      | Number of bats | Number of nights | Number of bats per night |
|---------------|----------------|------------------|--------------------------|
| Orltons Copse | 10             | 1                | 10                       |
| Scraggs Copse | 5              | 1                | 5                        |
| Mount Wood    | 2              | 1                | 2                        |

#### DNA analysis

4.1.3 Droppings were obtained from three of the trapped small Myotis bats, which were all sent for DNA analysis. Results are pending and will be provided in the ES.

#### 4.2 Radio-tracking

4.2.1 Fourteen of the sixteen trapped Bechstein's bats were selected for radio-tracking. The sex, breeding status and bat identification numbers are shown in and Table 4.2.1 below.

**Table 4.2.1: Radio-tagged bats**

| Bat identification number <sup>3</sup> | Trapping location | Species         | Sex | Breeding status          |
|--|-------------------|-----------------|-----|--------------------------|
| 1J                                     | 1                 | Bechstein's bat | F   | Lactating                |
| 2J                                     | 6                 | Bechstein's bat | F   | Lactating                |
| 3J                                     | 7                 | Bechstein's bat | F   | Lactating/post-lactating |
| 4J                                     | 11                | Bechstein's bat | F   | Post-lactating           |
| 5J                                     | 10                | Bechstein's bat | F   | Post-lactating           |
| 6J                                     | 13                | Bechstein's bat | M   | Adult                    |
| 7J                                     | 12                | Bechstein's bat | M   | Adult                    |

<sup>3</sup> The letter after the number indicates month of capture; J=July 2020, S=September 2020, M=May2021

| Bat identification number <sup>3</sup> | Trapping location | Species         | Sex | Breeding status    |
|--|-------------------|-----------------|-----|--------------------|
| 8J                                     | 14                | Bechstein's bat | M   | Adult              |
| 1S                                     | 4                 | Bechstein's bat | M   | N/A – Juvenile     |
| 2S                                     | 4                 | Bechstein's bat | F   | N/A – Juvenile     |
| 3S                                     | 4                 | Barbastelle     | M   | N/A – Juvenile     |
| 4S                                     | 9                 | Bechstein's bat | F   | N/A – Juvenile     |
| 5S                                     | 14                | Bechstein's bat | F   | N/A – Juvenile     |
| 1M                                     | 6                 | Bechstein's bat | F   | Adult – Non-parous |
| 2M                                     | 4                 | Bechstein's bat | F   | Adult - Parous     |

#### Flightlines

4.2.2 No flightlines were recorded from bat roosts to foraging areas as the majority of bats were recorded close to their roosting locations.

#### Roosts, Home ranges and foraging areas

4.2.3 A total of 10 confirmed roosting locations were identified from nine radio-tagged bats. Additionally, nine estimated roosting locations were identified. Dusk emergence surveys were undertaken on seven of the confirmed roosts. The location of these roosts and counts of the roosts are shown in Table 4.2.2 and Figure 4.2.1. The emergence survey section below provides information on roost counts and characterisation.

4.2.4 The fixes obtained during the radio-tracking study bats were analysed with BIOTAS software to calculate the maximum home range (100% MCP), the peripheral foraging areas (95% KDE) and the core foraging areas (50% KDE) of each tracked Bechstein's bat. The calculated 100% MCP, 95% KDE and 50% KDE for each tracked bat are shown in Annex 2. Figures 4.2.2-



4.2.6 display visual representations of the home ranges and foraging areas for the radio-tracked bats.

**Bechstein's bat**

- 4.2.5 Figure 4.2.2 shows the Bechstein's bats that were recorded within and adjacent to the Project Area in July 2020. This only included bats tagged in the post-maternity session (Bats 3J, 4J, 6J, 7J and 8J). Two of the bats were post-lactating females (Bat 3J and 4J) and the remainder were adult males.
- 4.2.6 Bat 1J, a lactating female Bechstein's bat, was caught in Glovers Wood and recorded roosting in an inaccessible roost within the same woodland. This bat was radio-tracked for four nights. It was recorded foraging within Glovers Wood only. It was not recorded within the Project Area.
- 4.2.7 Bat 2J, a lactating female Bechstein's bat, was caught in Glovers Wood and recorded roosting in an inaccessible roost on a treeline east of Ifield Road, Woodcote Estate. This bat was radio-tracked for two nights. It was recorded foraging in Glovers Wood. It was not recorded within the Project Area.
- 4.2.8 Bat 3J, a lactating female Bechstein's bat, was caught in Edolphins Copse and was recorded roosting in two separate inaccessible roosts between Glovers Wood and Edolphins Copse. The bat was radio-tracked for five nights. It was recorded foraging within Glovers Wood and Edolphins Copse, and the woodland blocks between the two, as well as within the Project Area along the River Mole north of Brockley Wood.
- 4.2.9 Bat 4J, a post-lactating female Bechstein's bat, was caught in Edolphins Copse. Three roosts were recorded for this bat; two in a tree line east of Edolphins Copse (one of which had 5J also roosting in it) and one in a tree line off Norwood hill Road/Rectory Lane/Stan Hill (peak count of six bats emerging from the roost). This bat was radio-tracked for two nights. It was recorded foraging within Edolphins Copse, the woodland blocks to the north east of Glover's Wood and the River Mole within the Project Area, northwest of Brockley Wood.
- 4.2.10 Bat 5J, a post-lactating female Bechstein's bat, was caught in Edolphins Copse. Two separate roosts were recorded for this bat; one in a tree line east of Edolphins Copse and one in a tree line off Norwood hill Road/Rectory Lane/Stan Hill (peak count of six bats emerging from the roost). Bat 4J was also recorded roosting in both of these trees. This bat was radio-tracked for three nights. It was recorded foraging within Edolphins Copse and the woodland

blocks to the north east of Glover's Wood. It was not recorded within the Project Area.

- 4.2.11 Bat 6J, an adult male Bechstein's bat, was caught in Brockley Wood and was recorded roosting in an estimated location within Brockley Wood. This bat was radio-tracked for three nights. It was recorded foraging within the Project Area along Man's Brook to the northwest of Brockley Wood, as well as outside the project area in Edolphins Copse and the woodland blocks and hedgerows between Edolphins Copse and the northwest of the Project Area.
- 4.2.12 Bat 7J, an adult male Bechstein's bat, was caught in Brockley Wood and was recorded roosting in an estimated location within Brockley Wood as well as a confirmed ash tree roost within Brockley Wood where it was the only bat recorded emerging from the tree during an emergence survey. This bat was radio-tracked for three nights. It was recorded foraging within the Project Area along Man's Brook, River Mole and woodland adjacent to the runway, as well as pockets of woodland between the Project Area and Glover's Wood to the west and north west.
- 4.2.13 Bat 8J, an adult male Bechstein's bat, was caught in Brockley Wood. Bat 8J was recorded roosting in an inaccessible roost within a woodland block to the north east of Glovers Wood. This bat was radio-tracked for three nights. It was recorded foraging within Charlwood, along Man's Brook to the east of Charlwood and within woodland blocks between Glovers Wood and Edolphins Copse.
- 4.2.14 Figure 4.2.3 details the Bechstein's bats that were recorded within and adjacent to the Project area in September 2020. Bat 1S, a juvenile male Bechstein's bat, was caught in Glovers Wood and was recorded roosting within an ash tree on the eastern edge of Glovers Wood. A peak count of eight bats were recorded roosting within the roost. This bat was radio-tracked for two nights and was recorded foraging in Glovers Wood only. It was not recorded within the Project Area.
- 4.2.15 Bat 2S, a juvenile female Bechstein's bat, was caught in Glovers Wood and was recorded roosting within southeast Glovers Wood. Two emergence surveys were undertaken on the tree which recorded counts of 19 and 20 bats. This bat was radio-tracked for four nights and was recorded foraging in Glovers Wood, Edolphins Copse and nearby areas. It was not recorded within the Project Area.
- 4.2.16 Bat 4S, a juvenile male Bechstein's bat, was caught in Edolphins Copse and was recorded roosting in an inaccessible location, estimated to be off Partridge Lane, Cudworth. This bat was radio-

tracked for three nights and was recorded foraging in Glovers Wood, Edolphins Copse, around Beam Brook in Toogoolawah, Cudworth, and pockets of woodland between Edolphins Copse and Toogoolawah. It was not recorded within the Project Area.

- 4.2.17 Bat 5S, a juvenile female Bechstein's bat, was caught in Brockley Wood but was not located by radio-telemetry following capture.
  - 4.2.18 Figure 4.2.5 shows Bechstein's bats that were recorded in the project area in May 2021. Bat 1M, an adult non-breeding female Bechstein's bat, was caught in Glovers Wood. This bat, along with Bat 2M was recorded roosting in two roosts within Glovers Wood; one of which had a peak count of three bats (including both Bat 1M and 2M) and the other had a peak count of 15 bats emerging from the roost. This bat was radio-tracked for five nights. This bat was recorded foraging exclusively in Glovers Wood during surveys. It was not recorded within the Project Area.
  - 4.2.19 Bat 2M, an adult breeding female Bechstein's bat, was caught in Glovers Wood. The details of the Bat 2M roosts are shown in the paragraph above. This bat was radio-tracked for five nights. This bat was recorded foraging exclusively in Glovers Wood during surveys. It was not recorded within the Project Area.
- Barbastelle bat**
- 4.2.20 Figure 4.2.6 Bat 3S, shows an adult male barbastelle, was caught in Glovers Wood. This bat was radio-tracked for five nights. Core foraging areas for the one barbastelle (Bat 3S) were identified to the south east of Glovers Wood, around Russ Hill Farm and adjacent to Man's Brook to the west of Prestwood Copse. No core foraging areas were recorded within the Project Area for barbastelles.
  - 4.2.21 The barbastelle bat was also recorded foraging within Faygate Forest, Prestwood Copse and adjacent watercourses, and a block of woodland and Bewbush Brook in Bewbush, west of Crawley. No peripheral foraging areas were recorded within the Project Area for this species.

Table 4.2.2: Roost Location, Count and Characterisation

| Roost locations           |                 |                           |         |          |  | Emergence surveys                     |             | Roost Characterisation |
|---------------------------|-----------------|---------------------------|---------|----------|--|---------------------------------------|-------------|------------------------|
| Bat identification number | Species         | Estimated/confirmed roost | Easting | Northing | Description  | Emergence date                        | Roost count | Likely roost type      |
| 1J                        | Bechstein's bat | Estimated                 | 523084  | 140706   | Glovers Wood   |                                       |             | Maternity <sup>4</sup> |
| 2J                        | Bechstein's bat | Estimated                 | 523853  | 140217   | Tree line E of Ifield Road, Woodcote Estate  |                                       |             | Maternity <sup>5</sup> |
| 3J                        | Bechstein's bat | Estimated                 | 523344  | 141522   | Woodland block north east of Glovers Wood  |                                       |             | Maternity <sup>6</sup> |
| 3J                        | Bechstein's bat | Estimated                 | 523376  | 141489   | In woodland between Edolphs and Glovers  |                                       |             | Maternity <sup>7</sup> |
| 4J                        | Bechstein's bat | Confirmed                 | 524085  | 142066   | On tree line east of Edolphs Copse   | 17/07/2020                            | 0           | Day                    |
| 4J and 5J                 | Bechstein's bat | Estimated                 | 524031  | 142105   | Hedge/tree line east of Edolphs  |                                       |             | Maternity <sup>8</sup> |
| 4J and 5J                 | Bechstein's bat | Confirmed                 | 523900  | 141446   | Ash tree in tree line off Norwood Hill Road/Rectory Lane/Stan Hill. Two woodpecker holes 10m in height on southern elevation | 15/07/2020                            | 6           | Maternity              |
| 6J                        | Bechstein's bat | Estimated                 | 525830  | 140917   | Brockley Wood - unknown location   |                                       |             | Unknown                |
| 7J                        | Bechstein's bat | Estimated                 | 525766  | 140712   | Brockley Wood - unknown location   |                                       |             | Unknown                |
| 7J                        | Bechstein's bat | Confirmed                 | 525771  | 140717   | Ash tree within Brockley Wood  | 17/07/2020                            | 1           | Day                    |
| 8J                        | Bechstein's bat | Estimated                 | 523470  | 141513   | Woodland block north east of Glovers Wood  |                                       |             |                        |
| 1S                        | Bechstein's bat | Confirmed                 | 523171  | 140839   | Eastern edge of Glovers Wood in branch of Ash tree 4-5m on SE elevation  | 08/09/2020                            | 8           | Maternity              |
| 2S                        | Bechstein's bat | Confirmed                 | 523197  | 140875   | SE Glovers Wood within stem at base of second major fork   | 10/09/2020<br>11/09/2020              | 19<br>20    | Maternity              |
| 3S                        | Barbastelle     | Confirmed                 | 522088  | 133294   | Faygate Forest - downy birch, lifted bark  |                                       |             | Unknown                |
| 3S                        | Barbastelle     | Confirmed                 | 523190  | 139589   | NE section of Prestwood Copse in dead oak under lifted bark 3-4m on eastern elevation  |                                       |             | Unknown                |
| 4S                        | Bechstein's bat | Estimated                 | 521655  | 142192   | Off Partridge Lane, Cudworth   |                                       |             | Unknown                |
| 4S                        | Bechstein's bat | Confirmed                 | 521592  | 142301   | Tree along Beam Brook E of Partridge Lane  |                                       |             | Unknown                |
| 1M and 2M                 | Bechstein's bat | Confirmed                 | 522441  | 140507   | Glovers Wood - split feature in oak main stem at 10m height. Split has been enlarged by woodpecker. Northern aspect          | 07/05/2021                            | 3           | Satellite maternity    |
| 1M and 2M                 | Bechstein's bat | Confirmed                 | 522768  | 149621   | Glovers Wood - oak tree 4x multistem. Woodpecker hole at 12m south west aspect   | 09/05/2021<br>14/05/2021 <sup>9</sup> | 14<br>15    | Maternity              |

<sup>4</sup> Although a roost count was not undertaken, it is considered likely that this roost was a maternity roost due to the breeding status of the tagged bat within the roost

<sup>5</sup> Although a roost count was not undertaken, it is considered likely that this roost was a maternity roost due to the breeding status of the tagged bat within the roost

<sup>6</sup> Although a roost count was not undertaken, it is considered likely that this roost was a maternity roost due to the breeding status of the tagged bat within the roost

<sup>7</sup> Although a roost count was not undertaken, it is considered likely that this roost was a maternity roost due to the breeding status of the tagged bat within the roost

<sup>8</sup> Although a roost count was not undertaken, it is considered likely that this roost was a maternity roost due to the breeding status of the tagged bat within the roost

<sup>9</sup> Emergence survey undertaken by Martyn Cooke of Surrey Bat Group

### Emergence surveys

- 4.2.22 A total of nine emergence surveys were undertaken on seven of the confirmed roosts for barbastelle and Bechstein's bat.
- 4.2.23 One emergence survey was undertaken within the Project Area for Bat 7J that was roosting within an ash tree in Brockley Wood. The tagged Bat 7J was the only bat to be recorded emerging from the tree. Due to the number of bats recorded emerging from this roost, this was considered to be a day roost for Bechstein's bats.
- 4.2.24 The other seven roosts were located outside the Project Area, within Glovers Wood, Faygate Forest, in a treeline off Norwood Hill Road/Rectory Lane/Stan Hill and in a treeline east of Edolphs Copse.
- 4.2.25 On 15<sup>th</sup> July 2020 an emergence survey was undertaken on the bat 4J and 5J roost in an ash tree in the tree line off Norwood Hill Road/Rectory Lane/Stan Hill. Six bats were recorded emerging from the roost including the two tagged bats. Due to the number of bats recorded emerging from this roost, and the breeding status of the tagged bats, this was considered to be a small maternity roost for Bechstein's bats.
- 4.2.26 On 17<sup>th</sup> July 2020 an emergence survey was undertaken on the Bat 4J roost in the tree line to the east of Edolphs Copse. No bats were recorded emerging from the roost. As no bats were recorded emerging from this roost, this tree was considered to be a day roost for Bechstein's bats.
- 4.2.27 On 8<sup>th</sup> September 2020 an emergence survey was undertaken on the Bat 1S roost located in an ash tree on the eastern edge of Glovers Wood. Eight bats were recorded emerging from the roost. Due to the number of bats recorded emerging from the roost this was considered to be a maternity roost for Bechstein's bats.
- 4.2.28 On 10<sup>th</sup> and 11<sup>th</sup> September 2020 an emergence survey was undertaken on the Bat 2S roost in south east Glovers Wood. A total of 19 and 20 bats were recorded emerging respectively. Eight bats were recorded emerging from the roost. Due to the number of bats recorded emerging from the roost this was considered to be a maternity roost for Bechstein's bats.
- 4.2.29 On 7<sup>th</sup> May 2021 an emergence survey was undertaken on the Bat 1M and 2M roost in Glovers Wood. A total of three bats were recorded emerging from the roost, including the two tagged bats.

4.2.30

Due to the breeding status of the bats this roost was considered to be a satellite maternity roost for Bechstein's bats.

On 9<sup>th</sup> May 2021 an emergence survey was undertaken on a separate roost for Bat 1M and 2M in Glovers Wood. A total of 14 bats were recorded emerging from the roost, including the two tagged bats. A repeat emergence survey of this tree was undertaken on 10<sup>th</sup> May 2021 which recorded 15 bats emerging from the roost. Due to the number of bats recorded emerging from the roost this was considered to be a maternity roost for Bechstein's bats.

## 5 Discussion

### 5.1 Species

#### Bechstein's bat

5.1.1

This species is listed in Annex II of the EU Habitat Directive, categorised as Near Threatened on the IUCN Red List of Threatened Species (Hutson and Paunovic, 2016), is a Species of Principal Importance in England, and is considered to be very rare at a national (Bat Conservation Trust, 2010) and local level (Sussex Bat Group, 2019 and Surrey Bat Group, 2019). Although this species' range is considered to be stable, the future prospects for this species' habitat is considered to be in decline (Matthews *et al.*, 2018).

5.1.2

Trapping surveys in 2019 captured a total of seven Bechstein's bats within the Project Area within the woodland strip west of Brockley Wood/River Mole, Brockley Wood, the strip of woodland to the south west of the Project area north of Charlwood Road, Riverside Park and Horleyland Wood.

5.1.3

No breeding individuals were recorded for this species during surveys within the Project Area in 2019; captured bats were all male or non-breeding females. However, juvenile male and females were recorded present in September indicating that there is likely to be a breeding colony close to the Project Area.

#### Barbastelle bat

5.1.4

This species is listed in Annex II of the EU Habitat Directive, categorised as Near Threatened on the IUCN Red List of Threatened Species (Hutson and Paunovic, 2016), is a Species of Principal Importance in England, and is considered to be very rare at a national (Bat Conservation Trust, 2010) and local level (Sussex Bat Group, 2019 and Surrey Bat Group, 2019). Although

this species' population and range is unknown its habitat status is considered to be in decline (Matthews *et al.*, 2018).

5.1.5

No barbastelle bats were captured within the Project Area during surveys in 2019.

5.1.6

The sections below summarise the results obtained for the trapping and radio-tracking surveys undertaken in 2020 and 2021.

### 5.2 Field survey

#### Trapping

5.2.1

A total of 98 bats from a minimum of nine species were captured over nine nights between 13<sup>th</sup> July 2020 and 7<sup>th</sup> May 2021. Species included barbastelle, Bechstein's bat, brown long-eared bat, common pipistrelle, Daubenton's bat, Natterer's bat, noctule, soprano pipistrelle, whiskered/Brandt's bat and whiskered bat.

5.2.2

The most commonly caught bat was brown long-eared bat with a total of 45 bats captured, followed by Bechstein's bats (16 bats). The least commonly caught bats were barbastelle, noctule and Daubenton's bats with just one of each species caught during the survey period.

5.2.3

Trapping locations were split into eight distinct areas across the Project Area; Glover's Wood, Edolphs Copse, Brockley Wood, strip west of Brockley Wood, strip of woodland to the south west of the Project Area, Orltons Copse, Scraggs Copse and Mount Wood. The highest number of average bats caught per night was 10 and this was recorded within Orltons Copse, however none of the target species were captured at this location. The location with the second highest number of bats caught per night was Glovers Wood, with an average of eight bats per night.

#### Radio-tracking

#### Roosts

5.2.4

Seventeen Bechstein's bat roosts and two barbastelle roosts were identified during the radio-tracking surveys. Emergence surveys were undertaken on seven of these roosts. Of these roosts, three were located within the Project Area. An emergence survey was undertaken on one of these roosts which identified one bat (Bat 7J) emerging from the roost. As the bats recorded roosting within the Project Area were all adult males it is considered unlikely that the roosts are roosts of high conservation significance for Bechstein's bats eg maternity roosts are likely to be present in the Project Area.

5.2.5 Of the remaining 14 Bechstein's bat roosts located outside the Project Area, four were confirmed as maternity roosts from roost counts, five were considered likely to be maternity roosts due to the breeding status of the females within the roost (lactating/post-lactating), one as a satellite maternity roost, one as a day roost, and three unknown roost types. Bechstein's bats are typically associated with fission fusion roost dynamics (Kerth *et al*, 2006, Kerth *et al* 2014), it is likely these use a number of trees in close proximity to one another throughout the pre & post breeding period.

**Foraging areas**

5.2.6 Core foraging areas for radio-tracked Bechstein's bats within the Project Area were identified within the following areas:

- Brockley Wood;
- Man's Brook; and
- River Mole.

5.2.7 Although two post-lactating female Bechstein's bats were recorded within the Project Area (Bats 3J and 4J), core foraging areas for these bats were not located within the Project Area. No core foraging areas were recorded within the Project Area for barbastelles.

5.2.8 Core foraging areas for radio-tracked Bechstein's bats outside the Project Area were identified within the following areas:

- Glover's Wood;
- Mountnoddy Wood;
- Edolphs Copse;
- woodlands around Toogoolawah and Beam Brook; and
- woodlands and waterbodies adjacent to Biltam Farm Nurseries.

5.2.9 Core foraging areas for the barbastelle were identified in the following areas:

- south east of Glovers Wood;
- around Russ Hill Farm;
- adjacent to Man's Brook to the west of Prestwood Copse.

5.2.10 Bechstein's bats were also recorded foraging around the following areas (peripheral foraging areas):

- Beggars Gill;
- Pagewood;
- Charlwood;

- woodland blocks and hedgerows north east of Charlwood; and
- Man's Brook and adjacent arable fields to the west of the Project Area.

5.2.11 Barbastelle bats were recorded foraging around the following areas (peripheral foraging areas):

- within Faygate Forest;
- Prestwood Copse and adjacent watercourses; and
- block of woodland and Bewbush Brook in Bewbush, west of Crawley.

5.2.12 The bats recorded foraging within the Project Area included two post-lactating females and three adult male Bechstein's bats. No core foraging areas for breeding females were identified within the Project Area, with data for these two bats limited to a relatively low number of fixes along the River Mole and Man's Brook, with the majority of their foraging (core foraging areas) recorded outside the Project Area in Edolphs Copse and woodland block to the north east of Glovers Wood.

**Assessment of importance**

5.2.13 This section aims to assess the importance of Bechstein's and barbastelle populations within and adjacent to the Project Area. The importance of the areas are assessed at a geographical level eg local, regional, national.

5.2.14 Paragraphs 5.1.1 and 5.1.4 above detail the protection afforded to Bechstein's and Barbastelle bats, rarity of the species within the UK, Sussex, and Surrey, and future prospects of the species.

5.2.15 The value of roosts and foraging areas for both Bechstein's bats and barbastelles have been calculated using Wray *et al.* (2010) for both within the Project Area and within the wider landscape, with calculations shown in Table 5.2.1-5.2.4 below.

**Table 5.2.1: Importance of roosts within Project Area**

| Species         | Rarity | Roost type present (highest conservation significance listed) | Geographic frame of reference |
|-----------------|--------|---|-------------------------------|
| Barbastelle     | Rarest | None  | N/A                           |
| Bechstein's bat | Rarest | Day roost   | County                        |

**Table 5.2.2: Importance of roosts outside Project Area**

| Species         | Rarity | Roost type present (highest conservation significance listed) | Geographic frame of reference |
|-----------------|--------|---|-------------------------------|
| Barbastelle     | Rarest | Likely day roost  | County                        |
| Bechstein's bat | Rarest | Maternity   | National/UK                   |

5.2.16 As barbastelle have not been recorded within the Project Area, this area is not considered to be of importance to this species. However, the areas in the wider landscape are considered to be of County/Regional importance for this species.

5.2.17 The population of Bechstein's bats is considered to be of County/Regional importance within the Project Area. However, the importance of the areas in the wider landscape are considered to be of Regional/National Importance.

**Table 5.2.3: Importance of foraging areas within Project Area**

| Species         | Species rarity | Number of bats      | Roosts/potential roosts nearby | Type/Complexity of linear features   | Total Score              |
|-----------------|----------------|---------------------|--------------------------------|--|--------------------------|
| Barbastelle     | Rarest (20)    | No bats             | None                           | N/A  | 0 – Not important        |
| Bechstein's bat | Rarest (20)    | Individual bats (5) | Small number of roosts (3)     | Isolated woodland patches, less intensive arable and/or small towns and villages (3) | 31 – Regional importance |

**Table 5.2.4: Importance of foraging areas outside Project Area**

| Species         | Species rarity | Number of bats            | Roosts/potential roosts nearby | Type/Complexity of linear features   | Total Score              |
|-----------------|----------------|---------------------------|--------------------------------|--|--------------------------|
| Barbastelle     | Rarest (20)    | Individual bats (5)       | Small number of roosts (3)     | Larger or connected woodland blocks, mixed agriculture, and small villages/hamlets (4) | 32 – Regional importance |
| Bechstein's bat | Rarest (20)    | Small number of bats (10) | Small number of roosts (3)     | Larger or connected woodland blocks, mixed agriculture, and small villages/hamlets (4) | 37 – Regional importance |

## 6 Conclusions

- 6.1.1 The highest rate of bat captures were recorded outside the Project Area in Orltons Copse, Glovers Wood and Edolphs Copse.
- 6.1.2 Three roosts were identified within the Project Area, all for male Bechstein's bats. The roosts were considered to be day roosts, or of unknown status. Fourteen roosts for Bechstein's bats were recorded outside the Project Area. Four of these roosts were confirmed as maternity roosts from roost counts, five were considered likely to be maternity roosts due to the breeding status of the females within the roost (lactating/post-lactating), one as a satellite maternity roost, one as a day roost, and three unknown roost types. Two barbastelle roosts of unknown type were also recorded outside the Project Area.
- 6.1.3 Glovers Wood and Edolphs Copse were used as core foraging areas for multiple Bechstein's bats with the majority of activity recorded in these areas being from breeding female Bechstein's bats.
- 6.1.4 Core foraging areas identified for Bechstein's bats within the Project Area included Brockley Wood, the River Mole and Man's Brook. These core foraging areas were for male Bechstein's bats.

- 6.1.5 The Project Area is considered to not to be of importance for barbastelle bats due to the lack of records but is considered to be of County/Regional importance for Bechstein's bats.
- 6.1.6 The area outside the Project is considered to be of County/Regional importance for barbastelle bats and Regional/National importance for Bechstein's bats.

## 7 References

- Bat Conservation Trust (2010) *Species Factsheet* <https://www.bats.org.uk/about-bats/what-are-bats/uk-bats> last accessed 07 November 2019.
- British Standards Institution (2015) *BS8956 Surveying for Bats in Trees and Woodland*. BSI London.
- CIEEM (2018) *Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal, 2nd edition*. Chartered Institute of Ecology and Environmental Management, Winchester.
- Collins (2016) *Bat Surveys for Professional Ecologists Good Practice Guidelines 3rd Edition*. Bat Conservation Trust, London.

Ministry of Housing, Communities and Local Government (2021) National Planning Policy Framework (NPPF). [Online] Available at:

[https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/1005759/NPPF\\_July\\_2021.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1005759/NPPF_July_2021.pdf)

Gatwick Airport (2018a) *Gatwick Airport Draft Master Plan 2018*.

Gatwick Airport (2018b) *Gatwick Biodiversity Action Plan Five Year Review 2012-2017*. Gatwick Airport Unpublished Report.

Kerth G., Ebert C. and Schmidtke C (2006) *Group decision making in fission–fusion societies: evidence from two-field experiments in Bechstein's bats*. Proceedings of the Royal Society Volume 273 Issue 1602.

Fleischmann D, and Kerth G (2014) *Roosting behavior and group decision making in 2 syntopic bat species with fission–fusion societies*. Behavioral Ecology, Volume 25, Issue 5, September–October 2014, Pages 1240–1247,

Harris & Yalden (2008). *Mammals of the British Isles: Handbook, 4th Edition*. The Mammal Society, Southampton.

Hutson, A.M. and Paunovic, M. (2016) *Myotis alcaethoe*. The IUCN Red List of Threatened Species 2016 <https://www.iucnredlist.org/species/136680/518740> last accessed 07 November 2019

Institute of Lighting Professionals (2018) Guidance Note 08/18: Bats and artificial lighting in the UK.

<https://www.theilp.org.uk/documents/guidance-note-8-bats-and-artificial-lighting/> last accessed 27 November 2019

Matthews, F., Kubasiewicz, L.M., Gurnell, J., Harrower, C.A., McDonald, R.A., Shore, R.F. (2018) *A Review of the Population and Conservation Status of British Mammals. A report by the Mammal Society under contract to Natural England, Natural Resources Wales and Scottish Natural Heritage*. Natural England, Peterborough. ISBN 978-1-78354-494-3.

Mitchell-Jones, A.J. & McLeish, A.P. (2004) *The Bat Workers' Manual 3rd Edition*. Joint Nature Conservation Committee, Peterborough.

Natural England (2013) *Guidance on the capture and marking of bats under the authority of a Natural England Licence (WML-G39(05/13))*.

Sussex Bat Group (2019) *Bats In Sussex*  
<http://www.sussexbatgroup.org.uk/batsinsussex> last accessed 07 November 2019

Surrey Bat Group (2019) *Bats In Surrey*. Unpublished.

Wray, S., Wells, D., Long, E., Mitchell-Jones, T. (2010) Valuing Bats in Ecological Impact Assessment. In Practice, December 2010 pp 23-25.

## 8 Glossary

### 8.1 Glossary of Terms

**Table 8.1.1: Glossary of Terms**

| Term | Description                                    |
|------|--|
| EIA  | Environmental Impact Assessment                |
| ES   | Environmental Statement                        |
| EU   | European Union                                 |
| GAL  | Gatwick Airport Limited                        |
| IUCN | International Union for Conservation of Nature |
| PEIR | Preliminary Environmental Information Report   |

Annex 1

Trapping data

| Bat No. | Date       | Time (24hr) | Trap No. | Easting | Northing | Species          | Extracted by | Measured by | Determined by | Sex - M/F | Age - Juv/ Imm/ Ad | Breeding status (male) - Testes size 0-2 | Breeding status (female) - Par/ NP/ Preg/ Lact | Forearm (mm) | Total weight (g) | Bag weight(g) | Bat weight (g) | Tagged bat? Include bat number | Sample taken? | ID features, damage, parasites photos and samples collected |
|---------|------------|-------------|----------|---------|----------|------------------|--------------|-------------|---------------|-----------|--------------------|--|--|--------------|------------------|---------------|----------------|--------------------------------|---------------|---|
| 1       | 13/07/2020 | 22:16       | 1        | 522591  | 140332   | <i>M.bec</i>     | DH           | DH          | DH            | F         | Ad                 | N/A                                      | Lact   | 39.7         | 25.9             | 17.1          | 8.7            | 1J                             | N             |   |
| 2       | 13/07/2020 | 22:58       | 3        | 522522  | 140542   | <i>M.mys</i>     | DH           | DH          | DH            | M         | Ad                 | 0  | N/A  | 33.9         | 22.7             | 17.1          | 5.6            | N/A                            | N             |   |
| 3       | 13/07/2020 | 23:47       | 1        | 522591  | 140332   | <i>M.mys</i>     | DH           | DH          | DH            | M         | Ad                 | 1  | N/A  | 35.1         | 22.7             | 17.8          | 4.9            | N/A                            | N             |   |
| 4       | 13/07/2020 | 23:58       | 3        | 522522  | 140542   | <i>P.pip</i>     | DH           | DH          | DH            | M         | Ad                 | 2  | N/A  | 33           | 22.2             | 17.2          | 5              | N/A                            | N             |   |
| 5       | 13/07/2020 | 22:30       | 6        | 523034  | 140711   | <i>M.bec</i>     | KH           | KH          | RM            | F         | Ad                 | N/A                                      | Lactating                                      | 39.3         | 44.5             | 35.5          | 9              | 2J                             | N             |   |
| 6       | 13/07/2020 | 22:30       | 6        | 523034  | 140711   | <i>M.mys</i>     | KH           | RM          | RM            | M         | Juv                | 0  | N/a  | 36           | 21.5             | 15.5          | 6              | N/A                            | N             |   |
| 7       | 13/07/2020 | 23:45       | 6        | 523034  | 140711   | <i>P.aur</i>     | KH           | KH          | KH            | F         | Ad                 | N/A                                      | Lactating                                      | 35.8         | 46               | 38            | 8              | N/A                            | N             |   |
| 8       | 13/07/2020 | 00:00       | 5        | 523077  | 141047   | <i>M.mys/bra</i> | KH           | KH          | KH            | F         | Ad                 | N/A                                      | NP   | 31.4         | 24.5             | 19.5          | 5              | N/A                            | Y             | Straight tragus   |
| 9       | 14/07/2020 | 22:12       | 9        | 523579  | 142520   | <i>M.nat</i>     | DH           | DH          | DH            | M         | Ad                 | 0  | N/A  | 38.5         | 26.1             | 19.9          | 6.2            | N/A                            | N             |   |
| 10      | 14/07/2020 | 22:22       | 7        | 523544  | 142326   | <i>P.aur</i>     | DH           | DH          | DH            | M         | Ad                 | 1  | N/A  | 39           | 24.3             | 16.8          | 7.5            | N/A                            | N             |   |
| 11      | 14/07/2020 | 22:22       | 7        | 523544  | 142326   | <i>P.aur</i>     | DH           | DH          | DH            | F         | Ad                 | N/A                                      | Lac/post                                       | 36.9         | 22.8             | 14.8          | 8              | N/A                            | N             |   |
| 12      | 14/07/2020 | 22:22       | 7        | 523544  | 142326   | <i>M.bec</i>     | DH           | DH          | DH            | F         | Ad                 | N/A                                      | Lac/post                                       | 42.5         | 25.7             | 16.8          | 8.9            | 3J                             | N             |   |
| 13      | 14/07/2020 | 23:09       | 8        | 523461  | 142376   | <i>P.aur</i>     | DH           | DH          | DH            | M         | Ad                 | 0  | N/A  | 37.1         | 26.4             | 19            | 7.4            | N/A                            | N             |   |
| 14      | 14/07/2020 | 23:12       | 7        | 523544  | 142326   | <i>P.aur</i>     | DH           | DH          | DH            | F         | Ad                 | N/A                                      | Lac/post                                       | 39           | 25.7             | 17.5          | 8.2            | N/A                            | N             |   |
| 15      | 14/07/2020 | 23:47       | 9        | 523579  | 142520   | <i>P.aur</i>     | DH           | DH          | DH            | F         | Ad                 | N/A                                      | NP   | 39.6         | 26.5             | 17.5          | 9              | N/A                            | N             |   |
| 16      | 14/07/2020 | 00:30       | 7        | 523544  | 142326   | <i>P.aur</i>     | DH           | DH          | DH            | F         | Ad                 | N/A                                      | Lac/post                                       | 38           | 28.2             | 18.9          | 9.3            | N/A                            | N             |   |
| 17      | 14/07/2020 | 01:27       | 9        | 523579  | 142520   | <i>P.aur</i>     | DH           | DH          | DH            | F         | Ad                 | N/A                                      | Post lact                                      | 39.9         | 24               | 16.3          | 7.7            | N/A                            | N             |   |
| 18      | 14/07/2020 | 01:31       | 8        | 523461  | 142376   | <i>P.aur</i>     | DH           | DH          | DH            | F         | Ad                 | N/A                                      | Lac/post                                       | 39.6         | 25.7             | 17.7          | 8              | N/A                            | N             |   |
| 19      | 14/07/2020 | 01:31       | 8        | 523461  | 142376   | <i>P.pip</i>     | DH           | DH          | DH            | F         | Ad                 | N/A                                      | NP   | 31.5         | 19.8             | 14.8          | 5              | N/A                            | N             |   |
| 20      | 14/07/2020 | 02:15       | 8        | 523461  | 142376   | <i>M.mys</i>     | DH           | DH          | DH            | M         | Ad                 | 0  | N/A  | 34.2         | 22.8             | 17.8          | 5              | N/A                            | N             |   |
| 21      | 14/07/2020 | 21:45       | 11       | 523754  | 142294   | <i>P.aur</i>     | SR           | SR          | RM            | M         | Ad                 | 1  | N/A  | 39           | 27               | 19.5          | 8.5            | N/A                            | N             |   |
| 22      | 14/07/2020 | 22:30       | 10       | 523713  | 142145   | <i>P.aur</i>     | SR           | SR          | SR            | F         | Ad                 | N/A                                      | Post lact                                      | 38           | 26.5             | 18            | 8.5            | N/A                            | N             |   |
| 23      | 14/07/2020 | 22:30       | 10       | 523713  | 142145   | <i>M.bec</i>     | SR           | SR          | SR            | M         | Juv                | 0  | N/A  | 41           | 27               | 18.5          | 8.5            | N/A                            | N             |   |
| 24      | 14/07/2020 | 22:40       | 11       | 523754  | 142294   | <i>M.bec</i>     | SR           | SR          | SR            | F         | Ad                 | N/A                                      | Post lact                                      | 42           | 25.5             | 16            | 9.5            | 4J                             | N             |   |
| 25      | 14/07/2020 | 23:55       | 11       | 523754  | 142294   | <i>P.aur</i>     | RM           | RM          | RM            | F         | Ad                 | N/A                                      | NP   | 39           | 24               | 16.5          | 7.5            | N/A                            | N             |   |
| 26      | 14/07/2020 | 23:55       | 11       | 523754  | 142294   | <i>P.aur</i>     | RM           | RM          | RM            | F         | Ad                 | N/A                                      | Post lact                                      | 39           | 26               | 19            | 7              | N/A                            | N             |   |
| 27      | 14/07/2020 | 00:10       | 10       | 523713  | 142145   | <i>M.mys</i>     | RM           | RM          | RM            | M         | Ad                 | 1  | N/A  | 38           | 20.5             | 15.5          | 5              | N/A                            | N             |   |
| 28      | 14/07/2020 | 00:10       | 10       | 523713  | 142145   | <i>M.bec</i>     | RM           | RM          | RM            | F         | Ad                 | N/A                                      | Post lact                                      | 41           | 44               | 34.5          | 9.5            | 5J                             | N             |   |
| 29      | 14/07/2020 | 00:10       | 10       | 523713  | 142145   | <i>M.mys/bra</i> | RM           | RM          | RM            | F         | Juv                | N/A                                      | NP   | 40           | 50               | 44            | 6              | N/A                            | N             | No droppings left   |
| 30      | 14/07/2020 | 01:10       | 10       | 523713  | 142145   | <i>M.bec</i>     | SR           | RM          | RM            | M         | Juv                | 0  | N/A  | 41           | 46               | 38.5          | 7.5            | N/A                            | N             |   |

| Bat No. | Date       | Time (24hr) | Trap No. | Easting | Northing | Species          | Extracted by | Measured by | Determined by | Sex - M/F | Age - Juv/ Imm/ Ad | Breeding status (male) - Testes size 0-2 | Breeding status (female) - Par/ NP/ Preg/ Lact | Forearm (mm) | Total weight (g) | Bag weight(g) | Bat weight (g) | Tagged bat? Include bat number | Sample taken? | ID features, damage, parasites photos and samples collected |
|---------|------------|-------------|----------|---------|----------|------------------|--------------|-------------|---------------|-----------|--------------------|--|--|--------------|------------------|---------------|----------------|--------------------------------|---------------|---|
| 31      | 14/07/2020 | 01:10       | 10       | 523713  | 142145   | <i>P.aur</i>     | SR           | RM          | RM            | M         | Juv                | 0  | N/A  | 37           | 43.5             | 36.5          | 8              | N/A                            | N             |   |
| 32      | 15/07/2020 | 22:24       | 13       | 525776  | 140837   | <i>M.bec</i>     | DH           | DH          | DH            | M         | Ad                 | 0  | N/A  | 40           | 25               | 17.6          | 7.4            | 6J                             | N             |   |
| 33      | 15/07/2020 | 23:45       | 12       | 525744  | 140813   | <i>M.bec</i>     | DH           | DH          | DH            | M         | Ad                 | 0  | N/A  | 42.1         | 25.8             | 16.8          | 9              | 7J                             | N             |   |
| 34      | 15/07/2020 | 23:54       | 13       | 525776  | 140837   | <i>M.nat</i>     | DH           | DH          | DH            | F         | Juv                | N/A                                      | NP   | 39.5         | 21.6             | 14.7          | 6.9            | N/A                            | N             |   |
| 35      | 15/07/2020 | 01:20       | 14       | 525809  | 140892   | <i>M.bec</i>     | DH           | DH          | DH            | M         | Ad                 | 0  | N/A  | 41.5         | 25.4             | 16.8          | 8.6            | 8J                             | N             |   |
| 36      | 15/07/2020 | 01:54       | 13       | 525776  | 140837   | <i>M.nat</i>     | DH           | DH          | DH            | F         | Juv                | N/A                                      | NP   | N/A          | N/A              | N/A           | N/A            | N/A                            | N             | Released at trap  |
| 37      | 15/07/2020 | 02:15       | 13       | 525776  | 140837   | <i>P.aur</i>     | DH           | DH          | DH            | M         | Ad                 | 0  | N/A  | 34.9         | 24.9             | 17.8          | 7.1            | N/A                            | N             |   |
| 38      | 15/07/2020 | 22:45       | 16       | 525492  | 140681   | <i>M.mys</i>     | TE           | TE          | TE            | F         | Ad                 | N/A                                      | NP   | 34.6         |                  |               | 5.48           | N/A                            | Y             | Likely young of last year. 2x ticks on face. Pale skin      |
| 39      | 15/07/2020 | 01:35       | 15       | 525457  | 140631   | <i>M.mys</i>     | TE           | TE          | TE            | M         | Juv                | 0  | N/A  | 34.6         |                  |               | 5.31           | N/A                            | Y             | Wing mite E = black   |
| 40      | 15/07/2020 | 01:40       | 16       | 525492  | 140681   | <i>M.mys/bra</i> | TE           | TE          | TE            | F         | Ad                 | N/A                                      | Lact   | 35.4         |                  |               | 5.9            | N/A                            | N             | Likely whiskered  |
| 41      | 16/07/2020 | 23:34       | 20       | 521870  | 138624   | <i>P.aur</i>     | DH           | DH          | DH            | F         | Ad                 | N/A                                      | Lac/post                                       | 40.7         | 25.4             | 16.6          | 8.8            | N/A                            | N             |   |
| 42      | 16/07/2020 | 23:43       | 21       | 521898  | 138831   | <i>M.nat</i>     | DH           | DH          | DH            | F         | Ad                 | N/A                                      | NP   | 37.6         | 26.6             | 18.9          | 7.7            | N/A                            | N             |   |
| 43      | 16/07/2020 | 00:24       | 20       | 521870  | 138624   | <i>N.noc</i>     | DH           | DH          | DH            | M         | Ad                 | 2  | N/A  | 55.6         | 49.5             | 17.1          | 32.4           | N/A                            | N             |   |
| 44      | 16/07/2020 | 00:36       | 22       | 522184  | 138752   | <i>P.aur</i>     | DH           | DH          | DH            | F         | Ad                 | N/A                                      | Lac/post                                       | 39.5         | 29.1             | 20            | 9.1            | N/A                            | N             |   |
| 45      | 16/07/2020 | 00:36       | 22       | 522184  | 138752   | <i>P.aur</i>     | DH           | DH          | DH            | M         | Ad                 | 0  | N/A  | 39.2         | 26.6             | 18.9          | 7.7            | N/A                            | N             |   |
| 46      | 16/07/2020 | 00:36       | 22       | 522184  | 138752   | <i>P.aur</i>     | DH           | DH          | DH            | F         | Ad                 | N/A                                      | Lac/post                                       | 38.7         | 24.2             | 16.3          | 7.9            | N/A                            | N             |   |
| 47      | 16/07/2020 | 00:36       | 22       | 522184  | 138752   | <i>P.aur</i>     | DH           | DH          | DH            | F         | Ad                 | N/A                                      | NP   | 40.3         | 23.3             | 14.9          | 8.4            | N/A                            | N             |   |
| 48      | 16/07/2020 | 02:10       | 21       | 521898  | 138831   | <i>P.pip</i>     | DH           | DH          | DH            | F         | Ad                 | N/A                                      | Lac/post                                       | 32.4         | 23.2             | 17.8          | 5.4            | N/A                            | N             |   |
| 49      | 16/07/2020 | 02:10       | 21       | 521898  | 138831   | <i>P.pyg</i>     | DH           | DH          | DH            | F         | Ad                 | N/A                                      | Lac/post                                       | 31.2         | 22.1             | 16.8          | 5.3            | N/A                            | N             |   |
| 50      | 16/07/2020 | 02:25       | 22       | 522184  | 138752   | <i>P.aur</i>     | DH           | DH          | DH            | M         | Ad                 | 1  | N/A  | 36.6         | 24.3             | 16.9          | 7.4            | N/A                            | N             |   |
| 51      | 07/09/2020 | 20:51       | 2        | 522442  | 140472   | <i>P.aur</i>     | DH           | DH          | DH            | F         | Ad                 | N/A                                      | Post lact                                      | 39.5         | 24.1             | 16.4          | 7.7            | N/A                            | N             |   |
| 52      | 07/09/2020 | 22:21       | 2        | 522442  | 140472   | <i>P.aur</i>     | DH           | DH          | DH            | F         | Juv                | N/A                                      | NP   | 38           | 25.7             | 17.7          | 8              | N/A                            | N             |   |
| 53      | 07/09/2020 | 23:01       | 2        | 522442  | 140472   | <i>M.nat</i>     | DH           | DH          | DH            | F         | Ad                 | N/A                                      | NP   | 40.9         | 24.3             | 17.3          | 7              | N/A                            | N             |   |
| 54      | 07/09/2020 | 00:14       | 2        | 522442  | 140472   | <i>P.aur</i>     | DH           | DH          | DH            | F         | Ad                 | N/A                                      | NP   | 39.7         | 24.7             | 16.4          | 8.3            | N/A                            | N             |   |
| 55      | 07/09/2020 | 00:15       | 2        | 522442  | 140472   | <i>P.aur</i>     | DH           | DH          | DH            | F         | Juv                | N/A                                      | NP   | 40.2         | 26.2             | 16.8          | 9.4            | N/A                            | N             |   |
| 56      | 07/09/2020 | 00:51       | 2        | 522442  | 140472   | <i>P.aur</i>     | DH           | DH          | DH            | F         | Juv                | N/A                                      | NP   | 39.3         | 24.6             | 16.4          | 8.2            | N/A                            | N             |   |
| 57      | 07/09/2020 | 21:00       | 4        | 523053  | 140706   | <i>P.aur</i>     | KH           | KH          | KH            | F         | Ad                 | N/A                                      | NP   | 37           | 28               | 19.5          | 8.5            | N/A                            | N             |   |
| 58      | 07/09/2020 | 21:00       | 4        | 523053  | 140706   | <i>M.bec</i>     | KH           | KH          | KH            | M         | Juv                | 0  | N/A  | 37.1         | 24               | 15.5          | 9.5            | 1S                             | N             |   |
| 59      | 07/09/2020 | 21:00       | 4        | 523053  | 140706   | <i>M.bec</i>     | KH           | KH          | KH            | F         | Juv                | N/A                                      | NP   | 38.2         | 25               | 19            | 6              | 2S                             | N             |   |
| 60      | 07/09/2020 | 22:30       | 4        | 523053  | 140706   | <i>M.nat</i>     | KH           | KH          | KH            | M         | Juv                | 1  | N/A  | 35.8         | 24               | 16.5          | 7.5            | N/A                            | N             |   |
| 61      | 07/09/2020 | 22:30       | 4        | 523053  | 140706   | <i>P.aur</i>     | RM           | RM          | RM            | M         | Juv                | 1  | N/A  | 34.7         | 22.5             | 15.5          | 7              | N/A                            | N             |   |
| 62      | 07/09/2020 | 22:30       | 4        | 523053  | 140706   | <i>B.bar</i>     | KH           | KH          | RM            | M         | Juv                | 1  | N/A  | 35.8         | 25.5             | 18.5          | 7              | 3S                             | N             | Parasites   |
| 63      | 07/09/2020 | 22:45       | 6        | 523081  | 141049   | <i>P.aur</i>     | RM           | RM          | RM            | M         | Juv                | 1  | N/A  | 35           | 42.5             | 36            | 6.5            | N/A                            | N             |   |
| 64      | 07/09/2020 | 22:45       | 6        | 523081  | 141049   | <i>P.aur</i>     | RM           | RM          | RM            | F         | Juv                | N/A                                      | NP   | 33.5         | 25.5             | 18.5          | 7              | N/A                            | N             | Parasites   |
| 65      | 07/09/2020 | 22:45       | 6        | 523081  | 141049   | <i>P.aur</i>     | N/A          | N/A         | N/A           | N/A       | N/A                | N/A                                      | N/A  | N/A          | N/A              | N/A           | N/A            | N/A                            | N/A           | Escaped   |



| Bat No. | Date       | Time (24hr) | Trap No. | Easting | Northing | Species          | Extracted by | Measured by | Determined by | Sex - M/F | Age - Juv/ Imm/ Ad | Breeding status (male) - Testes size 0-2 | Breeding status (female) - Par/ NP/ Preg/ Lact | Forearm (mm) | Total weight (g) | Bag weight(g) | Bat weight (g) | Tagged bat? Include bat number | Sample taken? | ID features, damage, parasites photos and samples collected |
|---------|------------|-------------|----------|---------|----------|------------------|--------------|-------------|---------------|-----------|--------------------|--|--|--------------|------------------|---------------|----------------|--------------------------------|---------------|---|
| 66      | 07/09/2020 | 01:15       | 4        | 523053  | 140706   | <i>P.aur</i>     | KH           | KH          | KH            | M         | Juv                | 1  | N/A  | 35           | 38               | 30.5          | 7.5            | N/A                            | N             |   |
| 67      | 07/09/2020 | 01:15       | 4        | 523053  | 140706   | <i>M.nat</i>     | KH           | KH          | KH            | F         | Ad                 | N/A                                      | NP   | 36.5         | 26.5             | 18.5          | 8              | N/A                            | N             | Parasites   |
| 68      | 08/09/2020 | 21:32       | 7        | 523544  | 142326   | <i>P.aur</i>     | DH           | DH          | DH            | M         | Ad                 | 0  | N/A  | 37.4         | 23.1             | 14.7          | 8.4            | N/A                            | N             |   |
| 69      | 08/09/2020 | 21:32       | 7        | 523544  | 142326   | <i>P.aur</i>     | DH           | DH          | DH            | F         | Ad                 | N/A                                      | NP   | 38.1         | 22.1             | 14.8          | 7.3            | N/A                            | N             |   |
| 70      | 08/09/2020 | 22:18       | 7        | 523544  | 142326   | <i>P.aur</i>     | DH           | DH          | DH            | F         | Juv                | N/A                                      | NP   | 36.3         | 22.1             | 14.6          | 7.5            | N/A                            | N             |   |
| 71      | 08/09/2020 | 00:00       | 7        | 523544  | 142326   | <i>P.aur</i>     | DH           | DH          | DH            | M         | Juv                | N/A                                      | N/A  | 36.1         | 21.7             | 14.8          | 6.9            | N/A                            | N             |   |
| 72      | 08/09/2020 | 00:37       | 9        | 523579  | 142520   | <i>M.bec</i>     | DH           | DH          | DH            | F         | Juv                | N/A                                      | NP   | 41.7         | 25.7             | 17.2          | 8.5            | 4S                             | N             |   |
| 73      | 08/09/2020 | 22:55       | 10       | 523544  | 142326   | <i>P.pyg</i>     | KH           | KH          | KH            | F         | Juv                | N/A                                      | NP   | 28.5         | 24               | 19.5          | 4.5            | N/A                            | N             |   |
| 74      | 09/09/2020 | 20:57       | 13       | 525776  | 140837   | <i>M.nat</i>     | DH           | DH          | DH            | F         | Juv                | N/A                                      | NP   | 40.1         | 24               | 17.2          | 6.8            | N/A                            | N             |   |
| 75      | 09/09/2020 | 21:41       | 13       | 525776  | 140837   | <i>P.pip</i>     | DH           | DH          | DH            | M         | Juv                | 0  | N/A  | 30.2         | 23.7             | 19.8          | 3.9            | N/A                            | N             |   |
| 76      | 09/09/2020 | 22:15       | 12       | 525744  | 140813   | <i>M.nat</i>     | DH           | DH          | DH            | F         | Ad                 | N/A                                      | Post lact                                      | 37.6         | 23.7             | 16.9          | 6.8            | N/A                            | N             |   |
| 77      | 09/09/2020 | 22:15       | 12       | 525744  | 140813   | <i>M.mys</i>     | DH           | DH          | DH            | M         | Ad                 | 1  | N/A  | 34.5         | 25               | 19.8          | 5.2            | N/A                            | N             |   |
| 78      | 09/09/2020 | 22:52       | 12       | 525744  | 140813   | <i>M.nat</i>     | DH           | DH          | DH            | F         | Juv                | N/A                                      | NP   | 39.9         | 24.7             | 17.5          | 7.2            | N/A                            | N             |   |
| 79      | 09/09/2020 | 23:37       | 14       | 525809  | 140892   | <i>M.bec</i>     | DH           | DH          | DH            | F         | Juv                | N/A                                      | NP   | 40.3         | 25.7             | 17.6          | 8.1            | 5S                             | N             |   |
| 80      | 09/09/2020 | 00:19       | 14       | 525809  | 140892   | <i>M.mys</i>     | DH           | DH          | DH            | M         | Juv                | 0  | N/A  | 31.4         | 20.6             | 16.3          | 4.3            | N/A                            | N             |   |
| 81      | 09/09/2020 | 00:49       | 14       | 525809  | 140892   | <i>M.nat</i>     | DH           | DH          | DH            | M         | Ad                 | 0  | N/A  | 37.2         | 21.7             | 14.7          | 7              | N/A                            | N             |   |
| 82      | 09/09/2020 | 01:20       | 14       | 525744  | 140813   | <i>P.aur</i>     | DH           | DH          | DH            | F         | Ad                 | N/A                                      | NP   | 40           | 25.3             | 17.5          | 7.8            | N/A                            | N             |   |
| 83      | 09/09/2020 | 23:20       | 16       | 525492  | 140681   | <i>M.mys</i>     | TE           | TE          | TE            | F         | Ad                 | N/A                                      | Par  | 34.1         | N/A              | N/A           | 5.6            | N/A                            | N             | Small hole in right wing. No cusp on P4                     |
| 84      | 09/09/2020 | 23:50       | 15       | 525457  | 140631   | <i>P.aur</i>     | TE           | TE          | TE            | F         | Ad                 | N/A                                      | Par  | 40.3         | N/A              | N/A           | 9              | N/A                            | N             | No droppings  |
| 85      | 10/09/2020 | 22:05       | 24       | 522610  | 139058   | <i>P.aur</i>     | DH           | DH          | DH            | M         | Juv                | N/A                                      | N/A  | 36.1         | 27.6             | 19.8          | 7.8            | N/A                            | N             |   |
| 86      | 10/09/2020 | 22:05       | 24       | 522610  | 139058   | <i>P.aur</i>     | DH           | DH          | DH            | F         | Ad                 | N/A                                      | Post lact                                      | 39.8         | 22.4             | 17.6          | 4.8            | N/A                            | N             |   |
| 87      | 10/09/2020 | 22:10       | 25       | 522716  | 138986   | <i>P.aur</i>     | DH           | DH          | DH            | M         | Ad                 | 1  | N/A  | 37.6         | 27.8             | 19.4          | 8.4            | N/A                            | N             |   |
| 88      | 10/09/2020 | 22:59       | 23       | 522673  | 138816   | <i>M.nat</i>     | DH           | DH          | DH            | F         | Ad                 | N/A                                      | NP   | 38.2         | 26.4             | 19.4          | 7              | N/A                            | N             |   |
| 89      | 10/09/2020 | 01:28       | 25       | 522716  | 138986   | <i>P.aur</i>     | DH           | DH          | DH            | F         | Ad                 | N/A                                      | NP   | 38.2         | 25.7             | 17.7          | 8              | N/A                            | N             |   |
| 90      | 04/05/2021 | 21:23       | 6        | 522543  | 140426   | <i>M.bec</i>     | DH           | DH          | DH            | F         | Ad                 | N/A                                      | NP   | 42.9         | 25.1             | 17.2          | 7.9            | 1M                             | N             |   |
| 91      | 04/05/2021 | 21:27       | 4        | 522458  | 140462   | <i>P.aur</i>     | DH           | DH          | DH            | F         | Ad                 | N/A                                      | NP   | 39.5         | 27.8             | 21.1          | 6.7            | N/A                            | N             |   |
| 92      | 04/05/2021 | 22:17       | 6        | 522543  | 140426   | <i>M.mys/bra</i> | DH           | DH          | DH            | F         | Ad                 | N/A                                      | Par  | 33.5         | 20.8             | 17.1          | 3.7            | N/A                            | N             |   |
| 93      | 04/05/2021 | 22:20       | 4        | 522458  | 140462   | <i>M.bec</i>     | DH           | DH          | DH            | F         | Ad                 | N/A                                      | Par  | 42.5         | 25.4             | 17.2          | 3.2            | 2M                             | N             |   |
| 94      | 04/05/2021 | 22:20       | 4        | 522458  | 140462   | <i>M.nat</i>     | DH           | DH          | DH            | F         | Ad                 | N/A                                      | Par  | 40.5         | 23.6             | 16.4          | 7.2            | N/A                            | N             |   |
| 95      | 06/05/2021 | 22:15       | 26       | 522669  | 138383   | <i>M.nat</i>     | TE           | TE          | TE            | M         | Imm                | 0  | N/A  | 38.45        | N/A              | N/A           | 7.33           | N/A                            | N             |   |
| 96      | 06/05/2021 | 23:50       | 27       | 522788  | 138370   | <i>M.dau</i>     | TE           | JL          | TE            | M         | A                  | 0  | N/A  | 37.9         | N/A              | N/A           | 8.08           | N/A                            | N             |   |
| 97      | 07/05/2021 | 22:00       | 1        | 523034  | 140733   | <i>P.aur</i>     | TE           | JL          | TE            | F         | Ad                 | N/A                                      | Par  | 39.2         | N/A              | N/A           | 6.57           | N/A                            | N             | Minor wing damage (hole with diameter <2mm), generally calm |

| Bat No. | Date       | Time (24hr) | Trap No. | Easting | Northing | Species       | Extracted by | Measured by | Determined by | Sex - M/F | Age - Juv/ Imm/ Ad | Breeding status (male) - Testes size 0-2 | Breeding status (female) - Par/ NP/ Preg/ Lact | Forearm (mm) | Total weight (g) | Bag weight(g) | Bat weight (g) | Tagged bat? Include bat number | Sample taken? | ID features, damage, parasites photos and samples collected |
|---------|------------|-------------|----------|---------|----------|---------------|--------------|-------------|---------------|-----------|--------------------|--|--|--------------|------------------|---------------|----------------|--------------------------------|---------------|---|
| 98      | 07/05/2021 | 23:00       | 1        | 523034  | 140733   | <i>P. aur</i> | TE           | JL          | TE            | F         | Ad                 | N/A                                      | Par  | 40           | N/A              | N/A           | 7.59           | N/A                            | N             | Bald patch on abdomen indicative of mating, very active     |

Annex 2

Home Range Analysis

Table 8.1.2 Home Range Analysis

| Bat number | 50% KDE (ha) | 95% KDE (ha) | 100% MCP (ha) |
|------------|--------------|--------------|---------------|
| 1J         | 0.09         | 2.21         | 28.37         |
| 2J         | 4.47         | 36.35        | 32.71         |
| 3J         | 0.48         | 15.61        | 183.49        |
| 4J         | 0.22         | 17.12        | 507.07        |
| 5J         | 4.03         | 40.87        | 58.77         |
| 6J         | 0.82         | 37.74        | 289.73        |
| 7J         | 5.51         | 64.76        | 388.46        |
| 8J         | 2.40         | 51.93        | 262.23        |
| 1S         | N/A          | N/A          | 5.04          |
| 2S         | 2.64         | 36.74        | 286.85        |
| 3S         | 6.01         | 107.70       | 1470.98       |
| 4S         | 1.67         | 23.40        | 290.99        |
| 5S         | N/A          | N/A          | N/A           |
| 1M         | 1.29         | 11.31        | 10.39         |
| 2M         | 0.87         | 9.44         | 11.09         |

Annex 3

Figures

















