Lower Thames Crossing

6.3 Environmental Statement Appendices
Appendix 8.8 – Bats

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Lower Thames Crossing

6.3 Environmental Statement Appendices
Appendix 8.8 – Bats

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1 Introduction

1.1.1 This document presents the results of the bat desk study and field surveys carried out between 2017 and 2022 to inform the Environmental Impact Assessment of the A122 Lower Thames Crossing (the Project). It forms an appendix to Chapter 8: Terrestrial Biodiversity of the Environmental Statement (Application Document 6.1) for the Project.

2 Legislation and conservation status

2.1.1 In the UK, all bat species are protected under Schedule 5 of the Wildlife and Countryside Act 1981 (as amended). The Wildlife and Countryside Act 1981 transposes into UK law the Convention on the Conservation of European Wildlife and Natural Habitats 1979 (commonly referred to as the Bern Convention). All bat species in the UK are also European Protected Species under Schedule 2 of the Conservation of Habitats and Species Regulations 2017 (hereafter referred to as the Habitats Regulations).

2.1.2 Of the species identified during the desk study and collection of field survey data for the Project, four are further protected as Species of Principal Importance (SoPIs) for the purpose of conserving biodiversity in England under Section 41 of the Natural Environmental and Rural Communities Act 2006: barbastelle *Barbastella barbastellus*, noctule *Nyctalus noctula*, brown long-eared bat *Plecotus auritus* and soprano pipistrelle *Pipistrellus pygmaeus*. Barbastelle is also listed on Annex II of the European Union Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora (the Habitats Directive).

2.1.3 Kent County Council is in the process of changing its Biodiversity Action Plan (BAP; Kent Biodiversity Action Plan Steering Group, 1997) to a Biodiversity Strategy (Kent County Council, 2019); a consultation on this was held in 2019. The draft strategy (Kent County Council, 2019) lists five bat species as priority species (barbastelle, soprano pipistrelle, brown long-eared bat, Bechstein's bat *Myotis bechsteinii and* noctule) as well as one indicator species serotine *Eptesicus serotinus*. The Essex BAP (Essex Biodiversity Action Plan Steering Group, 1999) lists two bat species (common pipistrelle *Pipistrellus pipistrellus* and soprano pipistrelle). The Thurrock BAP (Thurrock Council, 2007) mentions eight bat species that have been found within the Thurrock area and aims to protect them all, with specific mention of Natterer's bat *Myotis nattereri*, Daubenton's bat *Myotis daubentonii and* brown long-eared bat, and pipistrelle bats.

3 Methodology

3.1 Desk study

3.1.1 A desk study was carried out in 2017, and subsequently updated in 2020 and 2022, that considered all protected species records since 2007 which included records of bats within 5km of the Order Limits. Records were requested from Kent & Medway Biological Records Centre (KMBRC; 2022), Essex Wildlife Trust Biological Records Centre (EWTBRC; 2020), Essex Field Club (2022) and Greenspace Information for Greater London (2022).

3.1.2 The locations of designated sites of international, national and local importance for biodiversity were also obtained within 30km, 2km and 500m of the Order Limits, respectively. Citations for these sites, which provide information on the reasons for their designation, were reviewed to ascertain whether bats were included as interest features for any of the designated sites.

3.2 Survey scope

3.2.1 The survey boundary for bats, within which field surveys were carried out, consisted of the area within the Order Limits and areas within up to 2km from the Order Limits. The extension to the Order Limits in 2021 to include utilities diversions did not require any additional bat surveys. Within this, precise areas surveyed varied depending on the nature of the survey work being carried out. The details of, and justification for, these survey areas are summarised in Table 3.1 and provided in further detail within the survey-specific methodologies below. The survey areas are also illustrated in Figures 8.23, 8.24, and 8.25 (Application Document 6.2).

Table 3.1 Bat survey scope

Survey activity	Survey seasons, frequency and duration	Survey area	Survey purpose
Walked transect activity surveys (manned)	Once a month from April to October 2018, plus one additional dawn survey between June and August 2018. Dusk survey start time: sunset End time: two to three hours after sunset Dawn survey start time: two hours before sunrise End time: sunrise	A representative sample of habitats within and/or near the Project or areas of importance for bats in the vicinity of the Project.	To determine the bat species assemblage present and identify areas of high bat activity.
Transect point activity surveys (automated static detector)	Deployed for five consecutive nights each month from April to October 2018. Start time: 30 minutes before sunset End time: 30 minutes after sunrise		
Crossing point activity surveys (automated static detector)	Deployed for five consecutive nights each month from April to October 2018, and again at 21 locations from April to October 2019. Start time: 30 minutes before sunset End time: 30 minutes after sunrise	Linear features identified along the route of the Project that may be impacted by the Project.	To determine important linear features used by commuting bats that would be impacted by the Project.
A2 and High Speed 1 (HS1) corridor activity surveys (manned)	One survey in May 2019 and two in July 2019. Start time: sunset End time: two to three hours after sunset	On the A2 between Shorne Woods Country Park and Rochester & Cobham Park Golf Club.	To determine whether bats were actively crossing the HS1 railway and A2 road to move between habitats on either side of the A2.
Swarming surveys (manned)	Assessments carried out in October 2019. Start time: two hours after sunset End time: five hours after sunset	Surveys carried out at Muggins Chalk Pit and Hangman's Wood and Deneholes SSSI.	To determine if these sites are valuable swarming and hibernation sites as they would be impacted by the Project.

Survey activity	Survey seasons, frequency and duration	Survey area	Survey purpose
Tree assessment surveys (manned)	Ground assessments and further surveys were carried out at any time of the year in 2018, 2019, 2020, 2021 and 2022 (ground assessments undertaken during winter where possible).	Trees within the Order Limits plus a 50m buffer.	To determine whether trees that would be impacted by the Project are used by roosting bats.
Woodland assessment surveys (manned)	At any time of the year. Carried out between January 2019 and December 2019.	Woodland blocks within the Order Limits plus a 50m buffer.	To determine the level of roost resource provided for bats by woodlands that would be impacted by the Project.
Structure assessment surveys (manned)	Assessments and further surveys, as required, were conducted between 2018 and 2019.	Structures within, and adjacent to, the Order Limits to the Project that may be impacted by the proposed works.	To determine whether structures that would be impacted by the Project are used by roosting bats.
Emergence and re-entry surveys of trees and buildings (manned)	Emergence surveys began 15 minutes before sunset and continued for 1.5 to two hours after sunset. Re-entry surveys began two hours before sunrise and continued until up to 15 minutes after sunrise. Emergence/re-entry surveys were carried out in May 2019, and May/June 2021. Dusk survey (emergence) start time: 15 minutes before sunset End time: 1.5 to two hours after sunset Dawn survey (re-entry) start time: two hours before sunrise End time: 15 minutes after sunrise	Surveys on structures of low, moderate or high bat roosting suitability that may be impacted by the Project. Surveys on trees of moderate or high suitability that may be impacted by the Project.	To determine whether bats are roosting within features that would be impacted by the Project.

3.3 Activity surveys

3.3.1 Activity surveys comprised walked transects and use of automated static detectors. The purpose of the survey design was to look at flight lines and get information on bat activity within specific areas to inform the Environmental Statement and help determine the relevant mitigation that would be required.

Walked transect activity surveys

3.3.2 Transect routes were selected within habitats and landscape features that would be affected by the Project, and that could provide suitable bat habitat. Routes were initially identified through a detailed review of Ordnance Survey mapping, high resolution aerial imagery, desk study data and Phase 1 Habitat Survey data. They were then reviewed to ensure the identified routes were practical, safe and included a representative sample of appropriate habitats.

3.3.3 As a result of this process, 27 transect routes were identified for activity surveys. The transect routes are detailed in Figure 8.25 (Application Document 6.2) and in Table B.1 in Annex B, which include descriptions of the habitat types and locations of each transect. Transect routes varied in length depending on the nature of the habitats and land access permissions.

3.3.4 The starting point and direction of travel were varied over the course of the survey season (where practical) to ensure all parts of the route were walked at different times over of the survey period. Start and end times of the walked surveys can be found in Table 3.1. Transect routes were walked at a constant pace for the entire duration of the survey by a pair of surveyors.

3.3.5 Surveyors used Batlogger M bat detectors, set to manual recording[1], to listen for and record bat echolocation calls. Each pair of surveyors also had a digital voice recorder to record accompanying information for each bat recording, including the time and nature of activity, and an iPad, on which the transect route was shown. Recordings made by the Batlogger M bat detectors were manually identified by experienced analysts using BatExplorer sound analysis software.

Transect point activity surveys

3.3.6 Walked surveys of each transect route were complimented by deployment of Song Meter SM4BAT FS automated static bat detectors using SMM-U1 microphones. Depending on the length of the transect and the variation and quality of the habitats, between one and four automated static bat detectors were deployed in suitable locations along the transect route and left in place for five days. The locations of the automated static detectors were determined according to a professional judgement sampling protocol, as other, more randomised detector deployment strategies were not practical. This was due to access limitations, risk of interference from the public and types of land use.

[1] Under the manual setting, the ‘Batlogger M’ bat detector continually ‘listens’ for bat echolocation calls but a recording is only made when manually triggered by the surveyor.

3.3.7 The selection of automated static detector locations were based on the following considerations; ensuring automated static detectors were distributed across the transect to gain maximum representative sampling of habitats to determine bat activity; and positioned within or adjacent to a range of habitats within and around the Order Limits, ensuring all broad habitats received coverage from the automated static detectors.

3.3.8 Figure 8.25 (Application Document 6.2) and Table B.1 in Annex B details the locations of the automated static detectors. The automated static detectors were deployed during the daytime and left in place for a minimum of five consecutive nights (including the night of the walked transect survey for that month). Start and end times of automated/static surveys can be found in Table 3.1. Microphones were attached to existing features (i.e. tree branches) at a height of at least 1.5m and at a 45° downwards angle. The automated static detectors were programmed to turn on 30 minutes before sunset and record throughout the night until 30 minutes after sunrise.

Crossing point activity surveys

3.3.9 Crossing point surveys were conducted on linear features that would be severed by the Project. The surveys aimed to identify whether the crossing points were used by commuting bats. A total of 21 crossing point survey locations were selected from aerial imagery and Phase 1 Habitat Survey data (see Figure 8.25 (Application Document 6.2) for crossing point locations).

3.3.10 The crossing points were surveyed using Song Meter SM4BAT FS automated static bat detectors using SMM-U1 microphones. Depending on the length of the crossing point and the variation and quality of the habitats, between one and five automated static bat detectors were deployed and left in place for five days each month during the survey season (see Table 3.1). Start and end times of crossing point surveys are also detailed in Table 3.1.

3.3.11 Fourteen crossing points were surveyed in 2018, and the remaining seven crossing points were identified and surveyed in 2019 following amendments to the route alignment of the Project. In 2019, additional static detectors were deployed at one of crossing points previously surveyed in 2018 as a result of these amendments.

3.3.12 Bat activity was calculated in relation to sunset times to provide an understanding of times bats used crossing points. To draw further conclusions from the crossing point data, the average emergence times of bat species (Jones & Rydell, 1994) were compared with the data collected.

A2 and HS1 corridor activity surveys

3.3.13 Activity surveys of the A2 road and HS1 railway corridors between Shorne Woods Country Park and Rochester & Cobham Park Golf Club were carried out. These aimed to identify functionally connected habitats that would be severed by the Project.

3.3.14 The following survey locations and attention directions were identified:

a. Park Pale Road to the north of the A2, looking south over the road.

b. The footpath at the northern edge of Rochester & Cobham Park Golf Club south of the A2, looking north.

c. Park Pale bridge (crosses over the A2 between Shorne Woods Country Park and Rochester & Cobham Park Golf Club), looking west.

3.3.15 Two surveyors were positioned at each of the first two locations for each survey. The Park Pale bridge location was only used and manned during the early July 2019 survey.

3.3.16 Three surveys were carried out, following the methodology in Table 3.1 and paragraph 4.3.5.

Swarming surveys

3.3.17 Swarming surveys were carried out to identify whether any habitats within the Order Limits were used by bats for autumn swarming.

3.3.18 Two locations, Muggins Hill Chalk Pit and East Tilbury Battery, were identified as having potential to be used by swarming bats. Additionally, Hangman's Wood and Deneholes SSSI is designated for hibernating bats. All three areas contained features suitable for hibernating bats and were therefore identified for survey due to the tendency of some bat species to carry out autumn swarming at sites that are then later used for hibernation (Collins, 2016).

3.3.19 Swarming surveys were conducted in line best practice (Collins, 2016), with one survey undertaken at each site during October 2019, following the methodology in Table 3.1 and paragraph 4.3.5.

3.4 Analysis methodology of data from automated static bat detectors

3.4.1 Recordings made by automated static bat detectors were analysed using the automated identification software Kaleidoscope Pro[2] (auto ID) with the Bats of Europe classifiers[3] selected for the UK region only. Despite the high quality of Kaleidoscope data analysis, all bat analysis software have varying percentages of incorrect or uncertain identifications. To address this, a verification procedure was conducted, whereby either 1%, 5% or 100% (depending on the number of recordings) of each 2018 and 2019 dataset (recordings of each species, species group, noise, or noID as classified by the auto ID) was verified manually. The percentage and results of the verification for each dataset are presented in Table 3.2.

[2] Version 5.0.3.
[3] Version 4.3.0.

3.4.2 Based on the findings of the verification of the 2018 and 2019 data, in order to handle and suitably interpret the large quantities of data from the automated static bat detectors, recordings were collated into the following simplified species groups. These were then also applied to the 2019 data. The species that fall within each species group (listed below) are detailed in Table 3.2:

a. Pipistrelle species group

b. Big bat species group

c. Woodland bat species group

3.4.3 Further detail is provided within Annex A.

3.4.4 The number of bat passes per night were then calculated to provide an indication of the proportionate activity of each simplified species group at each static detector location.

Table 3.2 Simplified species groups and verification protocols used with auto ID results, and verification findings

Auto ID category		Total calls (% verified)	Verification findings	Simplified species group
Abbreviation	**Meaning**			
PIPPIP	Common pipistrelle	175,051 (1%)	100% correct identifications	Pipistrelle species group
PIPPYG	Soprano pipistrelle	74,089 (1%)	100% correct identifications	
PIPNAT	Nathusius' pipistrelle *Pipistrellus nathusii*	7,055 (1%)	26.36% correct identifications 100% correct to species group	
NYCNOC	Noctule	8,036 (5%)	61.22% species correct 65.95% correct to species group	Big bat species group
NYCLEI	Leisler's bat *Nyctalus leisleri*	9,492 (5%)	12.7% correct to species level 81.8% correct to species group	
EPTSER	Serotine	705 (5%)	0% correct to species level but 100% correct to species group	
PLEAUR	Brown long-eared bat	1,753 (5%)	19.4% of the calls correct to species group	Woodland bat species group
BARBAR	Barbastelle	250 (100%)	0.4% correct to species level and group	
MYOALC	Alcathoe bat *Myotis alcathoe*	Grouped for verification as *Myotis* species 1,601 (5%)	Grouped as *Myotis* species during the verification process 94.9% correct to this genus level	
MYOBEC	Bechstein's bat			
MYOBRA	Brandt's bat *Myotis brandtii*			
MYODAU	Daubenton's bat			
MYOMYS	Whiskered bat *Myotis mystacinus*			
MYONAT	Natterer's bat			

3.5 Roost surveys

Tree assessment surveys

3.5.1 An inspection of individual trees within the Order Limits plus a 50m buffer was carried out to identify if they had bat roosting suitability. Larger areas of woodland were assessed separately, as detailed below.

3.5.2 Specific ground-level tree inspections were carried out in 2018, 2019, 2020 and 2021. Inspections were carried out by suitably qualified ecologists assessing trees for suitable roost features.

3.5.3 Each suitable roost feature was assessed for its suitability to roosting bats in line with guidance from the Bat Conservation Trust (BCT) and categorised as detailed in Table 3.3 (adapted from Bat Surveys for Professional Ecologists: Good Practice Guidelines, Table 4.1, Collins, 2016).

Table 3.3 Tree and structure suitability assessment criteria

Suitability	Description
Negligible	Habitat features onsite with no features likely to be used by roosting bats
Low	A tree or structure of sufficient size and age to contain potential roost features but with none seen from the ground, or feature seen with only very limited roosting potential.
Moderate	A tree or structure with one or more potential roost sites that could be used by bats due to their size, shelter, protection, conditions[4] and surrounding habitat, but unlikely to support a roost of high conservation status (with respect to roost type only – the assessments in this table are made irrespective of species conservation status).
High	A tree or structure with one or more potential roost sites that are obviously suitable for use by larger numbers of bats on a more regular basis and potentially for longer periods of time due to their size, shelter, protection, conditions and surrounding habitat.
Confirmed roost	A tree or structure with a roost identified within it through bats or signs of bats within it.

3.5.4 Trees are shown in Figure 8.23 (Application Document 6.2).

3.5.5 Recommendations for further surveys were then provided based on the roost suitability assessment and the nature and location of the suitable roost feature(s). In line with BCT guidelines, further surveys were carried out only for suitable roost features assessed as being of moderate or high roost suitability. Further surveys were carried out using the following hierarchy of preference, depending on the nature of the potential roost feature.

a. Endoscope inspection from the ground or from a ladder

i. Further surveys in the form of endoscope inspections from the ground or from a ladder were carried out by a pair of surveyors, where at least

[4] For example, in terms of temperature, humidity, height above ground level, light levels or levels of disturbance.

one surveyor was an ecologist experienced in bat tree inspections and held a minimum of a Natural England Class 2 bat licence[5]. A record was made regarding any changes to the feature since the preliminary assessment, including any changes to the suitability of the feature for roosting bats.

b. A climbed inspection

   i. Further surveys in the form of a climbed tree inspection were undertaken between July 2018 and July 2022 by a pair of experienced and suitably qualified surveyors, where at least one surveyor was an ecologist experienced in bat tree inspections and held a minimum of a Natural England Class 2 bat licence[6].

c. Emergence/re-entry surveys

   i. As detailed in paragraph 3.5.15

Woodland assessment surveys

3.5.6 Where substantial woodland blocks would have required detailed assessment of individual trees for roosting bat suitability, it was not deemed practical to carry out detailed tree assessment. A technical note (see Annex C, section Annex C) detailing the proposed alternative approach for areas such as these was produced. This technical note is summarised below:

a. Detailed assessment from the ground of all the trees within the order limits, with further roost surveys as required was carried out, with the type and suitability of any potential roost features recorded.

b. The results of this exercise provided an indication of the nature of the overall bat tree roost resources within the woodland.

c. Aerial photographs were considered, and a walkover survey of the area carried out to assess the size and connectivity of the woodland block, as well as the type and quality of its surrounding habitats.

3.5.7 This information was combined with information from other activity surveys carried out in the woodland blocks to enable an assessment of the suitability of the woodland as a resource for bats. As there are currently no guidelines relating to this type of assessment, professional judgement was used to determine the value of the woodland for bats. The woodlands were categorised as either negligible, low, moderate or high value resources for bats, using the definitions provided in Table 3.3 as a guide.

3.5.8 Locations of woodland blocks are shown in Figure 8.23 (Application Document 6.2).

[5] Nick Downs (2015-11591-CLS-CLS (level 3); 2015-11592-CLS-CLS (level 4)), Patrick James (2015-14826-CLS-CLS), Ellen Quinton (2017-31734-CLS-CLS).
[6] Chris Long (2015-15643-CLS-CLS).

Structure assessment surveys

3.5.9 Structure assessments for suitability for roosting bats were proposed for buildings and structures identified within the Order Limits plus a 50m buffer, that were considered likely to be subject to significant levels of additional disturbance, above and beyond that which they already experience, as a result of the Project.

3.5.10 Structure assessments were carried out in May 2018, and May/June 2021. Buildings and structures were inspected internally and externally, where landowner permission was granted and health and safety considerations allowed, to identify any features that may be used by bats to gain access to the structure and any areas that may be used by roosting bats. These features were then assessed to determine their potential suitability for use by roosting bats. Inspections were carried out by a pair of surveyors, and at least one surveyor in the pair was an ecologist experienced in bat building inspections and held a minimum of a Natural England Class 2 bat licence[5]. For all assessed structures, the following information was recorded:

a. General information on the date and time of the survey, the surveyors and the weather conditions.

b. Details relating to the building including its build, design, materials, surrounding habitat and any other distinguishing features.

c. Details relating to potential roost access points and/or roost features including the location (including height and aspect) and dimensions of access points as well as any evidence indicating use by bats.

3.5.11 Individual structures are detailed in Table D.1 and Table D.2 in Annex D and their locations are shown in Figure 8.24 (Application Document 6.2). The structures were assessed and categorised in line with guidance from the BCT (Collins, 2016), as detailed in Table 3.3.

3.5.12 Recommendations for further surveys were then provided based on the roost suitability assessment. Further surveys consisted of emergence/re-entry surveys, the number of which depended on the bat potential suitability category of the structure.

Emergence/re-entry surveys

3.5.13 Emergence/re-entry surveys were carried out on trees categorised as moderate or high suitability for use by roosting bats that could not be surveyed using an endoscope and/or tree climbing. They were also carried out on buildings categorised as low, moderate or high suitability for use by roosting bats.

3.5.14 During the emergence/re-entry surveys, it was ensured that all potential roost features/access points were visible to at least one surveyor.

3.5.15 Emergence surveys began 15 minutes before sunset and continued for one and a half to two hours after sunset. Re-entry surveys began two hours before sunrise and continued until up to 15 minutes after sunrise. Emergence/re-entry surveys were carried out between May and September with at least two weeks between each survey visit, following the methodology in Table 3.1 and Section 3.5. Emergence/re-entry survey metadata for trees and structures are provided in Annex D and Annex E.

4 Results

4.1.1 The following results are presented separately for the two geographical regions of the Project: south of the River Thames and north of the River Thames.

4.2 South of the River Thames

Desk study results

Habitats

4.2.1 The area south of the River Thames was characterised by a large extent of ancient semi-natural broadleaved woodland. However, the majority of this habitat was located outside of the Order Limits, with predominantly agricultural land consisting improved grassland and a network of hedgerows located within. These habitats were all likely to be used by roosting and foraging bats, particularly where there was suitable connectivity in the form of linear features such as hedgerows.

Designated sites

4.2.2 The Greater Thames Estuary including the South Thames Estuary and Marshes SSSI (Natural England, 1991) was located within the Order Limits. The marsh and wetland habitats were considered suboptimal for bats due to reduced cover and the greater degree of exposure to the elements in the open landscape along the estuary. No statutory designated sites for which bats were listed as a notifiable feature are present within 2 km of the order limits.

Non-statutory designated sites

4.2.3 A review of the desk study identified a single non-statutory designated sites for which bats were listed: Walderslade Woods Local Widlife Site. This is designated in part for it use by bats.

Desk study records

4.2.4 The desk study (KMBRC, 2020) returned 406 records of bats. These records identified 12 species and included both activity and roost records. The results of this data search are summarised in Table 4.1.

4.2.5 For relevant species, a summary of the local (Kent; Young *et al.*, 2015) and national (BCT, 2018) population trends are provided in Table 4.2.

Hibernation roosts

4.2.6 Records of hibernation roosts were returned for five species, from four species groups. The majority of the hibernation roost records were of brown long-eared bat, Daubenton's bat and Natterer's bat, with common pipistrelle and Nathusius' pipistrelle also returned.

4.2.7 Brown long-eared bat hibernation roosts were recorded from eight locations within or immediately adjacent to the Order Limits. These were located in and near to former air raid shelters within Shorne Woods Country Park, part of Shorne and Ashenbank Woods SSSI, which are known hibernation sites for this species (KMBRC, 2020). The hibernation roost records consisted of between one and four individuals.

4.2.8 Natterer's bat hibernation roosts were recorded from five locations. This included 21 records (each consisting of between one and five individuals) located within or immediately adjacent to the Order Limits, near to Shorne Woods Country Park. Three desk study records were located in or near to former air raid shelters within Shorne Woods Country Park, part of Shorne and Ashenbank Woods SSSI, which are known hibernation sites.

4.2.9 Muggins Chalk Pit, a disused quarry located within the order limits close to Southern Valley Golf Club, returned 57 hibernation records from brown long-eared bat, Natterer's bat, Daubenton's bat and whiskered bat/Brandt's bat/Alcathoe bat.

4.2.10 The remaining hibernation roost records related to between one and two individuals of small Myotis bat species (whiskered bat/Brandt's bat/Alcathoe bat), with nine records located within or immediately adjacent to the Order Limits, near Shorne Woods Country Park.

Maternity roosts

4.2.11 Maternity roosts were identified for five species and one species group, the closest located approximately 300m east of the Order Limits, comprising Leisler's bat and common pipistrelle/soprano pipistrelle records.

Table 4.1 Summary of desk study data south of the River Thames

Species/group	Number of records				
	Activity[7]	Hibernation roost[8]	Maternity roost[9]	Unknown roost[10]	Other[11]
Brandt's bat	-	-	-	-	1
Brown long-eared bat	8	38	1	14	20
Common pipistrelle	59	4	2	12	37
Daubenton's bat	3	48	3	2	10
Kuhl's pipistrelle *Pipistrellus kuhlii*	-	-	-	-	1
Leisler's bat	12	-	1	1	8
Nathusius' pipistrelle	8	1	-	-	5
Natterer's bat	2	42	-	-	7
Noctule	24	-	-	-	2
Serotine	13	-	-	-	2
Soprano pipistrelle	34	-	2	13	43
Whiskered bat	-	-	-	-	3
Unidentified bat	1	5	-	1	1
Common/soprano pipistrelle	14	-	3	4	5
Long-eared bat spp. (several species)	3	-	-	3	5

[7] Activity records are those records where bats were observed or heard in flight.
[8] Hibernation roost records are those where bats were found to be hibernating. Hibernation roosts might be used between November and March.
[9] Maternity roost records are those where bats were found to be rearing young. Maternity roosts might be used between May and August.
[10] 'Unknown roost' includes those records where the type of roost was not specified.
[11] 'Other' records consist of those that do not match the other categories provided and include records such as grounded or dead bats, captured/handled bats (e.g. from harp traps) and bat signs, as well as those where information on the nature of the record was not provided.

Species/group	Number of records				
	Activity[7]	Hibernation roost[8]	Maternity roost[9]	Unknown roost[10]	Other[11]
Myotis spp.	8	1	-	1	-
Nyctalus spp.	1	-	-	-	-
Pipistrellus spp.	9	-	-	-	4
Whiskered/Brandt's bat	-	8	-	-	-
Whiskered/Brandt's/ Alcathoe bat	-	11	-	-	-

Table 4.2 Local (Kent) and national population trends of relevant bat species

Conservation status	Species	Local (Kent) population trend	National population trend
Habitats Directive Annex II species	Barbastelle	Single unconfirmed record from mid-Kent in 2009.	Rare
SoPIs	Nathusius' pipistrelle	Migratory with more frequent recordings than areas further north. First maternity roost identified in 2012 in south-east Kent.	Rare but widespread
	Brandt's bat/whiskered bat	Whiskered – historically considered rare but recently identified in 12 woodland sites[12]. Brandt's – no maternity colonies identified and few verified records.	Uncommon but widespread[13]
	Daubenton's bat	Can be seen over most waterbodies. Very few summer roosts identified but one of two species most frequently recorded in winter using underground sites.	Population considered stable since 1999
	Natterer's bat	As one of two species most frequently recorded in winter using underground sites, most records are from hibernating bats. Fifteen new woodland sites found during the BCT's Bechstein's Bat Survey (BCT, 2011).	Evidence to suggest an increase since 1999[14]
	Leisler's bat	Rare. Have been more frequently recorded in recent years in parts of the south-east.	Uncommon but widespread
	Noctule	Scarce, with only single individuals or small numbers seen occasionally. Only three tree roosts recorded in the last 10 years.	Population considered stable since 1999
	Serotine	Uncommon with declines in the number of summer roosts, and numbers within roosts, noted over the last 10 years.	Population considered stable since 1999
	Common pipistrelle	Most abundant bat species in Kent.	Population considered to have increased since 1999

[12] Incidentally to the BCT's Bechstein's Bat Survey in 2007 and 2011 (BCT, 2011), whiskered bats were found to be the second most frequently trapped bat in woodlands after brown long-eared bats.
[13] This should be considered with caution due to the combining of species trend information from two species.
[14] This should be considered with caution due to the regularity of roost switching behaviour in this species.

Conservation status	Species	Local (Kent) population trend	National population trend
Common	Soprano pipistrelle	Widespread with most known maternity roosts near rivers. Average maternity colony size in Kent has declined.	Population considered stable since 1999
	Brown long-eared bat	Widespread but often under recorded. Incidentally found to be the most frequently captured species in woodlands during the BCT's Bechstein's Bat Survey[12] (BCT 2011).	Population considered stable since 1999
	Alcathoe bat	Single individual identified in west Kent in 2010 incidentally to the BCT's Bechstein's Bat Survey (BCT 2011).	Data insufficient (only confirmed as a resident species in the UK in 2010 due to its similarity to the whiskered and Brandt's bat species)

Activity survey results

Walked transect and transect point activity survey results

4.2.12 There were 19 automated static detector transect point locations within nine transects to the south of the River Thames (see Figure 8.25 (Application Document 6.2)) and Table B.1 in Annex B for transect locations and habitats).

4.2.13 Table 4.3 and Table 4.4 provide a summary of the data recorded on the transect activity surveys, by month and by species/group, and include both the automated static detector transect point data and the walked transect survey data. The automated static detector data was summarised as mean passes per night to ensure that these large data sets could be adequately presented. Due to relatively shorter sampling periods and surveys, the walked transect data was summarised as mean passes per hour. The data has been summarised this way to ensure statistically robust comparison within survey types and to enable evidence-based comparisons to be made between transect routes. Both Table 4.3 and Table 4.4 include bold text to indicate where bat activity was particularly high.

4.2.14 Bats within the Pipistrelle species group were the most frequently recorded species group across all locations.

4.2.15 At least seven species (common pipistrelle, soprano pipistrelle, Nathusius' pipistrelle, noctule, brown long-eared bat, *Myoti*s spp. and Barbastelle bats) were recorded during the surveys. A single Barbastelle bat recording was identified from the walked survey of Transect 4 in October 2018, with no other recordings of this species identified.

4.2.16 Transect 3, located in Ashenbank Wood, recorded a relatively high level of bat activity, particularly at automated static detector position two which recorded a mean of over 500 bat passes per night during May, June, July and August surveys. In addition, the walked survey of this transect recorded a mean of over 10 bat passes per hour from every month except April.

4.2.17 Transect 3 was the only location where bats from all three species groups averaged above 10 passes per night (mean per automated static detector position). This criterion was also met for the Pipistrelle species group on all other transects, and for the Big bat species group on Transects 4 and Transect 5.

4.2.18 Transect 2, located within Rochester & Cobham Park Golf Club, also had relatively high levels of activity throughout the survey season averaging 180 passes per night per position for all bat species combined.

4.2.19 Transect 5, located within Shorne Wood and Transect 6, located partly within Claylane Woodland both had relatively moderate levels of activity averaging 75 passes per night per automated static location.

Table 4.3 Mean number of bat passes by month and by survey type/position from transects south of the River Thames

Month	Survey type/position[15]	Transect number[16]							
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8 & 9**
April	Automated static 1	-	-	2	-	89	-	4	16
	Automated static 2	-	-	269	-	38	-	19	9
	Automated static 3	-	-	-	-	72	-	10	-
	Automated static 4	-	-	-	-	-	-	5	-
	Walked (dusk)	-	-	0.3	-	3.4	0.6	0	4
May	Automated static 1	18	343	158	98	45	25	19	23
	Automated static 2	5	147	**1023**	-	195	41	-	19
	Automated static 3	-	-	-	-	52	-	30	115
	Automated static 4	-	-	-	-	-	-	17	-
	Walked (dusk)	2.8	**16**	**28.9**	**16.3**	**13.8**	6.6	1.8	0
June	Automated static 1	10	459	164	142	98	6	28	28
	Automated static 2	58	64	**1383**	-	42	320	110	16
	Automated static 3	-	-	-	-	57	-	46	101
	Automated static 4	-	-	-	-	-	-	31	-
	Walked (dusk)	4	7	**24.6**	8	**10.8**	**10.3**	7.1	6*
	Walked (dawn)	0.5*	-	-	-	14*	-	7.5*	11.4

[15] The automated static detector data presents mean passes per night, whereas the walked transect data presents mean passes per hour.
[16] A'-' indicates there was no survey or no automated static detector deployed on the date/position, while '0' indicates a survey was carried out but no bats were recorded. Bold text indicates where bat activity was relatively high (over 500 passes per night for static surveys and over 10 passes per hour for transect survey).

Month	Survey type/position[15]	Transect number[16]							
		1	2	3	4	5	6	7	8 & 9
July	Automated static 1	9	399	66	50	9	7	0	96
	Automated static 2	482	482	**805**	-	29	59	20	-
	Automated static 3	-	-	-	-	43	-	22	-
	Automated static 4	-	-	-	-	-	-	36	-
	Walked (dusk)	1.5	4.5*	**17***	8.9	9	8.5*	5.2	7.4
	Walked (dawn)	-	5.8	24	-	-	9.8	-	-
August	Automated static 1	33	90	252	91	45	6	36	82
	Automated static 2	10	14	**631**	-	153	173	47	-
	Automated static 3	-	-	-	-	212	-	104	-
	Automated static 4	-	-	-	-	-	-	110	-
	Walked (dusk)	9.2	8.3	**24**	**10.5**	9.5	8.7	8.9	**14.2**
September	Automated static 1	18	11	248	70	30	7	139	34
	Automated static 2	12	57	116	-	78	21	28	17
	Automated static 3	-	-	-	-	111	-	41	87
	Automated static 4	-	-	-	-	-	-	25	-
	Walked (dusk)	6.1	4.3	**18.8**	5.8	0.6	4.9	6.8	8.9
October	Automated static 1	7	9	181	0	26	2	31	1
	Automated static 2	4	94	154	-	82	28	0	5
	Automated static 3	-	-	-	-	79	-	45	-
	Automated static 4	-	-	-	-	-	-	29	-
	Walked (dusk)	0.3	**20**	**16.3**	3.1	6.5	7.1	-	3.1

Table 4.4 Mean number of bat passes by survey type and by species/group from transects south of the River Thames

Survey type	Species/group	Transect number[17]							
		1	2	3	4	5	6	7	8 & 9
Walked (mean passes per hour)	Common pipistrelle	3.3	**5.3**	**10.6**	2.7	1	**5.1**	2.5	3.1
	Soprano pipistrelle	0.1	3.3	**5.7**	4.7	**6.1**	1.3	2	2.6
	Nathusius' pipistrelle	0	0	0	0.05	0.04	0.04	0.05	0.04
	Pipistrellus spp.	0	0	0.12	0.5	0.1	0.04	0.05	0.3
	Noctule	0.05	0.3	0	0	0.04	0.08	0.1	0.1
	Nyctalus spp.	0	0.2	0.04	0.1	0	0	0.05	0
	Big bat spp.	0	0.3	0.3	0.6	0.5	0.04	0.1	0.08
	Brown long-eared bat	0	0.05	0	0	0.04	0.04	0	0.04
	Myotis spp.	0	0.2	0.8	0.2	0.5	0.1	0.3	0.6
	Barbastelle	0	0	0	0.05	0	0	0	0
	All species/group combined	3.45	9.65	17.56	8.9	8.32	6.74	5.15	6.86
Automated static (mean passes per night per position)	Big bat species group	3.3	3.7	**12.3**	**10.1**	**12.8**	7.2	8	6.9
	Pipistrelle species group	52	175.7	366.8	61.2	60.2	49.6	29.2	39.7
	Woodland species group	0.3	1.4	**10.2**	4	2.6	1.1	0.6	1.9
	All bat species groups combined	55.6	180.8	389.3	75.3	75.6	57.9	37.8	48.5

[17] Bold text indicates where bat activity was relatively high (Above ten passes per night for non-pipistrelle species at automated static locations and above five passes per hour per species during walked transects).

Crossing point activity survey results

4.2.20 Three crossing points (Crossing Points 0.5, 1 and 2) were located south of the River Thames (see Figure 8.25 (Application Document 6.2)). Table 4.5 summarises the results from each of these locations.

Table 4.5 Summary of crossing point survey results south of the River Thames

Crossing point number	Survey results	Conclusions
0.5	Two automated static detector positions were surveyed for this crossing point. The peak count was in July at Position 2, with 584 bat passes. At Position 1, there was a peak in the Pipistrelle species group 0 to one hour after sunset, with a small spike at six hours after sunset. Activity of the Big bat species group remained at constant numbers throughout the night and Woodland bat species group activity peaked at three hours after sunset. Position 2 had three activity peaks in the Pipistrelle species group numbers, between 0.5 and one hour after sunset, at 2.5 hours after sunset, and between 6.75 and seven hours after sunset. Big bat species group activity was consistent throughout the survey period. Members of the Woodland bat species group were predominantly recorded between two hours after sunset until 4.5 hours after sunset.	The dusk/dawn activity peaks of the Pipistrelle species group indicate that individuals are commuting to/from a nearby roost or that they are foraging during the peak emergence of small invertebrates (Altringham, 2003). At both positions, multiple passes were recorded between before sunset to one hour after sunset, indicating a likely roost close by. The Big bat species group had a relatively moderate number of passes, and activity was consistent throughout the night. Big bats travel large distances throughout the night. However, at both static detector positions, Big bat passes were recorded before sunset, indicating a roost close to the static detector positions. Big bat and Pipistrelle species group activity remained constant throughout the night, indicating that both groups are using the area as a foraging/commuting resource. The Woodland bat species group activity recorded at these positions was relatively low throughout the night. In both positions, the peak number of passes were recorded midway through the night, indicating relatively low levels of potential foraging/commuting activity.

Crossing point number	Survey results	Conclusions
1	Three automated static detector positions were surveyed for this crossing point. The peak count was in August at Position 3, with 434 bat passes. Positions 1 and 2 recorded peak numbers of bat passes during October and July, respectively. Most recordings at Position 1, 2 and 3 were between 0.5 and 0.75 hours after sunset on each occasion. At Position 2, the number of Pipistrelle species group passes peaked between 0.5 and 0.75 hours after sunset. Big bat species activity peaked between 0.25 and 0.5 hours after sunset, and 4.5 and 4.75 hours after sunset. The Woodland bat species group activity recorded at this location was relatively low, with no notable peak. At Position 3, numbers of Pipistrelle species group passes had two notable peaks. The first was between 0.25 and 0.50 hours after sunset, and the second was between 7.75 and 8 hours after sunset. The Big bat species group saw relatively moderate numbers of passes throughout the night, with two peaks in numbers of passes at 0.25 and 0.50 hours after sunset and 6.50 and 6.75 hours after sunset. Woodland bat species group activity recorded at this location was relatively low throughout the night, with no notable peak.	The Pipistrelle species group activity at all three static detector positions indicated two distinct activity peaks; one just after sunset and one just before dawn, indicating commuting to/from a nearby roost or that Pipistrelle bat species are foraging during the peak emergence of small invertebrates (Altringham, 2003). The Big bat species group, in all static detector positions, followed a similar activity pattern to the Pipistrelle species group with two peaks, one after sunset and one before dawn. This suggests that Big Bats are likely commuting to/from a nearby roost and/or foraging activity. In all three positions, a member of the Big bat species group was recorded before sunset. No notable peak in the number of Woodland bat species group passes was recorded in any position and a relatively low number of passes was recorded throughout the night. The low number of passes indicates small amounts of foraging/commuting activity.

Crossing point number	Survey results	Conclusions
2	Five automated static detector positions were surveyed for this crossing point. The peak count recorded was in June at Position 3, with 1,249 bat passes. There was a similarly high count in May and July. Positions 1 (range 80 to 349 bat passes) and 4 (range 73 to 486) recorded relatively consistent numbers across each month of survey. A peak count at Position 2 of 647 bat passes was recorded in September, followed by 480 bat passes recorded in July. The peak count recorded at Position 5 was in October, with 518 bat passes, with similarly high count in June, July and August. At Position 1, nightly peak activity of the Pipistrelle species group was recorded between 0.75 and one hour after sunset. At Positions 2 and 4, peak activity was recorded between one and 1.25 hours after sunset. At Position 3, nightly activity peaks were recorded between 2.25 and 2.5 hours after sunset, and at Position 4 there was a peak between 6.25 and 6.5 hours after sunset. At Position 1, there was a peak in activity of the Big bat species group between 0.25 and 0.5 hours after sunset. At Positions 2 and 5, there was a peak between 8 and 8.25 hours after sunset, with a similar additional peak at Position 5 between 0.5 and 0.75 hours after sunset. Big bat and Woodland bat species group activity was fairly consistent throughout the night, with the highest number of Big bat passes between 2.25 and 2.5 hours after sunset and no obvious peak of activity in the Woodland bat species group.	For Positions 1, 2, 4 and 5, the Pipistrelle species group activity was constant throughout the night in relatively low to moderate numbers. The peak activity recorded at Positions 4 and 5 indicate the crossing point used by bats commuting back to their roost. At Position 3, there was constant relatively high activity throughout the night suggesting foraging activity. Passes were recorded before sunset at Position 2 and within the first 0.5 hours following sunset for all other positions. Therefore, these positions are likely to be close to a roost or linked to one via a dark corridor. A relatively low/moderate number of Big bat species group passes were recorded throughout the night. At all positions, there were three distinct activity peaks just after sunset, approximately 6.5 hours after sunset and then just before dawn. Activity was recorded at all positions before or at sunset, indicating that there was likely a roost of a member of the Big bat species group in the area. There were relatively low numbers of passes through the night in the Woodland bat species group, suggesting that the site may be used as a foraging/commuting route to/from a nearby roost.

A2 and HS1 corridor activity survey results

4.2.21 A total of seven bats of two species were recorded crossing HS1 and/or A2 during the 2019 activity surveys, detailed as follows:

a. Three noctules were recorded crossing the A2 and HS1 south to north from Ashenbank Wood towards the eastern edge of Shorne Woods Country Park during the May 2019 survey.

b. Four soprano pipistrelles were recorded crossing the A2 south to north from the Rochester & Cobham Park Golf Club towards Shorne Woods Country Park at estimated heights between four and eight metres during the May 2019 survey.

c. No bats were recorded crossing the HS1 railway or the A2 road during either of the July 2019 surveys.

Swarming survey results

4.2.22 No bats were recorded swarming at Muggins Chalk Pit. A hibernating bat and a second flying bat were recorded in the Muggins Chalk Pit lime kiln tunnels during the second survey in October 2019, neither bat was identified to species level. Although no swarming activity was recorded during surveys, the location provides suitable swarming habitat and has known hibernating bats present, it is therefore considered an area of high value to bats.

Roost survey results

Tree assessment survey results

4.2.23 The results of the tree assessments to the south of the River Thames are illustrated on Environmental Statement (Application Document 6.2), Chapter 8: Terrestrial Biodiversity, Figure 8.23 and are summarised in Table 4.6.

Table 4.6 Summary of tree assessment survey results with the Order Limits and 50m buffer to the south of the River Thames

Bat roost suitability	Number of trees
Confirmed Roost	2
Probable Roost	0
Possible Roost	0
High	67
Moderate	128
Low	49
Negligible	32
Total	**278**

4.2.24 Two confirmed tree roosts were identified south of the river, Tree 284 was a pedunculate oak (*Quercus robur*) within the order limits and had a soprano pipistrelle emerge from a broken trunk at the top of the tree on 13/09/18 and a brown long-eared bat probable emergence from midway up the tree on 23/06/2021. Tree 911 was a mature beech *Fagus sylvatica* with a tear-out located at 8 m on the northern aspect of the stem. A climbing inspection was undertaken on Tree 911 in November 2019 when at least one noctule bat was recorded within the feature.

4.2.25 Of the 67 trees identified as having high suitability for roosting bats, 41 were within the Order Limits and 24 of these trees received some form of secondary survey.

Woodland assessment survey results

4.2.26 Woodland assessment surveys were carried out in eight woodlands to the south of the River Thames as detailed below and shown in see Figure 8.23 (Application Document 6.2). Table C.2 in Annex C details the proportion of each woodland sampled and summarises the results of the tree assessments and extrapolated results from these sampled areas.

Rochester and Cobham Golf Course woodland

4.2.27 Small areas of semi-natural broadleaved woodland were present within Rochester & Cobham Park Golf Club, with species predominantly consisting of pedunculate oak, ash *Fraxinus excelsior* and sweet chestnut *Castanea sativa*. The northern extent of Rochester & Cobham Park Golf Club woodland falls within the Order Limits and provides suitable habitat for foraging and commuting bats. In addition, the survey area had good connectivity by tree lines to perceived suitable foraging habitats such as Ashenbank Wood, Cobham Hall Estate and Shorne Woods.

4.2.28 Rochester & Cobham Park Golf Club is located adjacent to areas of woodland and parkland, with arable land approximately 1km to the south and the HS1 railway and the A2 along the northern boundary.

4.2.29 Within the Order Limits, no trees were identified with moderate or high bat roosting suitability. Within the sampled area, a further 8 trees were identified with moderate or high bat roosting suitability. Results are summarised in Table 4.7 below.

Table 4.7 Rochester & Cobham Park Golf Club woodland tree assessment survey results

Suitability	Number of trees within the Order Limits	Number of trees outside the Order Limits
Confirmed roost	0	0
High	0	4
Moderate	0	4
Low	0	2
Negligible	1	1
Total	**1**	**11**

4.2.30 The transect point activity surveys for Rochester & Cobham Park Golf Club recorded a mean number of passes per night of 1,054 passes from the Pipistrelle species group, 22 passes from the Big bat species group and eight passes from the Woodland bat species group. Common pipistrelle, soprano pipistrelle, noctule, *Nyctalus/Eptesicus* spp., brown long-eared bat and *Myotis* spp. were recorded on the walked transect activity surveys.

4.2.31 Rochester & Cobham Park Golf Club was well connected to adjacent woodland and provided a good resource of mosaic and edge habitat within the wider landscape for tree-roosting bat species. Nevertheless, the presence of the A2 and HS1 decreases the likelihood of bats commuting to the area and the vast amount of suitable habitat in the surrounding landscape would further decrease the value of the woodland for bats. It was therefore considered that Rochester & Cobham Park Golf Club provides a roost resource of moderate value for bats.

Ashenbank Wood

4.2.32 Ashenbank Wood forms part of the Shorne and Ashenbank Woods SSSI, and consists of 29.95ha of mature broadleaved woodland containing sweet chestnut, birch *Betula sp.*, sycamore *Acer pseudoplatanus*, pedunculate oak and ash.

4.2.33 Ashenbank Wood sits in a landscape predominantly of parkland, which provides optimal habitat for bats, with other significant areas of woodland located in close proximity.

4.2.34 Within the Order Limits, six trees were identified with moderate or high bat roosting suitability. Within the sampled area, a further two trees were identified as confirmed roosts and 14 trees were identified with moderate or high bat roosting suitability. Results are summarised in Table 4.8 below.

Table 4.8 Ashenbank Wood tree assessment survey results

Suitability	Number of trees within the Order Limits	Number of trees outside the Order Limits
Confirmed roost	0	2
High	1	3
Moderate	5	11
Low	0	4
Negligible	1	2
Total	7	22

4.2.35 The transect point activity surveys for Ashenbank Wood recorded a mean number of passes per night of 2,568 passes from the Pipistrelle species group, 86 passes from the Big bat species group and 72 passes from the Woodland bat species group. Common pipistrelle, Soprano pipistrelle, Nathusius' pipistrelle, *Nyctalus/Eptesicus* spp. and *Myotis* spp. were recorded on the walked transect activity surveys.

4.2.36 Ashenbank Wood provides a significant number of suitable roost features for use by bats as well as two confirmed roosts within the woodland, and high levels of recorded bat activity suggested it was an important resource for bats. It is therefore considered that Ashenbank Wood provides a roost resource of high value for roosting bats.

Brewers Wood

4.2.37 Brewers Wood forms part of the Shorne and Ashenbank Woods SSSI and is approximately 30ha in size. It consisted of mature sweet chestnut coppice woodland that had not been managed for an estimated 20 years. The canopy consisted largely of coppiced ash and sweet chestnut, with scattered standard trees. An understorey of ash, field maple *Acer campestre*, field maple *Acer campestre*, hazel *Corylus avellana*, birch and hawthorn *Crataegus monogyna* was also present.

4.2.38 Brewers Wood is located in a predominantly woodland and parkland landscape and is well connected to other habitats such as Shorne Wood; this landscape is considered optimal for the foraging and roosting of bats. The wider landscape also provides extensive connectivity and mosaic habitat for foraging bats.

4.2.39 Within the sampled area, seven trees were identified with moderate or high bat roosting suitability, summarised in Table 4.9 below. No trees with moderate to high roosting suitability were identified within the Order Limits.

Table 4.9 Brewers Wood tree assessment survey results

Suitability	Number of trees within the Order Limits	Number of trees outside the Order Limits
Confirmed Roost	0	0
High	0	4
Moderate	0	3
Low	0	1
Negligible	0	1
Total	0	9

4.2.40 The transect point activity surveys for Brewers Wood recorded a mean number of passes per night of 367 from the Pipistrelle species group, 61 from the Big bat species group and 24 from the Woodland bat species group. Common pipistrelle, soprano pipistrelle, Nathusius' pipistrelle, *Nyctalus/Eptesicus* spp., Barbastelle and *Myotis* spp. were recorded on the walked transect activity surveys.

4.2.41 Brewers Wood provided a significant number of suitable roost features for use by bats, with moderate bat activity levels recorded. However, in comparison with the other woodlands there were fewer numbers of bat passes. It is likely that this was a result of alternative suitable habitat, including the nearby Shorne Wood. It is therefore considered that Brewers Wood provides a roost resource of moderate value for bats.

Shorne Wood

4.2.42 Shorne Wood forms part of the Shorne and Ashenbank Woods SSSI. Shorne Wood, which is approximately 118ha in size, consisted of semi-natural coppiced woodland widely used for recreational purposes. The canopy consisted primarily of young trees including ash, sweet chestnut, sycamore, silver birch *Betula pendula*, pedunculate oak and hornbeam *Carpinus betulus*.

4.2.43 Shorne Wood is located in a landscape of predominantly arable and improved grassland, which is considered to be suboptimal for bats, with other significant areas of woodland located close by. An air raid shelter within the woodland was a confirmed hibernation roost.

4.2.44 Within the Order Limits, 19 trees were identified with moderate or high bat roosting suitability. Within the sampled area, a further five trees were identified with moderate or high bat roosting suitability. Results are summarised in Table 4.10 below.

Table 4.10 Shorne Wood tree assessment survey results

Suitability	Number of trees within the Order Limits	Number of trees outside the Order Limits
Confirmed Roost	0	0
High	8	4
Moderate	11	1
Low	3	3
Negligible	3	2
Total	25	10

4.2.45 The transect point activity surveys for Shorne Wood recorded a mean number of passes per night of 421 from the Pipistrelle species group, 89 from the Big bat species group and 18 from the Woodland bat species group. Common pipistrelle, soprano pipistrelle, Nathusius' pipistrelle, *Nyctalus/Eptesicus* spp., brown long-eared bat and *Myotis* spp. were recorded on the walked transect activity surveys.

4.2.46 Shorne Wood provided a significant number of suitable roost features for use by bats, with recorded activity suggesting use by a high number of bats of potential roosts in the vicinity. The presence of the confirmed bat roost within the underground former air raid shelter provides evidence that the woodland is a valuable resource for bats. It was therefore considered that Shorne Wood provides a roost resource of high value for bats.

Woodland at the north-western corner of Shorne Wood

4.2.47 Woodland at the north-western corner of Shorne Wood, which is approximately 1.6ha in size, consists of semi-natural coppiced trees. The northern extent of the woodland is predominantly ash with occasional sweet chestnut.

4.2.48 This woodland is located in a landscape of agricultural land with other significant areas of woodland (i.e. Shorne Wood) located in close proximity.

4.2.49 Within the Order Limits, two trees were identified with high bat roosting suitability. Within the sampled area, a further five trees were identified with moderate or high bat roosting suitability. Results are summarised in Table 4.11 below.

Table 4.11 Woodland at the north-western corner of Shorne Wood tree assessment survey results

Suitability	Number of trees within the Order Limits	Number of trees outside the Order Limits
Confirmed Roost	0	0
High	2	3
Moderate	0	2
Low	0	0
Negligible	0	0
Total	2	5

4.2.50 No activity surveys were carried out in this woodland; however, it was adjacent to the northern extent of Transect 5. Due to the proximity of this transect, it was anticipated that the same species composition as that described above for Shorne Wood would be present here.

4.2.51 The number of suitable trees and suitable habitat in the locality mean this was a resource of value for bats. In addition, owing to the lack of detailed survey data throughout the full woodland area that extends beyond the Order Limits, it was considered that the north-western corner of Shorne Wood provides a roost resource of high value for bats, on a precautionary basis.

Woodland adjacent to Thong Lodge

4.2.52 Within the sampled area, two trees were identified with high bat roosting suitability. The woodland within the Order Limits, adjacent to Thong Lodge, was not surveyed. Results are summarised in Table 4.12 below. Therefore assumptions were made based on results from Shorne Wood and the woodland to the north-western corner of Shorne Wood. Shorne Wood provided a significant number of suitable roost features for use by bats, with recorded activity suggesting use by a high number of bats of potential roosts in the vicinity. It was therefore considered that the woodland adjacent to Thong Lodge, which forms part of Shorne Wood, also provides a roost resource of high value for bats.

Table 4.12 Woodland adjacent to Thong Lodge tree assessment survey results

Suitability	Number of trees within the Order Limits	Number of trees outside the OL
Confirmed roost	0	0
High	0	2
Moderate	0	0
Low	0	0
Negligible	0	1
Total	0	3

Claylane Wood

4.2.53 Claylane Wood is an area of ancient semi-natural broadleaved woodland approximately 10.7ha in size. It consists of a canopy of hornbeam, pedunculate oak, ash, sycamore, field maple and an old outgrowth of coppiced sweet chestnut.

4.2.54 Claylane Wood is located in a landscape of predominantly arable land and residential properties with the A2 to the south, with other significant areas of woodland located in close proximity, including Shorne Wood to the east. Residential properties are adjacent to the western extent of Claylane Wood. The wider landscape provides connectivity north via vegetation adjacent to residential gardens, and south-east via vegetation that connects to waterbodies and Shorne Wood.

4.2.55 Within the Order Limit,34 trees were identified with moderate or high bat roosting suitability. Within the sampled area a further five trees were identified with moderate or high bat roosting suitability. Results are summarised in Table 4.13 below.

Table 4.13 Claylane Wood tree assessment survey results

Suitability	Number of trees within the Order Limits	Number of trees outside the Order Limits
Confirmed Roost	0	0
High	11	1
Moderate	23	4
Low	4	1
Negligible	0	3
Total	38	9

4.2.56 The transect point activity surveys data for Claylane Wood recorded a mean number of passes per night of 595 from the Pipistrelle species group, 43 from the Big bat species group and seven for the Woodland bat species group. Common pipistrelle, soprano pipistrelle, Nathusius' pipistrelle, noctule, *Nyctalus/Eptesicus* spp., brown long-eared bat and *Myotis* spp. were recorded on the walked transect activity surveys.

4.2.57 Claylane Wood provided a significant number of suitable roost features for use by bats. Activity levels suggest a moderate number of bats use the woodland. Crossing Point 0.5, which lies immediately north of the A2, provided a commuting link used by bats between Shorne Wood and Claylane Wood. It was anticipated that the woodland was used as a foraging resource but primarily as a stop-gap between commuting from known roosts in the vicinity (see Gravelhill Wood). It was considered that Claylane Wood provides a roost resource of high value for bats.

Cobham Hall Wood

4.2.58 Cobham Hall Wood is approximately 60ha in size and consists of an extensive area of parkland trees and a large area of mature deciduous woodland.

4.2.59 Cobham Hall woodland is located in a landscape of grazing pasture, arable and recreational use, which was considered to be optimal for bats. Cobham Hall Estate consisted of multiple buildings, some of which were built in the 16th century. Cobham Hall Estate buildings were not assessed fully but it is highly likely they would be of high suitability for roosting bats. The wider landscape provides extensive connectivity to other suitable habitats.

4.2.60 Within the Order Limits, no trees were identified with moderate or high bat roosting suitability. Within the sampled area, a further two trees were identified with moderate or high bat roosting suitability. Results are summarised in Table 4.14 below.

Table 4.14 Cobham Hall Wood tree assessment survey results

Suitability	Number of trees within the Order Limits	Number of trees outside the Order Limits
Confirmed roost	0	0
High	0	1
Moderate	0	1
Low	0	0
Negligible	0	1
Total	0	3

4.2.61 The transect point activity surveys for Cobham Hall Wood recorded a mean number of passes per night of 1,054 from the Pipistrelle species group, 22 from the Big bat species group and eight from the Woodland bat species group. Common pipistrelle, soprano pipistrelle, noctule, *Nyctalus/Eptesicus* spp., brown long-eared bat and *Myotis* spp. were recorded on the walked transect activity surveys.

4.2.62 The activity data for Cobham Hall woodland provided a relatively low number of suitable roost features for use by bats; however, the activity levels suggested it was a well used woodland resource for foraging and commuting bats. The known roost locations in close proximity at Ashenbank Wood and connectivity to other woodlands in close proximity increase the woodland value for bats. It is therefore considered that Cobham Hall woodland provides a roost resource of high value for bats.

Gravelhill Wood

4.2.63 Gravelhill Wood is an area of semi-natural broadleaved woodland approximately 2.4ha in size. It consists of a canopy of predominantly sweet chestnut with occasional mature pedunculate oak.

4.2.64 Gravelhill Wood is located in a landscape of predominantly arable land with the A2 to the south. Significant areas of woodland located in close proximity include Shorne Wood to the east.

4.2.65 Within the Order Limits, one tree was identified as a confirmed roost and eight trees were identified with moderate or high bat roosting suitability. No further trees were identified within the sample area. Results are summarised in Table 4.15 below.

Table 4.15 Gravelhill Wood tree assessment survey results

Suitability	Number of trees within Order Limits	Number of trees outside the Order Limits
Confirmed Roost	1	0
High	5	0
Moderate	3	0
Low	0	0
Negligible	0	0
Total	9	0

4.2.66 No activity surveys were carried out in this woodland; however, it was adjacent to the northern extent of Transect 5. Due to the proximity of this transect, it was anticipated that the same species composition as that described above for Shorne Wood would be present here.

4.2.67 Gravelhill provided a moderate number of suitable roost features for use by bats despite majority of the woodland comprising of relatively young sweet chestnut. It was considered that Gravelhill Wood provides a roost resource of moderate value for bats.

Structure assessment survey results

4.2.68 There were 86 structures identified as requiring assessment for suitability for roosting bats to the south of the River Thames, of which 74 were assessed. The locations of these structures are shown in Figure 8.24 (Application Document 6.2) and detailed individually within Table D.1 in Annex D. A summary of the results of the structure assessments is provided in Table 4.16 below.

Table 4.16 Summary of structure assessment survey results from the south of the River Thames

Suitability	Number of structures
Confirmed roost	5
High	19
Moderate	26
Low	11
Negligible	13
Total	74

4.2.69 Two of the confirmed roosts (St. Mary's Church and Marling Manor) were associated with brown long-eared bat, which was confirmed via DNA analysis of bat droppings collected during the inspection.

4.2.70 One of the confirmed roosts was located at 1 Longview, with two separate emergences recorded, firstly of three common pipistrelles recorded during survey 2, and a further one common pipistrelle recorded during survey 3.

4.2.71 The two remaining confirmed roosts were in underground air raid shelters within Shorne Wood, confirmed by desk study information and consultation with

Shorne Wood rangers. Internal inspections were carried out on 25 January and 23 February 2021 on the underground air raid shelters within Shorne Wood. A single Daubenton's bat was identified within Bunker 2 during the February visit.

Emergence/re-entry survey results

4.2.72 Results of the emergence/re-entry surveys and survey metadata are provided in Annex D and Annex E. Confirmed roosts are shown in Figure 8.24 and Figure 8.25 (Application Document 6.2), for trees and structures, respectively.

4.2.73 Ten trees were identified as requiring emergence/re-entry surveys to the south of the River Thames. Emergence surveys were carried out on five of the trees. One soprano pipistrelle was recorded emerging from a knot hole on Tree 284 in 2018. Tree 284 was subject to a further survey in 2021 and a brown long-eared was recorded emerging from it. No bats were recorded emerging from any of the other five trees.

4.2.74 There were 57 structures identified as requiring emergence/re-entry surveys to the south of the River Thames. One emergence survey was carried out at the Southern Valley Golf Club in 2018, during which no bats were recorded emerging from the building.

4.3 North of the River Thames

Desk study results

Habitats

4.3.1 The area to the north of the River Thames primarily consisted of intensively managed arable land. However, small areas of semi-natural habitat remain, and bats within the Order Limits are likely to be focused within these remaining areas. Arable land may be used in a more limited manner, particularly where well connected with linear features, such as hedgerows and tree lines.

Designated sites

4.3.2 A review of the desk study identified a single statutory designated site for which bats were listed as a notifiable feature. Hangman's Wood and Deneholes SSSI was designated for ancient and semi-natural woodland and the most important underground bat hibernation site in Essex (Natural England, 1992). Brown long-eared bat, Natterer's bat and Daubenton's bat have been recorded using the series of medieval chalk mines that are present across the SSSI. Hangman's Wood and Deneholes SSSI is located approximately 500m to the west of the Order Limits.

Non-statutory designated sites

4.3.3 A review of the desk study identified five non-statutory designated sites for which bats were listed: Puddle Dock Angling Centre Site of Importance for Nature Conservation (SINC); Hall Farm moat, paddock and St Mary Magdalene's Churchyard, North Ockendon SINC; Fairplay Farm SINC; Stubbers Adventure Centre SINC; and Ingrebourne Valley SINC.

4.3.4 Puddle Dock SINC is located immediately adjacent to the Order Limits and is designated in part for a line of old oak trees, which are of potential interest for bats.

4.3.5 Hall Farm moat, paddock and St Mary Magdalene's Churchyard, North Ockendon SINC, is located immediately adjacent to the Order Limits. The site is designated in part for the presence of St. Cedd's Well, a grotto, and the church, all of which are potential bat roosts.

4.3.6 Fairplay Farm SINC is immediately adjacent to the Order Limits. The site is designated in part for an unusually large number of ancient oak pollards, which are in the hedges. These old oak pollards include fissures and dead limbs, and therefore the site is likely to be of value for bats.

4.3.7 Stubbers Adventure Centre SINC is within the Order Limits. This site is designated in part for a large and important bat roost, and it is also an important foraging area for bats.

4.3.8 Ingrebourne Valley SINC is located to the north of the Order Limits. The site is designated in part for Berwick Pond, which is important for foraging bats, with at least four species regularly present.

Desk study records

4.3.9 The desk study (Essex Wildlife Trust Biological Records Centre 2020; Essex Field Club, 2022 returned 279 records of bats. These records identified nine species and included both activity and roost records. The results of this data search are summarised in Table 4.17. The Greenspace Information for Greater London Records centre (2022) returned an additional 97 records of bats within 2km of the Order Limits, this included records for Nathusius's pipistrelle, common pipistrelle, soprano pipistrelle, and unconfirmed bat species. No geographical locations for the records were provided.

4.3.10 For relevant species, a summary of the local (Essex; Essex Bat Group, 2020; Dobson & Tansley, 2014) and national (BCT, 2018) population trends are provided in Table 4.18.

Hibernation roosts

4.3.11 Hibernation roost records were identified for four species and two species groups. These records primarily related Daubenton's bat.

Maternity roosts

4.3.12 No records of maternity roost were provided.

Table 4.17 Summary of desk study data north of the River Thames

Species/group	Number of records				
	Activity[18]	Hibernation roost[19]	Maternity roost[20]	Unknown roost[21]	Other[22]
Brown long-eared bat	16	3	-	3	16
Common pipistrelle	21	3	-	2	79
Daubenton's bat	7	-	-	-	10
Leisler's bat	6	-	-	-	-
Nathusius' pipistrelle	7	-	-	-	5
Natterer's bat	3	5	-	3	9
Noctule	9	-	-	-	14
Serotine	4	-	-	-	1
Soprano pipistrelle	18		-	1	48
Unidentified bat	1	-	-	1	42
Long-eared bat spp.	-	-	-	-	3
Myotis spp.	9	1	-	3	-
Pipistrellus spp.	-	1	-	-	22

[18] Activity records are those where bats were observed or heard in flight.
[19] Hibernation roost records are those where bats were found to be hibernating. Hibernation roosts may be used between November and March.
[20] Maternity roost records are those where bats were found to be rearing young. Maternity roosts may be used between May and August.
[21] 'Unknown roost' includes those records where the type of roost was not specified.
[22] 'Other' records consist of those that do not match the other categories provided and include records such as grounded or dead bats, captured/handled bats (e.g. from harp traps), and bat signs, as well as those where information on the nature of the record was not provided.

Table 4.18 Local (Essex) and national population trends of relevant bat species

Conservation status	Species	Local (Essex) population trend	National population trend
SoPIs	Nathusius' pipistrelle	Migratory, may breed in small numbers Considered rare but may be under recorded	Rare but widespread.
	Brandt's bat/whiskered bat	Whiskered – rare with only a single record from mid-Essex in 1987[23] Brandt's – unknown	Uncommon but widespread[24].
	Daubenton's bat	Widespread, relatively frequent near still water	Population considered stable since 1999
	Natterer's bat	Widespread, relatively scarce with most records coming from hibernation sites or summer roosts, often in barns or churches	Evidence to suggest an increase since 1999[25]
	Leisler's bat	Widespread, but scarce and possible declining Found in Essex in all months but no evidence of hibernation recorded	Uncommon but widespread
	Noctule	Recorded in most areas of Essex but usually only individuals or very small numbers recorded, a decline on numbers recorded in the 1980s	Population considered stable since 1999
	Serotine	Widespread but scarce Roosts infrequently found and seldom recorded in winter	Population considered stable since 1999
Common	Common pipistrelle	Widespread, occasionally common Most frequently encountered bat in Essex	Population considered to have increased since 1999
	Soprano pipistrelle	Widespread, occasionally common	Population considered stable since 1999
	Brown long-eared bat	Widespread, relatively frequent	Population considered stable since 1999

[23] Incidentally to the BCT's Bechstein's Bat Survey in 2007 and 2011 (BCT, 2011), whiskered bats were found to be the second most frequently trapped bat in woodlands after brown long-eared bats.
[24] This should be considered with caution due to the combining of species trend information from two species.
[25] This should be considered with caution due to the regularity of roost switching behaviour in this species.

Activity survey results

Walked transect and transect point activity survey results

4.3.13 Eighteen activity transects (Transects 10 to 27) were conducted to the north of the River Thames with a total 37 automated static detector locations spread across the transect routes (see Figure 8.25 (Application Document 6.2) and Table B.1 in Annex B for transect locations and habitats).

4.3.14 Table 4.19 and Table 4.20 provide a summary of data recorded on the transect activity surveys, by month and by species/group. They include both the automated static detector transect point data and the walked transect survey data. The automated static detector data was summarised as mean passes per night to ensure that these large data sets could be adequately presented. Due to relatively shorter sampling periods and surveys, the walked transect data was summarised as mean passes per hour. The data has been summarised in this way to ensure statistically robust comparison within survey types and to enable evidence-based comparisons to be made between transect routes. Both Table 4.19 and Table 4.20 include bold text to indicate where bat activity was particularly high.

4.3.15 Bats within the Pipistrelle species group were the most frequently species group recorded across all locations. Pipistrelle, woodland bat and Big bat species groups were recorded at each transect and all positions during the surveys.

4.3.16 At least seven species (common pipistrelle, soprano pipistrelle, Nathusius' pipistrelle, noctule, *Nyctalus* spp., Big bat spp., brown long-eared bat, *Myotis* spp., and Barbastelle) were recorded during the surveys. A single Barbastelle recording was identified from a static detector on Transect 12.

4.3.17 Overall, the highest levels of activity were consistently recorded from Transects 13, 14 and 17 across the season. Nevertheless, the highest levels of activity recorded from one survey location was Transect 20 Position 1, with more than 500 passes recorded during a single survey.

4.3.18 The automated static detectors situated along Transects 14, 18 and 20 recorded mean pipistrelle passes of over 200 per night per position.

4.3.19 Transect 19 is the only location where both common and soprano pipistrelles average above five passes per hour from walked transect activity surveys.

Table 4.19 Mean number of bat passes by month and by survey type/position from transects north of the River Thames

Month	Survey type/ position[26]	Transect number[27]																	
		10	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**
April	Automated static 1	9	57	8	17	**783**	9	114	90	354	**571**	10	30	10	2	1	-	-	4
	Automated static 2	267	-	22	**1,076**	**1,374**	5	-	261	-	87	26	-	36	1	0	-	-	23
	Automated static 3	-	-	-	57	-	-	-	-	-	-	-	-	-	2	2	-	-	-
	Walked (dusk)	1.2	4.6	0.9	**22.2**	**17.8**	8.6	**10.8**	**16**	**15.4**	**12.3**	3.4	6.5	4.3	4.9	0.3	-	-	-
May	Automated static 1	86	18	8	13	203	26	48	63	174	**639**	35	168	-	5	3	-	4	33
	Automated static 2	233	-	213	-	320	12	-	89	-	76	54	-	-	8	5	-	37	16
	Automated static 3	-	-	-	81	-	-	-	-	-	-	-	-	-	2	7	-	101	-
	Walked (dusk)	4.3	6.5	**15.7**	7.1	**14.5**	9.8	**16.6**	**18.5**	**34.5**	**20.6**	1.2	4.3	-	1.5	0.6	-	**15.7**	**10.2**
June	Automated static 1	45	38	30	-	-	23	-	154	-	-	-	298	45	11	4	70	-	-
	Automated static 2	27	-	63	-	-	73	-	217	-	-	-	-	187	16	53	167	239	-

[26] The automated static detector data presents mean passes per night, whereas the walked transect data presents mean passes per hour.
[27] A '-' indicates there was no survey or no automated static detector deployed on the date/position, while '0' indicates the survey was carried out but no bats were recorded. Bold text indicates where bat activity was relatively high (Over 500 passes per night on average at automated static locations and over 10 passes per hour for walked surveys).

Month	Survey type/ position[26]	Transect number[27]																	
		10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
	Automated static 3	-	-	-	-	-	-	-	-	-	-	-	-	-	12	7	66	381	-
	Walked (dusk)	3.4	**14.8**	**21.5**	-	-	**14.8**	-	7.1	-	-	-	4.6	3.7	5.8	3.1	**11.7**	6*	3.5*
	Walked (dawn)	1*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.3	2.5
July	Automated static 1	251	21	40	28	84	18	53	241	-	-	-	147	89	13	20	121	-	-
	Automated static 2	261	-	423	-	138	13	-	85	-	-	-	-	37	40	19	85	-	-
	Automated static 3	-	-	-	17	-	-	-	-	-	-	-	-	-	25	12	49	-	-
	Walked (dusk)	8.6	6	**16.5**	3.7	**11.1**	5.5	8.6	**12.5**	-	-	-	1.5	**14**	2*	1*	3*	-	-
	Walked (dawn)	-	5.7	**13.2**	-	-	-	-	**14.5**	-	-	-	**11.1**	**21.8**	3.7	6.2	8.9	-	-
August	Automated static 1	20	10	15	9	34	10	8	160	89	2	**687**	55	23	20	5	-	-	-
	Automated static 2	52	-	14	-	93	4	-	103	-	114	87	-	26	15	8	-	-	-
	Automated static 3	-	-	-	57	-	-	-	-	-	-	-	-	-	6	22	-	-	-
	Walked (dusk)	3.4	5.8	**13.5**	8.5	9.5	**10**	**11**	**10.2**	4.5	**21.5**	2.5	**18.5**	**40**	6.8	-	-	-	-
	Walked (dawn)	-	-	-	9.2	**22.8**	**11.7**	6.2	-	4.6	**72.3**	7.4	-	-	-	-	-	-	-
September	Automated static 1	5	7	6	9	30	3	20	51	**991**	-	**654**	69	17	10	-	-	-	-
	Automated static 2	313	-	23	-	15	12	-	184	-	125	11	-	40	16	-	-	-	-

Month	Survey type/ position[26]	Transect number[27]																	
		10	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**
	Automated static 3	-	-	-	37	-	-	-	-	-	-	-	-	-	20	-	-	-	-
	Walked (dusk)	0.9	6.5	**14.8**	**15.7**	8.3	7.4	4.9	8.9	**10.2**	**40**	8	**14.5**	7.7	7.1	4.6	-	-	-
October	Automated static 1	-	-	35	19	**594**	7	103	114	-	171	50	91	13	3	-	-	-	-
	Automated static 2	29	-	49	-	111	8	-	12	-	195	24	-	29	1	-	-	-	-
	Automated static 3	-	-	-	14	-	-	-	-	-	-	-	-	-	1	-	-	-	-
	Walked (dusk)	1.5	-	**12.9**	**12.6**	**21.5**	6.2	**22.5**	**11.7**	**13.5**	**21.8**	6.8	4.9	5.5	0.6	1.8	-	-	-

Table 4.20 Mean number of bat passes by survey type and by species/group from transects north of the River Thames

Survey type	Species/ group	Transect number[28]																	
		10	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**
Walked (mean passes per hour)	Common pipistrelle	2.4	5.4	**8.2**	**6.9**	**10.9**	7	**9.3**	**7.7**	**9.5**	**10.6**	3.6	**5.3**	**10**	3.5	2.1	**6.8**	**8.1**	4
	Soprano pipistrelle	0.6	1.5	3.2	2.1	3.7	1.2	1.2	3.3	3.4	**15.3**	1.3	2.5	3.4	0.4	0.3	0	0.4	1.4
	Nathusius' pipistrelle	0.08	0	0.5	0.8	0.1	0.1	0.3	0.04	0.6	0.6	0.05	0.04	0	0.08	0.1	0	0.1	0
	Pipistrellus spp.	0	0.4	0.34	0.10	0.1	0.04	0.5	0.2	0.25	0.6	0	0.08	0.15	0.04	0	0.2	0.3	0.1
	Noctule	0	0	0.2	0.1	0.05	0.4	0.1	0.9	0.1	2	0	0	0	0	0	0.1	0	0
	Nyctalus spp.	0.04	0	0	0.1	0.05	0.04	0	0	0	0.1	0	0.08	0.05	0	0	0	0	0
	Big bat spp.	0	0	0.08	0.4	0	0.4	0.05	0.2	0.3	1.5	0.05	0.08	0.05	0.04	0	0.2	0	0
	Brown long-eared bat	0.08	0	0	0	0.05	0	0	0	0	0.05	0	0	0	0	0	0	0	0
	Myotis spp.	0	0.05	0.9	0.9	0.4	0.04	0.1		0.2	1.4	0.05	0.4	0.2	0.2	0.1	1.2	0.1	0.1
	Barbastelle	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	All bat species/group total	8.6	7.35	13.42	11.4	15.35	9.22	11.45	12.34	14.35	32.15	5.05	8.48	13.85	4.26	2.6	8.5	9	5.6
Automated static (mean passes per	Big bat species group	109.6	**10.9**	1.8	2.1	4.5	2.2	1.2	19.3	3	**32.9**	3.3	2.6	3.0	1.6	1.8	**12.5**	**11.1**	1.9
	Pipistrelle species group	1.2	13.0	65.2	84.8	308.8	13.5	56.0	107.8	398.6	175.1	283.8	119.6	41.7	8.7	7.5	80.2	167.6	16.8

[28] Bold text indicates where bat activity was relatively high (Above ten passes per night for non-pipistrelle species at automated static locations and above five passes per hour per species during walked transects).

Survey type	Species/ group	Transect number[28]																	
		10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
night per position	Woodland species group	0	1.1	0.8	0.7	1.8	0.2	0.5	3.1	0.6	2.3	1.3	0.4	1.5	0.7	0.6	0.2	0	0.2
	All bat species/group total	110.8	25	67.8	87.6	315.1	15.9	57.7	130.2	402.2	210.3	288.4	122.6	46.2	11	9.9	92.9	178.7	18.9

Crossing point activity survey results

4.3.20 Eighteen crossing points (Crossing Points 3, 4, 4.5, 5, 6, 6.5, 7, 7.5, 7.75, 8, 9, 9.5, 10, 11, 12, 12.5, 13 and 14) were located to the north of the River Thames (Figure 8.25 (Application Document 6.2)). Table 4.21 summarises the results from each of these locations. Similarly, to the automated static detector surveys the Pipistrelle species group was the most frequently recorded at each location throughout the surveys.

Table 4.21 Summary of crossing point survey results north of the River Thames

Crossing point number	Survey results	Conclusions
3	Two automated static detector positions were surveyed for this crossing point. The peak count was in July at Position 1, with 619 bat passes. At Position 1, there was a peak in the Pipistrelle species group activity between 2.75 and three hours after sunset. The Big bat species group had two peaks, the first peak between 0.25 and 0.5 hours before sunset and the second peak at six hours after sunset. The Woodland bat species group activity was low throughout the night, with the first peak at 2.25 hours after sunset and the second peak at six hours after sunset. At Position 2, the Pipistrelle species group activity had two significant peaks, one between two and 2.25 hours after sunset and the second between 5.50 and 5.75 hours after sunset. The Big bat species group had a similar trend with two significant peaks, one between 0.5 and 0.75 hours after sunset and the second between 6.25 and 6.5 hours after sunset. The Woodland bat species group activity was low throughout the night, with a peak between 3.25 and 3.5 hours after sunset.	At Positions 1 and 2, Pipistrelle group species were recorded within the first hour after sunset indicating that there was potentially a roost in close proximity or linked to one via a dark corridor. Similarly, the continuous passes throughout the night suggests that the area was used as a foraging/commuting resource. Big bat species were recorded with a relatively moderate to high numbers of bat passes. At both Positions 1 and 2, the timing of the peaks suggests that individuals were likely commuting to/from a nearby roost. Similarly, the fluctuating number of passes throughout the remainder of the evening implies the area was sporadically used as a foraging resource. Woodland bat species were present at both Positions 1 and 2 but in low numbers, indicating low levels of foraging/commuting activity.
4	Two automated static detector positions were surveyed for this crossing point. The peak count was in June at Position 1, with 403 bat passes. At Position 1, there were two peaks in the Pipistrelle species group activity, the first peak between one and 1.25 hours after	At Positions 1 and 2, Pipistrelle species were active throughout the night in relatively moderate numbers. Passes were recorded within the first hour after sunset and was therefore potentially close to a roost or linked to one via a dark corridor. Position 2 recorded two peaks close to dusk

Crossing point number	Survey results	Conclusions
	sunset, the second between 4.75 and five hours after sunset. In the Big bat species group, there were two peaks, the first peak between 0.75 and one hour after sunset and the second between 9.25 and 9.5 hours after sunset. The Woodland bat species group activity had one peak between 2.5 and 2.75 hours after sunset. At Position 2, two peaks were recorded within the Pipistrelle species group activity, the first between 0.75 and one hour after sunset and the second between 7.75 and eight hours after sunset. The Big bat species group had two peaks, the first peak between 1.25 and 1.5 hours after sunset and the second peak between 4.25 and 4.5 hours after sunset. The Woodland bat species group activity had just one peak between four hours and 4.25 hours after sunset.	and dawn. This could indicate that individuals were commuting to/from a nearby roost or that they were foraging during the peak emergence of small invertebrates (Altringham 2003). Big bats at Positions 1 and 2 were sporadically active throughout the night in relatively moderate numbers. At Position 1, there was a peak close to sunset and dawn. Like in the Pipistrelle species group, this could indicate commuting to/from a nearby roost or foraging during the small invertebrate peak (Altringham 2003). At Position 2, there were considerably fewer passes of Big bats with small amounts of foraging/commuting throughout the night. Woodland bat species were present at both Positions 1 and 2 in relatively low numbers, indicating low levels of foraging/commuting activity.
4.5	Four automated static detector positions were surveyed for this crossing point. The peak count was in July at Position 3, with 1,259 passes. This was consistent with all other positions with their peak counts occurring in July. The Pipistrelle species group activity at Position 1 had two peaks in the number of passes, the first between 1.5 and 1.75 hours after sunset and the second between 6.25 and 6.5 hours after sunset. The number of passes in the Big bat species group fluctuated throughout the night, with the most notable peak between 1.75 and two hours after sunset. The Woodland bat species group activity had a similar trend with fluctuations throughout the night, the most significant peak occurred between 1.5 and 1.75 hours after sunset. At Position 2, the Pipistrelle species group activity had two peaks in passes, the first between 2.25 and 2.5 hours after sunset and the second between 6.25 and 6.5 hours after sunset. The Big bat	Positions 3 and 4 recorded Pipistrelle species at consistently relatively high numbers of passes throughout the night. All four positions recorded two peaks during the night, after sunset and before dawn. This could indicate that individuals were commuting to/from a nearby roost or that they were foraging during the peak emergence of small invertebrates (Altringham, 2003). All four positions recorded Big bat species peaks in the number of passes close to dawn. However, only Positions 1 and 2 had peaks in number of passes after sunset. These peaks could be as a result of commuting to/from a nearby roost. In Woodland bat species, relatively low numbers were identified in all four positions, indicating low levels of commuting and foraging activity in the area.

Crossing point number	Survey results	Conclusions
	species group fluctuated throughout the night, the most notable peak between 0.5 and 0.75 hours after sunset. The Woodland bat species group activity was low throughout the night, with one peak between 3.25 and 3.5 hours after sunset. At Position 3, the Pipistrelle species group activity had two distinct peaks, between 2.5 and 2.75 hours after sunset and 5.25 and 5.5 hours after sunset. The Big bat species group had just one peak between 1.25 and two hours after sunset. The Woodland bat species group activity had no peak with consistently low numbers throughout. At Position 4, the Pipistrelle species group activity had two peaks between 1.25 and 1.5 hours after sunset and 6.25 and 6.5 hours after sunset. The Big bat species group had fluctuating numbers of passes throughout the night, with three distinct peaks between 0.5 and 0.75, 1.75 and 2 and 10.75 and 11 hours after sunset. The Woodland bat species group activity was low; however, there was one notable peak in passes between 3.25 and 3.5 hours after sunset.	
5	Two automated static detector positions were surveyed for this crossing point. The peak count was in April at Position 1, with 983 passes. At Position 1, the Pipistrelle species group activity fluctuated throughout with the most notable peak between 2.5 and 2.75 hours after sunset. The Big bat species group had one distinct peak between 0.75 and one hour after sunset. The Woodland bat species group activity was low throughout the night, with no significant peaks. At Position 2, the Pipistrelle species group activity had three peaks throughout the night, the first between 1.75 and two hours after sunset, the second between 3.25 and 3.5 hours after sunset and third between 5.5 and 5.75 hours after sunset. The Big bat	For the Pipistrelle species group, the peaks in activity could be as a result of relatively high levels of foraging activity during the peak of small invertebrates or commuting to/from a nearby roost (Altringham 2003). The Big bat species group had a relatively low number of passes throughout the night. The identified peaks could be as a result of relatively high levels of foraging activity during the peak of small invertebrates or commuting to/from a nearby roost (Altringham 2003). The Woodland bat species at Positions 1 and 2 had a relatively very low number of passes throughout the night. This indicated that the area was only used by a small number of foraging and/or commuting individuals.

Crossing point number	Survey results	Conclusions
	species group had passes throughout the night, with two notable peaks between 0.5 and 0.75 hours after sunset and 6.25 and 6.5 hours after sunset. The Woodland bat species group activity was low throughout the night with no significant peak.	
6	Five automated static detector positions were surveyed for this crossing point. The peak count was in October at Position 1, with 5,390 bat passes. Position 2 had a similar trend, with peak counts in April and October. Positions 3 and 4 both had peak numbers of passes in April, whereas the peak number of passes for Position 5 was in May. At Position 1, the Pipistrelle species group activity had a notable peak between 1.25 and 1.5 hours after sunset. A similar trend was obvious in the Big bat species group with a peak between 0.25 and 0.5 hours after sunset. The Woodland bat species group activity was low, with a small peak between 2.0 and 2.75 hours after sunset. Position 2 was similar to Position 1, but with no distinct peak. The Big bat species group and Woodland bat species group both had one peak in passes between 0.25 and 0.5 hours after sunset and 2.5 and 2.75 hours after sunset, respectively. At Position 3, the Pipistrelle species group also had consistently relatively high levels of activity throughout the night, with a slight peak between 0.75 and one hour after sunset. The Big bat species group experienced multiple peaks in number of passes, the two most distinct identified were at 0.75 and one hour after sunset, the second between 7.5 and 7.75 hours after sunset. The Woodland bat species group activity followed a similar trend, with the first peak at 0.75 and one hour after sunset and the second peak between2.25 and 2.5 hours after sunset. At Position 4, the Pipistrelle species group activity had one peak between 2.75 and three hours after sunset. The Big bat group	At all positions, the substantial number of Pipistrelle species group passes throughout the night infers relatively very high levels of foraging and commuting activity in the area. Position 1 had the greatest number of passes throughout; however, all positions demonstrate the importance of the area as a foraging and commuting resource for pipistrelles. The Big bat species group showed relatively high numbers of passes at Crossing Point 6. Position 4 had the greatest number of bat passes, with a high peak just after sunset. This activity suggests that the crossing point was sporadically used as a foraging and/or commuting route. Positions 4 and 5 recorded passes before sunset which indicates that it was potentially very close to a roost or linked to one via a dark corridor. The Woodland bat species at all positions had a relatively low number of passes throughout the night. Sporadic peaks were recorded in the number of passes, indicating low levels of foraging activity.

Crossing point number	Survey results	Conclusions
	had relatively low levels of activity throughout the night; however, there was a notable peak between 0.25 to 0.5 hours after sunset. The Woodland bat species group had a low number of bat passes, with no notable peak. Position 5 had relatively high levels of Pipistrelle species group passes consistently throughout the night. The Big bat and Woodland bat species groups both experienced just one peak between 0.25 and 0.5 and 4.5 and 4.75 hours after sunset, respectively.	
6.5	Five automated static detector positions were surveyed for this crossing point. The peak count was in July at Position 2, with 533 bat passes. This peak was also seen in Position 1. Position 3 had peaks in May and September, with a similar trend with Position 4 with most of its passes recorded in September. Position 5 had a peak count in August. At Position 1, a moderate number of passes of Pipistrelle species group bats were recorded throughout the night, with numerous intermittent peaks. The Big bat species group had approximately five peaks, with large fluctuations in levels of activity. The most notable peaks were recorded between1.25 and 1.5 hours after sunset and 3.5 and 3.75 hours after sunset. The Woodland bat species group had consistently relatively low levels of activity, with one peak between three and 3.25 hours after sunset. At Position 2, a relatively moderate number of passes of the Pipistrelle species group were recorded throughout the night, with a notable peak between 3.25 and 3.5 hours after sunset. The Big bat species group had two peaks in passes between 0.5 and 0.75 and 7 and 7.25 hours after sunset. The Woodland bat species groups had consistently relatively low levels of activity between two and 2.25 hours after sunset.	Relatively moderate numbers of passes of the Pipistrelle species group were recorded throughout the night. All positions at this crossing point had numerous fluctuating peaks, indicating that the area was likely used as a foraging/commuting resource. Positions 1 and 2 both recorded passes before sunset and was therefore potentially very close to a roost or linked to one via a dark corridor. For the Big bat species group, a relatively low/moderate numbers of passes were recorded throughout the night. Position 5 recorded passes 15 minutes before sunset, indicating that there was likely a roost in the locality. Similarly, to the Pipistrelle species group, all five positions recorded numerous peaks throughout the night, this would suggest that the area was utilised as a foraging and commuting resource. For the Woodland bat species group, relatively low numbers of passes were recorded throughout the night. Position 2 and 3 both recorded small peaks after sunset, this suggests that the area was sporadically used as a foraging and/or commuting route.

Crossing point number	Survey results	Conclusions
	At Position 3, a relatively moderate number of passes for the Pipistrelle species group were recorded throughout the night, with one peak between 2.25 and 2.5 hours after sunset. The Big bat species group were recorded with a fluctuating number of passes with approximately five peaks, the most notable peaks recorded were between one and 1.25 hours after sunset and 7.75 and eight hours after sunset. The Woodland bat species group activity was relatively low throughout, with one peak between 2.25 and 2.5 hours after sunset. At Position 4, the Pipistrelle species group activity had two peaks, the first between two and 2.25 hours after sunset and the second between 4.25 and 4.5 hours after sunset. For the Big bat species group, there was one peak in passes between 1.75 and two hours after the sunset. The Woodland bat species group showed consistent numbers with no notable peaks. At Position 5, the Pipistrelle species group activity had one peak between 3.5 and 3.75 hours after sunset. The Big bat species group followed a similar trend with one notable peak between 2.25 and 2.5 hours after sunset. The Woodland bat species group activity was relatively low throughout, with no notable peak.	
7	Three automated static detector positions were surveyed for this crossing point. The peak count was in October at Position 1, with 3,876 passes. At Position 1, the Pipistrelle species group activity had one peak between 0.75 and one hour after sunset. The Big bat species group were recorded with a fluctuating level of passes throughout the night, with approximately four peaks, the two most notable passes between 0.25 and 0.5 and 4.5 and 4.75 hours after sunset. The Woodland bat species group showed generally relatively low numbers of passes with a small peak between 3.5 and 3.75 hours after sunset.	At all three positions the Pipistrelle species group displayed a similar trend in the number of passes, with a peak after sunset and a steady decrease in the number of passes throughout the remainder of the night. This suggests that the area was consistently used as a commuting/foraging resource. Also, all three positions recorded passes before sunset/in the hour after sunset, therefore potentially suggesting that these positions were very close to a roost or linked to one via a dark corridor.

Crossing point number	Survey results	Conclusions
	At Position 2, there was a peak in the number of passes recorded of the Pipistrelle species group with a peak in the number of passes between one and 1.75 hours after sunset, which steadily decreased throughout the night. The Big bat species group were recorded with two peaks in passes between 0.25 and 0.5, and six and 6.25 hours after sunset. The Woodland bat species showed consistently relatively low numbers of passes, with no notable peak. At Position 3, for the Pipistrelle species group, a high number of passes were recorded, with the most notable peak between 0.75 and one hour after sunset. The passes in the Big bat species group fluctuated throughout the night, with approximately four peaks. The most notable peaks were recorded between one and 1.25, 1.75 and two, and 2.5 and 2.75 hours after sunset. The Woodland bat species were recorded as consistently relatively low numbers of passes, with no notable peak.	The Big bat species group were recorded with a relatively moderate number of passes throughout the night. All three positions recorded passes after sunset and then numerous fluctuating peaks throughout the duration of the night. This activity suggests that the crossing point was sporadically used for foraging and/or commuting. Position 2 and 3 recorded passes 0.25 to 0.5 hours before sunset, indicating that there was likely a roost in the locality. The Woodland bat species showed a relatively low number of passes throughout the night. However, Position 1 had one peak midway through the night which suggests that the crossing point was used for foraging. The low numbers throughout the remainder of the night suggests low levels of foraging/commuting activity.
7.5	Three automated static detector positions were surveyed for this crossing point. The peak count was in August at Position 2, with 4,839 bat passes. At Position 1, for the Pipistrelle species group, there was a consistently high number of passes recorded throughout the night. The Big bat species group showed a fluctuating number of passes throughout the night, consisting of approximately three peaks, the most notable peak between 9.75 and 10 hours after sunset. The Woodland bat species showed a consistently low numbers of passes, with no notable peak. At Position 2, for the Pipistrelle species group, there was a consistently high number of passes recorded throughout the night. The Big bat species group showed two peaks in passes, the first peak between 0.25 and 0.5 hours which was visibly much smaller than the peak at 6.75 and seven hours after	A relatively high number of passes were recorded for the Pipistrelle species group throughout the night, with Position 2 having the greatest peak. All positions recorded a peak in the number of passes after sunset, besides Position 2, which continued to increase until midway through the night. For all positions, passes continued throughout the night, indicating that the area was consistently used as a commuting/foraging resource. Passes were also recorded before sunset/in the hour after sunset, therefore suggesting that there was potentially a roost in close proximity or linked to one via a dark corridor. A relatively high/moderate number of passes were registered for the Big bat species group throughout the night, with a trend in all three positions of a peak in passes after sunset and before dawn. These peaks could be as a result of relatively high levels of foraging activity during the

Crossing point number	Survey results	Conclusions
	sunset. The Woodland bat species group were recorded with consistently low numbers throughout the night except for one peak between 2.25 and 2.5 hours after sunset. At Position 3, the Pipistrelle species group activity had a notable peak in passes between 0.5 and 0.75 hours after sunset, which then considerably declined as the night progressed. The Big bat species group showed two significant peaks between sunset and 0.25 hours after sunset and 7.5 and 7.75 hours after sunset. A low number of passes were recorded for the Woodland bat species group throughout, besides two peaks in number of passes between 0.25 hours before sunset to sunset and within three and 3.25 hours after sunset.	peak of small invertebrates or commuting to/from a nearby roost (Altringham 2003). Position 3 recorded passes before sunset, indicating that there is likely a roost in the locality. The Woodland bat species group showed a relatively low number of passes throughout the night. Position 2 had one peak midway through the night, suggesting that the site is used for foraging. The relatively low number throughout the remainder of the night suggests relatively low levels of foraging/commuting activity.
7.75	Four automated static detector positions were surveyed for this crossing point. The peak count was in May at Position 2, with 1,089 bat passes. At Position 1, the Pipistrelle species group showed two distinct peaks, the first between 2.5 and 2.75 hours after sunset and the second between 6.5 and 6.75 hours after sunset. The Big bat species group were recorded with fluctuating numbers of passes throughout, with a notable peak between 1.25 and 1.5 hours after sunset. Consistently relatively low numbers of passes were recorded for the Woodland bat species, with two peaks between 2.75 to three hours after sunset and 4.75 to five hours after sunset. At Position 2, there was a Pipistrelle species group notable peak between 1.75 and two hours after sunset. The Big bat species group showed relatively low numbers overall, with two peaks between one and 1.25 hours after sunset, and 2.5 and 2.75 hours after sunset. The Woodland bat species group displayed low numbers throughout, with approximately four peaks, the most distinct between 2.20 and 2.5 hours after sunset, and 3.50 and 3.75 hours after sunset.	A relatively high number of passes were registered for the Pipistrelle species group throughout the night. All positions recorded a similar trend with a peak after sunset and before dawn. For all positions passes extended throughout the night, suggesting that the area was consistently used as a commuting/foraging resource. Passes were also recorded before sunset/the hour after sunset for Positions 3 and 4, therefore potentially indicating that they were very close to a roost or linked to one via a dark corridor. The Big bat species group showed a relatively low/moderate number of passes throughout the night. All positions showed a peak after sunset but only Position 4 showed a peak before dawn; these peaks could be as a result of commuting to/from a nearby roost or foraging activity during the peak of small invertebrates (Altringham 2003). Positions 3 and 4 both recorded passes before sunset, indicating that there was likely a roost in the locality. The Woodland bat species were recorded with a relatively low number of passes throughout the night. Position 3 had

Crossing point number	Survey results	Conclusions
	At Position 3, the Pipistrelle species group were recorded passing throughout the night. There were three notable peaks between 2.25 and 2.5 hours, 3.5 and 3.75 hours and 6.25 and 6.5 hours after sunset. The Big bat species group displayed two notable peaks between 0.5 and 0.75 hours after sunset, and 1.25 and 1.5 hours after sunset. The Woodland bat species group showed a peak at the start and end of the night between 2.25 and 2.5 hours after sunset, and 4.25 and 4.5 hours after sunset. At Position 4, there were pipistrelle passes throughout the night, with two notable peaks at the start and end of the night at 1.75 hours after sunset, and between 6.5 and 6.75 hours after sunset. The Big bat species group were recorded with two peaks in the number of passes, the first between one and 1.25 hours after sunset and the second between 6.25 and 6.5 hours after sunset. Relatively low numbers of the Woodland bat species group were recorded throughout the night, with no notable peaks.	one peak after sunset, suggesting that the site may be used as a commuting route to/from a nearby roost. The remainder of the night recorded relatively low numbers of passes suggesting relatively low levels of foraging/commuting activity.
8	Two automated static detector positions were surveyed for this crossing point. The peak count was in May at Position 1, with 3,348 bat passes. At Position 1, Pipistrelle species group passes were recorded throughout the night with three notable spikes at 0.75, 2.75 and 5.25 hours after sunset. The Big bat species group peaked between 2.25 and 2.5 hours after sunset, with two other notable spikes at 1.5 hours and 7.75 hours after sunset. The Woodland bat species was recorded with relatively very low numbers, with a peak of two passes between two and 2.25 hours after sunset. At Position 2, there was a peak in the Pipistrelle species group passes between 0.75 to one hour after sunset, with the number of passes steadily declining throughout the night and then a small spike at 6.25 hours after sunset. The Big bat species group displayed a low number of passes, with two distinct peaks at 1.5	At Positions 1 and 2, the Pipistrelle species group was active throughout the night in relatively moderate to high numbers. This suggests that the crossing point area provides a foraging/commuting resource. At Positions 1 and 2, the Big bat species group had two distinct peaks; this could indicate commuting to/from a nearby roost or foraging during the dusk small invertebrate peak (Altringham, 2003). The Woodland bat species at Positions 1 and 2 had a relatively very low number of passes throughout the night. This indicated that the area was only used by a small number of foraging and/or commuting individuals.

Crossing point number	Survey results	Conclusions
	and 4.25 hours after sunset. Woodland bat species showed relatively very low numbers, with a peak of two passes between one and 1.25 hours after sunset.	
9	Two automated static detector positions were surveyed for this crossing point. The peak count was in May at Position 1, with 1,539 bat passes. At Position 1, there was a peak in the Pipistrelle species group activity between 0.5 and 0.75 hours after sunset, with number of passes steadily declining throughout the night. The Big bat species group registered as low numbers of bat passes but with notable peaks at 0.75 and 7.25 hours after sunset. Woodland bat species displayed low numbers that fluctuated through the night, with a peak between one and 1.25 hours after sunset. At Position 2, there was a peak in the Pipistrelle species group activity between 0.75 and one hour after sunset, with number of passes steadily declining throughout the night. Big bat species group passes peaked between 1.25 and 1.5 hours after sunset. Woodland bat species passes were low, with a peak between 1.25 and 1.5 hours after sunset.	At Positions 1 and 2, the Pipistrelle species group activity decreased throughout the night. This suggests that the crossing point area provides a foraging/commuting resource. Peak number of passes was recorded within the first hour following sunset and was therefore likely close to a roost or linked to one via a dark corridor. At Position 1, the Big bat species group displayed two distinct peaks. Position 2 had a later peak after sunset, which could indicate the emergence preference times between the Big bat species. Woodland bat species were present at both Positions 1 and 2 in moderate numbers, indicating low levels of foraging/commuting activity in these species. Fluctuating activity throughout the night likely represents differences in foraging strategies of woodland species.
9.5	Two automated static detector positions were surveyed for this crossing point. The peak count was in July at Position 1, with 4,449 bat passes. At Position 1, there was a peak in the Pipistrelle species group activity within the two hours to 2.25 hours after sunset, with consistently relatively high passes throughout the night and a small spike at six hours after sunset. For the Big bat species group, relatively low numbers of bat passes were recorded with notable peaks at 0.75, 2.25, 3.25 and 4.25 hours after sunset. Woodland bat species passes were low in numbers, with a peak between 2.5 and 2.75 hours after sunset with a second spike at 1.5 hours after sunset.	At Positions 1 and 2, the Pipistrelle species group activity remained relatively high throughout the night. This suggests that the crossing point area provides a foraging/commuting resource. Passes were recorded within the first hour following sunset and was therefore likely close to a roost or linked to one via a dark corridor. At Positions 1 and 2, the Big bat species group showed fluctuating activity, the majority of which occurred at the beginning of the night suggesting foraging behaviour. Bat passes occurred before sunset with a small spike just before sunrise, indicating it was likely close to a roost or linked to one via a dark corridor.

Crossing point number	Survey results	Conclusions
	At Position 2, there was a peak in the Pipistrelle species group activity between two hours to 2.25 hours after sunset with foraging throughout the night and a decline in activity 6.50 hours after sunset. Number of passes for the Big bat species group fluctuated, but highest passes were between 1.25 and 3.25 hours after sunset with a small spike 10.5 hours after sunset. Woodland bat species passes were relatively low, with a peak 1.5 hours after sunset and two smaller spikes at 2.5 and 5.5 hours after sunset.	Woodland bat species were present at both Positions 1 and 2 in relatively moderate numbers, indicating relatively moderate levels of foraging/commuting activity in these species.
10	Two automated static detector positions were surveyed for this crossing point. The peak count was in April at Position 1, with 734 bat passes. At Position 1, there was a peak in the Pipistrelle species group activity between the 2.25 hours to 2.5 hours after sunset. The Big bat species group passes had a notable peak between one hour and 1.25 hours after sunset. Woodland bat species passes were relatively low in numbers, with a peak between 3.25 and 3.5 hours after sunset. Position 2 had passes of the Pipistrelle species group throughout the night, reaching its highest between three and 3.25 hours after sunset, slowly decreasing from this point. The majority of passes for the Big bat species group were during the beginning of the night, with a peak between 1.25 and 1.5 hours after sunset. Woodland bat species passes were relatively low with a peak between 5.25 and six hours after sunset.	At Positions 1 and 2, the Pipistrelle species group activity remained relatively moderate throughout the night. This suggests that the crossing point area provides a foraging resource. Passes were recorded within the first hour following sunset and is therefore potentially near a roost or linked to one via a dark corridor. At Positions 1 and 2, the Big bat species group displayed a majority of activity at the beginning of the night and a second much smaller spike later in the night, suggesting foraging/commuting activity. The Woodland bat species at Positions 1 and 2 showed a relatively very low number of passes throughout the night, indicating that the area was only used by a small number of foraging and/or commuting individuals.
11	Two automated static detector positions were surveyed for this crossing point. The peak count was in August at Position 1, with 332 bat passes. At Position 1, there was a peak in the Pipistrelle species group activity between 1.25 and 1.5 hours after sunset, with lower numbers of passes throughout the rest of the night. The Big bat	At Positions 1 and 2, the Pipistrelle species group was active throughout the night in moderate numbers. This suggests that the crossing point area provides a foraging/commuting resource. Passes were recorded within the first hour following sunset and was therefore likely close to a roost or linked to one via a dark corridor.

Crossing point number	Survey results	Conclusions
	species group had peak passes between 1.5 and 1.75 hours after sunset, which then decreased throughout the night to very few passes past three hours after sunset. Passes for Woodland bat species were relatively low in numbers, with a peak between one and 1.25 hours after sunset. At Position 2, there was a peak in the Pipistrelle species group activity between one and 1.25 hours after sunset. The Big bat species group had peak passes between 1.5 and 1.75 hours after sunset, which then decreased with very little activity past 2.75 hours after sunset. Passes for Woodland bat species were relatively low in numbers, with a peak between two and 2.25 hours after sunset with fluctuating numbers of passes throughout the night.	At Positions 1 and 2, the majority of the Big bat species group activity was relatively moderate within the three hours after sunset followed by relatively very low activity. This suggested that the crossing point was sporadically used as a foraging and/or commuting route. The Woodland bat species recorded at Positions 1 and 2 were a relatively very low number of passes throughout the night, indicating that the area was only used by a relatively small number of foraging and/or commuting individuals.
12	Two automated static detector positions were surveyed for this crossing point. The peak count was in August at Position 2, with 3,542 bat passes. At Position 1, there was a peak in the Pipistrelle species group activity between 1.5 and 1.75 hours after sunset, with the number of passes slowly decreasing throughout the night. The Big bat species group had peak passes between 1.75 and two hours after sunset, which then decreased throughout the night. Passes for Woodland bat species peaked between 5.5 and 5.75 hours after sunset with a small spike at 2.25 hours after sunset. At Position 2, there was a peak in the Pipistrelle species group activity between 1.75 and two hours after sunset, with the number of passes slowly decreasing throughout the night. The Big bat species group had peak passes between two and 2.25 hours after sunset, which then decreased throughout the night. Passes for Woodland bat species peaked between 5.75 and six hours after sunset, with two small spikes at two and three hours after sunset.	Position 1 had the highest number of passes in April, which could be due to increased foraging post hibernation with subsequent relatively high values over spring and summer (also in Position 2), indicating it was potentially an important area for foraging/commuting. At Positions 1 and 2, the majority of the Big bat species group activity was relatively high, within the 5.25 hours after sunset followed by relatively low activity. This suggested that the area was sporadically used as a foraging/commuting resource. A relatively very low number of passes were before sunset, indicating a nearby roost or linked to one via a dark corridor. The Woodland bat species recorded at Positions 1 and 2 showed a relatively moderate number of passes fluctuating throughout the night, with the most activity recorded five hours after sunset. This indicated that the area was used by a relatively moderate number of foraging and/or commuting individuals.

Crossing point number	Survey results	Conclusions
12.5	Two automated static detector positions were surveyed for this crossing point. The peak count was in August at Position 1, with 2,007 bat passes. At Position 1, there was a peak in the Pipistrelle species group activity between 3.75 and four hours after sunset. Relatively low numbers of the Big bat species group were recorded, with a peak of eight passes at sunset. Relatively very low numbers of Woodland bat species passes were recorded throughout the night, with a peak of two passes six hours after sunset. Numbers in the Pipistrelle species group at Position 2 peaked at 0.5 to 0.75 hours after sunset, with reduced activity throughout the rest of the night. Big bat species group passes were present throughout the night, with the peak between 2.25 and 2.5 hours after sunset. Woodland bat species passes were recorded throughout the night in relatively low numbers, with higher activity before 3.75 hours after sunset.	At Position 1, a relatively high number of passes of the Pipistrelle species group were recorded throughout the night. This suggests that the crossing point area provided a foraging resource. Position 2 had peak numbers of bats within 0.75 hours after sunset, with decreased activity throughout the rest of the night. This suggested that the crossing point was likely close to a roost or linked to one via a dark corridor. At Positions 1 and 2, the Big bat species group showed fluctuating relatively low activity throughout the night, suggesting foraging/commuting behaviour. The Woodland bat species recorded at Positions 1 and 2 showed a relatively very low number of passes throughout the night, indicating that the area was only used by a small number of foraging and/or commuting individuals.
13	Two automated static detector positions were surveyed for this crossing point. The peak count was in June at Position 2, with 2,410 bat passes. At Position 1, there was a peak in the Pipistrelle species group passes between four and 4.25 hours after sunset. For the Big bat species group, there was a peak between two and 2.25 hours after sunset. Woodland bat species peaked at 3.25 hours after sunset. Position 2 had a peak in the Pipistrelle species group numbers between 4.5 and 4.75 hours after sunset. Big bat species group had three distinct peaks throughout the night, at one, six and 7.25 hours after sunset. There was a relatively low number of recordings for Woodland bat species, with the peak count between 3.5 and 3.75 hours after sunset.	At Positions 1 and 2, the Pipistrelle species group activity remained moderate/high throughout the night. This suggests that the crossing point area provided a foraging/commuting resource. Passes were recorded within the first hour following sunset and it was therefore likely close to a roost or linked to one via a dark corridor. At Positions 1 and 2, the Big bat species group showed two distinct peaks, which could indicate commuting to/from a nearby roost or foraging during the small invertebrate peak (Altringham 2003). Position 1 and 2 also had bat passes before sunset, further evidence for a nearby roost. The Woodland bat species at Positions 1 and 2 were recorded with a relatively very low number of passes throughout the night, indicating that the area was only used by a small number of foraging and/or commuting individuals.

Crossing point number	Survey results	Conclusions
14	Two automated static detector positions were surveyed for this crossing point. The peak count was in August at position 1, with 6,067 bat passes. Position 2 also had a high count of 3,500 bat passes in August. There were also significantly high results in June for Position 1 (4,927 passes) and Position 2 (3,138 passes). The recordings at Positions 1 and 2 showed no obvious peak. At Position 1, bat passes of the Pipistrelle species group were consistently over 300 passes every 15 minutes between 0.75 and 6.75 hours after sunset. For the Big bat species group activity, there was a peak of bat passes between four and 4.25 hours after sunset. Relatively low numbers were seen within the Woodland bat species group, with a peak between 1.5 and 1.75 hours after sunset. At Position 2, bat passes of the Pipistrelle species group were consistently over 200 passes every 15 minutes (excluding between 5.25 and 5.5 hours) between 0.75 and 6.5 hours after sunset. For the Big bat species group, there was a peak of bat passes between 3.75 and four hours after sunset. Relatively low numbers were seen within the Woodland bat species group, with a peak between 3.25 and 3.5 hours after sunset.	At Positions 1 and 2, the Pipistrelle species group was active throughout the night in relatively high numbers. This suggests that the crossing point area provided a foraging/commuting resource. Passes were recorded before sunset and is therefore likely close to a roost or linked to one via a dark corridor. At Positions 1 and 2, the Big bat species group showed relatively moderate to high activity, the majority of which occurred close to dawn. This suggests foraging/commuting behaviour. Bat passes occurred before sunset indicating a nearby roost or link to one via a dark corridor. Woodland bat species were present at Positions 1 and 2 in relatively very low numbers, indicating relatively low levels of foraging/commuting activity in these species.

Swarming survey results

4.3.21 The swarming survey at Hangman's Wood and Deneholes SSSI did not identify any bats swarming at the hibernation locations.

4.3.22 Swarming surveys at East Tilbury Battery were not carried out due to access restrictions.

Roost survey results

Tree assessment survey results

4.3.23 The results of tree assessments to the north of the River Thames are illustrated in Figure 8.23 (Application Document 6.2) and are summarised in Table 4.22.

4.3.24 One noctule roost was confirmed in Tree 1003 within the Order Limits Tree 1003 had three woodpecker holes, at least seven noctules were in the uppermost woodpecker hole and at least one noctule in one of the other woodpecker holes. It was not possible to fully endoscope the woodpecker hole with one noctule recorded without risking injury to the bat, therefore more noctules could have been behind it. Due to the number of bats and the time in which the tree was surveyed (24th August 2021) it is likely that this is a maternity roost. One probably noctule roost was found at Tree 1036, outside of the Order Limits. This had suspected noctule droppings at the base of the feature and showed signs of staining and the walls of the feature looked waxed, all very typical signs of a roost.

4.3.25 All the remaining trees that were found to probably (Tree 183) or possibly (Tree 116 and Tree 185) contain a roost were in the Order Limits. Tree 116 had a possible noctule emergence on 15/05/18. Tree 183 had a possible noctule and myotis sp. emergence on 12/09/18 and two probable common pipistrelle emergences on 21/05/19. Tree 185 had one possible emergence of a soprano pipistrelle on 18/06/2019. In addition, Tree 1015 had a polished opening indictatin it is inuse by bats, and this is considered a probable bat roost.

4.3.26 The single possible emergence was located at Gammon Staples Farmhouse where a single common pipistrelle was seen to possible emerge from a tree immediately behind the main building.

Table 4.22 Summary of tree assessment survey results within the Order Limits and 50m buffer to the north of the River Thames

Bat roost suitability	Number of trees
Confirmed roost	1
Probable	3
Possible	2
High	130
Moderate	266
Low	216
Negligible	98
Total	716

Woodland assessment survey results

4.3.27 Woodland assessment surveys were carried out in three locations to the north of the River Thames, as detailed below and shown in Figure 8.23 (Application Document 6.2). Table C.2 in Annex C details the proportion of each woodland sampled and summarises the results of the tree assessments and extrapolated results from these sampled areas.

East Tilbury Battery woodland

4.3.28 East Tilbury Battery woodland, which is approximately 2ha in size, comprises broadleaved woodland and is adjacent to the Order Limits.

4.3.29 It is located in an otherwise largely agricultural landscape, approximately 500m from the River Thames. Despite the nature of the wider landscape, there is a degree of connectivity to suitable foraging habitats present via hedgerows and tree lines.

4.3.30 Within the sampled area, five trees were identified as having moderate or high bat roosting suitability. No trees with moderate to high roosting suitability were identified within the Order Limits. The results are summarised in Table 4.23 below.

Table 4.23 East Tilbury Battery woodland tree assessment survey results

Suitability	Number of trees within the Order Limits	Number of trees outside the Order Limits
Confirmed roost	0	0
High	0	1
Moderate	0	4
Low	0	1
Negligible	0	0
Total	**0**	**6**

4.3.31 East Tilbury Battery woodland provides several suitable roost features for use by bats. Although relatively isolated, it provides one of the best resources within the wider project landscape for tree-roosting bat species. It is therefore considered that East Tilbury Battery woodland provides a roost resource of high value for bats.

Rainbow Shaw woodland

4.3.32 Rainbow Shaw is approximately 2ha of broadleaved woodland consisting of a canopy of pedunculate oak (>100 years old), beech and sweet chestnut. There was also an understorey of hawthorn and field maple.

4.3.33 Rainbow Shaw woodland is located in an otherwise largely arable landscape, which was suboptimal for bats, with Ashen Shaw woodland (approximately 0.45ha) and further woodland surrounding a nearby quarry adjacent to the north. There was suitable connectivity to these foraging habitats via hedgerows and tree lines with the exception to the west.

4.3.34 Within the Order Limits, 31 trees were identified with moderate or high bat roosting suitability. Within the sampled area, no trees with moderate to high roosting suitability were identified. Results are summarised in Table 4.24 below.

Table 4.24 Rainbow Shaw woodland tree assessment survey results

Suitability	Number of trees within the Order Limits	Number of trees outside the Order Limits
Confirmed roost	0	0
High	20	0
Moderate	11	0
Low	4	0
Negligible	2	0
Total	37	0

4.3.35 The transect point activity surveys for Rainbow Shaw recorded a mean number of passes per night of 1,853 from the Pipistrelle species group, 27 from the Big bat species group, and 11 from the Woodland bat species group. Common pipistrelle, soprano pipistrelle, Nathusius' pipistrelle, Noctule, *Nyctalus* spp., brown long-eared bat and *Myotis* spp. were recorded on the walked transect activity surveys.

4.3.36 Rainbow Shaw woodland provides a high number of potential bat roosting features, with recorded bat activity frequent throughout the night, it is anticipated that roosts are present in the locality. The woodland was used as a commuting and foraging resource for bats, with potential roosting also in sections not surveyed. It was therefore considered that Rainbow Shaw woodland provides a roost resource of high value for bats.

The Wilderness woodland

4.3.37 The Wilderness woodland is approximately 3.7ha of broadleaved woodland consisting of a canopy of ash, pedunculate oak, poplar spp. and sycamore.

4.3.38 It is located in an otherwise largely arable landscape that was suboptimal for bats, with no other significant areas of woodland located in close proximity. However, a degree of connectivity to suitable foraging habitat at the Mardyke is present via a tree line that runs eastwards from the south-east corner of the Wilderness woodland.

4.3.39 Within the Order Limits, 31 trees were identified with moderate or high bat roosting suitability. Within the sampled area, one trees was identified with moderate or high bat roosting suitability. Results are summarised in Table 4.25.

Table 4.25 The Wilderness woodland tree assessment survey results

Suitability	Number of trees within the Order Limits	Number of trees outside the Order Limits
Confirmed Roost	0	0
High	16	1
Moderate	15	0
Low	7	0
Negligible	0	1
Total	38	2

4.3.40 The transect point activity surveys for the Wilderness woodland recorded a mean number of passes per night of 250 from the Pipistrelle species group, 18 from the Big bat species group, and nine from the Woodland bat species group. Common pipistrelle, soprano pipistrelle, Nathusius' pipistrelle, *Nyctalus/Eptesicus* spp., and *Myotis* spp. were recorded on the walked transect activity surveys.

4.3.41 Despite the lack of functional connectivity to other suitable bat habitats, the Wilderness woodland provides a significant number of potential bat roosting features. However, during the assessment of the woodland a high number of invasive ring-necked parakeets were observed. The relatively low numbers of bats from automated surveys could be in part due to the direct competition for tree cavities with this species (Menchetti *et al.*, 2014; Hernández-Brito et al, 2018). In spite of this, it was considered that the Wilderness woodland still provides a roost resource of moderate value for bats.

Structure assessment survey results

4.3.42 Woodland assessment surveys were carried out in three locations to the north of the River Thames, as detailed below in Table 4.26 and shown in Figure 8.23 (Application Document 6.2). Table C.2 in Annex C details the proportion of each woodland sampled and summarises the results of the tree assessments and extrapolated results from these sampled areas.

Table 4.26 Summary of structure assessment survey results from the north of the River Thames

Suitability	Number of structures
Confirmed Roost	10
Probable Roost	1
Possible Roost	2
High	27
Moderate	59
Low	51
Negligible	71
Total	221

4.3.43 There were ten confirmed roosts within built structures, four of which were identified from DNA analysis, and five from emergence surveys. The remaining confirmed roost was found within St Mary Magdalene Church North Ockendon, which is part of a SINC site designated in part for its bat roost. The possible roost was identified by emergence surveys.

4.3.44 Two structures at Benton's Farmyard and two structures at Manor Farm were confirmed as bat roosts following DNA analysis of droppings, confirming the presence of brown long-eared bats. At Benton's Farmyard, droppings were located in the attic of Building 12 (a hayloft) and a small number of droppings were located scattered around Building 15b (a workshop). At Manor Farm, droppings and moth feeding remains were located in the east barn section of Building 12 (barn) and droppings were also located within the loft space of Building 13 (farmhouse).

4.3.45 Four confirmed common pipistrelle day roosts were identified during emergence surveys in 2019 and 2021. These were at 1 Bridge Cottage, Yellowstock Mews, 2 Grays Corner and Estate House. The remaining confirmed roost was located at the Rosary, which consisted of four confirmed common pipistrelle and one soprano pipistrelle possibly seen emerging from the main house.

4.3.46 The possible bat roosts was located at Alde Cottage, where there were two common pipistrelle possibly emergening from the garage. The other potential emergence was located at Yellowstock Mews, where there were two possible common pipistrelle emergences from either the main house or a tree behind Yellowstock Mews.

Emergence/re-entry survey results

4.3.47 Results of the emergence/re-entry surveys and survey metadata are provided in Annex D and Annex E. Confirmed roosts are shown in Figure 8.24 and Figure 8.25 (Application Document 6.2), for trees and structures, respectively.

4.3.48 There were 25 trees identified as requiring emergence/re-entry surveys to the North of the River Thames from within the Order Limits and 50m buffer. Emergence surveys were carried out on 16 trees with no bats recorded emerging. The required number of visits were completed for 11 of these trees.

4.3.49 There were 140 structures identified as requiring emergence/re-entry surveys to the north of the River Thames. Emergence surveys were carried out at 1 and 2 Bridge Cottages, Yellowstock Mews and Estate House in 2019. In 2021, further emergence surveys were carried out on 20 buildings requiring additional surveys. One common pipistrelle was recorded emerging from 1 Bridge Cottage in 2019, and no bats emerged from Estate House. One common pipistrelle was recorded emerging from Yellowstock Mews, and one common pipistrelle was recorded emerging from 2 Grays Corner in 2021.

5 Assumptions and limitations

5.1 Activity survey limitations

Walked transect, transect point and crossing point activity survey limitations

5.1.1 Access restrictions, weather conditions, health and safety constraints, technical issues, surveyor error and removal of equipment by the public prevented a number of walked transect and/or automated static detector surveys being carried out or caused them to be cancelled mid survey. See Table F.1 and Table F.2 in Annex F for detailed list of constraints, transect and crossing point locations that were impacted.

5.1.2 When an activity transect was prevented from occurring on more than one attempt, it was concluded that the extent of survey work that was carried out would still provide a solid underpinning for the assessment of the bat assemblage and use of these locations. The absence of data from the two months within the more active period for bats is taken into consideration during the assessment of the value of these locations for bats and, where necessary, a precautionary approach to this valuation was taken.

5.1.3 Where weather conditions were not in line with BCT Guidelines (Collins, 2016), it was not considered that these weather conditions significantly affected the assessments made, given the large extent of survey effort carried out within optimal conditions, the conditions being minimally different to those recommended and that the survey length was longer than required by BCT guidelines.

5.1.4 Individual automated static detectors and microphones were not exclusively used at the same transects throughout the survey period. It was likely that there may have been slight deviations in the recording numbers due to the sensitivity of differing detectors and microphones (although the same make and model) from one month to the next.

A2 and HS1 corridor activity survey limitations

5.1.5 Limited visibility was the most significant limitation associated with the activity surveys of the A2 and HS1 corridors. The positioning of the surveyors was as outlined in paragraph 4.3.14; the choice of locations of these positions were restricted due to the health and safety constraints associated with proximity to two major road and rail networks.

5.1.6 The significant noise levels associated with the A2 may have drowned out bat calls, leading to under recording.

Swarming survey limitations

5.1.7 Swarming surveys could not be carried out on East Tilbury Battery, due to land access restrictions being enforced throughout the survey period. Therefore, a precautionary approach was taken regarding this area.

5.1.8 While swarming surveys were carried out at Muggins Chalk Pit, on the initial survey (1 October 2019), there was no access to the chalk pit itself. The survey was carried out from the other side of the chalk pit boundary fence, which offered only limited views into the interior due to the height of the surrounding vegetation. This location was also exposed, with suboptimal weather conditions (strong breeze and heavy rain) experienced throughout the survey. This survey was therefore repeated later in the month (28 October 2019) when access to the chalk pit had been obtained and the survey was carried out from a significantly more sheltered location.

5.2 Roost survey limitations

Tree assessment survey limitations

5.2.1 It was not possible to get access to all areas within the tree assessment survey area (the Order Limits plus a 50m buffer). This was due to landowners refusing or revoking access before or during surveys, an inability to identify the appropriate landowner of some land parcels during the survey period, and/or health and safety constraints due to the nature of land use or the absence of a safe means of access.

5.2.2 Where possible, the number of further surveys carried out was in accordance with BCT guidelines (Collins, 2016)[29]. However, this was not possible on all occasions due to the above constraints. It was not considered that this would materially change the assessment of the tree roost resource. This was due to the precautionary nature of initial ground-level assessments and the regularity with which tree-roosting bat species move between trees.

5.2.3 Difficulties associated with the identification of bat roosts in trees are widely recognised. These difficulties include the small likelihood of encountering a bat in a tree roost at the time of survey, the lack of persistence of evidence associated with tree-roosting bats and the limited visibility of suitable roost features in trees.

5.2.4 Professional judgement has been used where necessary to address any gaps in survey data that have occurred as a result of the limitations outlined above, such that the conclusions of the assessment of likely effects of the Project on bats are sufficiently robust.

Woodland assessment survey limitations

5.2.5 Trees within woodland blocks that are within the Order Limits have been ground assessed, excluding the woodland at the north-western corner of Shorne Wood and the woodland adjacent to Thong Lodge (where further surveys are planned but could not be carried out in 2021 due to access restrictions). Each woodland was assessed individually to inform an assessment of the resource value.

[29] Two further surveys for features of moderate suitability and three further surveys for features of high suitability.

5.2.6 At the time of the assessment of Claylane Wood (March 2019), considerable clear felling occurred, removing mature trees across large sections of the interior woodland, which restricted surveyor access at this time. An updated assessment was carried out in December 2019 and June 2021 to access the whole woodland.

5.2.7 It is possible that features in Ashenbank Woodland were not identified at the time of survey, as the survey was carried out in the summer and high levels of foliage may have obscured visibility of features.

5.2.8 It was not possible to complete a woodland assessment for Cobham Hall and East Tilbury Battery due to access restrictions.

5.2.9 Surveyor error resulted in a section of the woodland adjacent to Thong Lodge not being surveyed. Therefore, an assumption was made of the value of the resource based on neighbouring woodlands.

Structure assessment survey limitations

5.2.10 Access restrictions, health and safety constraints and survey logistics meant that 64 structures within the study area were unable to be surveyed, as detailed within Table D.1 and Table D.2 in Annex D. For the purposes of this assessment, a precautionary approach was taken for these structures, with detailed surveys recommended before construction works for the Project begins.

5.2.11 In certain circumstances where homeowners refused access or were reluctant to provide internal access, external surveys were carried out to assess the suitability for bats to gain entrance to internal areas. In these cases, a precautionary approach was used to ensure that the potential suitability of the structure for roosting bats was not underestimated.

Emergence/re-entry survey limitations

5.2.12 A total of 40 trees were identified as requiring emergence/re-entry surveys within the Order Limits. Emergence surveys, with the required number of visits carried out on 14 of these trees, as detailed in Table E.2 and Table E.4 in Annex E. There are nine trees (T273, 284, 285, 287, 382, 398, 427, 554 and 575) that were surveyed but not completed to the guidelines. The remaining 17 trees were unable to be surveyed due to health and safety constraints or access issues.

5.2.13 There were 197 structures identified as requiring emergence/re-entry surveys within the Order Limits. One emergence survey was undertaken on 10 of these structures, as detailed in Table E.1 and Table E.30 in Annex E, nine of which required more than one survey. Due to access restrictions, no emergence/re-entry surveys were carried out on the remaining 162 structures (see Table D.1 and Table D.2 in Annex D).

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Annexes

Annex A Auto ID and Verification

A.1 Kaleidoscope auto ID

A.1.1 Large-scale automated detector surveys can be expected to generate a large amount of data. Due to both this, and the need to analyse all collected data, so ensuring that the maximum amount of information was obtained, it was determined that manual identification would not be practical. It was therefore decided to employ automatic identification (auto ID) software.

A.1.2 Kaleidoscope Pro was chosen as the most appropriate auto ID software following a review of the available options. Version 5.0.3 of Kaleidoscope Pro and was used for all analyses.

A.1.3 The methodology employed during auto ID of the bat data followed guidance laid out in Reason *et al*. (2016).

A.1.4 Recordings collected using handheld Batlogger M detectors were manually identified using BatExplorer and are not discussed here.

A.1.5 Kaleidoscope Pro (version 5.0.3) is a conversion and bat call auto ID software package created by Wildlife Acoustics specifically for use with recordings made by Wildlife Acoustics bat detectors, including the SM4 detector.

A.1.6 At the time of these analyses (2018 and 2019), Kaleidoscope Pro was capable of identifying 15 species of British bats using version 4.3.0 of Wildlife Acoustics 'Bats of Europe' classifiers and selecting as the region the United Kingdom. Kaleidoscope Pro provides identifications at the species level only and does not provide group-level identifications, such as Big bat species (consisting of noctule, Leisler's bat and serotine) or *Myotis* spp. (consisting of all *Myotis* species), which may commonly be used during manual analyses. Where insufficient information is present to allow a species-level identification, but it is still considered that a bat call is likely to be present, a classification of 'NoID' is provided. Where no bat call(s) are identified, a classification of 'noise' is provided.

A.1.7 While updates to Kaleidoscope Pro and its associated 'Bats of Europe' classifiers have become available since the commencement of SM4 detector recordings in 2018, these have not been used due to the potential for new parameters to be uploaded as part of these updates which may render results pre- and post-update incomparable.

A.1.8 The settings detailed in Table A.1 below were used for all auto ID through Kaleidoscope Pro.

Table A.1 Kaleidoscope Pro setting options

Setting option	Chosen setting
Analysis mode	Bat analysis mode
Input data – file type	Waveform Audio File Format (WAV)
Time expansion factor	Auto
Output date – file type	None selected30
Noise filtering	Disabled
Signal parameters	
Max-Min frequency range	8-120kHz (kilohertz)
Max-Min length of detected pulses	2-500ms (millisecond)
Maximum inter-syllable gap	500ms
Minimum number of pulses	2
Auto ID	
Classifiers	Bats of Europe 4.3.0
Region	United Kingdom
Manual selection of species	Alcathoe[31]
Sensitivity	0 balanced (neutral)

A.2 Manual verification methodology and results

Manual verification

A.2.1 To ensure that the identifications provided through auto ID by Kaleidoscope Pro were accurate, and that recordings, particularly for those species of particular interest, were not being missed or wrongly identified, a series of manual verifications were carried out.

A.2.2 The appropriate number of recordings, based on the verification effort determined, were selected at random through the use of the random number generator in Excel. All files relating to a given classification were summarised in an Excel spreadsheet by month, crossing point or transect number and static detector position number, and the random numbers generated applied to the row numbers to determine the files selected for verification.

[30] This functionality is relevant to the file conversion element of Kaleidoscope Pro and is not required for auto-identification.
[31] This species is not automatically selected as part of the United Kingdom region but was manually added to the list of considered species.

NoID verification results

A.2.3 Kaleidoscope Pro returned a number of recordings with an identification of NoID, indicating that a bat call may be present, but that insufficient information was present to enable a species identification to be provided. Such calls may often be recorded by automated detectors due to the sensitivity of the microphones, which enables even very faint calls to be recorded. Calls of this nature are often very difficult, if not impossible, to identify even when considered manually.

A.2.4 To determine the likelihood that identifiable calls were being missed within the NoID classification provided by Kaleidoscope Pro, a 5% random sample of these calls (452 recordings) were selected for manual verification.

A.2.5 Of those 452 recordings, 166 were classed as 'noise', without a bat present. The remaining 286 recordings contained bats, with 207 of these from common, soprano, or Nathusius' pipistrelle (although some of these also contained calls from an additional species). Other bat species present were classified as *Myotis* spp., *Nyctalus*, noctule and Big bat species. Regarding particular transect areas, no species were recorded that had not been noted as already present from clearer recordings.

Noise verification results

A.2.6 To consider what proportion of bat calls may be missed by Kaleidoscope Pro (i.e. those not being provided with an identification and therefore being dismissed as 'noise' files) a 1% randomly selected sample, equating to 7,067 recordings, was considered for verification. This was not achieved, with 4,693 recordings verified.

A.2.7 Of these, 1,915 (40.8%) were confirmed noise recordings, 1,842 (39.2%) were possible noise recordings, and 938 (20%) contained bats. The possible noise recordings contained a lot of crickets, frequently with a quiet bat call in the background that would not have been recorded were it not for the louder (mainly) cricket calls. Therefore, for the purpose of this assessment, this category was also be classified as noise.

A.2.8 Of the 938 recordings that were found to contain a bat call, 139 related to Pipistrelle species group (97 common pipistrelle, 39 soprano pipistrelle, three Nathusius' pipistrelle), 20 Big bat, eight *Nyctalus* spp., two noctule, two serotine, two brown long-eared bat, and five *Myotis* spp. The remainder (760) comprised bat social and orientation calls that could not be identified to species.

Conclusions

A.2.9 It was decided that owing to the discrepancies relating to some species verification, the separation of all species into three groups was the most quantifiable way to interpret the results. This meant that suitable conclusions could be drawn on the bat activity throughout the Order Limits.

Annex B Transect and Automated Static Detector Locations

B.1.1 Table B.1 provides details of the location of transect routes and automated detector positions within these transect route, see Figure 8.25 (Application Document 6.2) for the exact locations.

Table B.1 Location of transect routes and automated detector positions within transects

Transect number	Transect		Automated static detectors	
	Location	Habitats covered	Position	Habitats covered
1	Great Wood, Rochester	Broadleaved woodland bounding the M25 and HS1	1	Broadleaved woodland and grassland
			2	Broadleaved woodland and grassland
2	Rochester & Cobham Park Golf Club	Managed landscape on golf course with amenity grassland and surrounding broadleaved woodland	1	Broadleaved plantation woodland
			2	Broadleaved semi-natural woodland and amenity grassland
3	Ashenbank Wood	Mostly ancient broadleaved semi-natural woodland. The north-east corner is recently coppiced woodland with standard sweet chestnut trees remaining	1	Ancient broadleaved semi-natural woodland
			2	Ancient broadleaved semi-natural woodland
4	Brewers Wood	Ancient broadleaved semi-natural woodland	1	Ancient broadleaved semi-natural woodland
5	Shorne Wood	Ancient broadleaved semi-natural woodland	1	Ancient broadleaved semi-natural woodland
			2	Ancient broadleaved semi-natural woodland
			3	Ancient broadleaved semi-natural woodland
6	Claylane Wood	Mostly broadleaved semi-natural woodland. The north-east section is arable grassland bordered by a line of trees and hedgerow	1	Broadleaved semi-natural woodland
			2	Arable grassland and hedgerow

Transect number	Transect		Automated static detectors	
	Location	Habitats covered	Position	Habitats covered
7	Southern Valley Golf Club	Amenity and species-poor semi-improved grassland with areas of dense and scattered scrub	1	Woodland mixed plantation and hard standing
			2	Amenity grassland and a line of broadleaved trees
			3	Amenity grassland with dense scrub and species-poor intact hedgerow
			4	Amenity grassland, poor semi-improved grassland and mixed plantation
8	Filborough Marshes	Complex ditch network surrounded by poor semi-improved grassland	1	Poor semi-improved grassland ditch and scrub
			2	Poor semi-improved grassland, ditch and scrub
			3	Poor semi-improved grassland, ditch and dense scrub
9	Milton Rifle Range	Amenity and poor semi-improved grassland with scattered scrub throughout	N/A	N/A
10	Ingrebourne Valley	Artificial spoil (pulverised fuel ash (PFA)) and arable fields	1	Other tall ruderal and artificial spoil (PFA) fields
			2	Artificial spoil (PFA)
11	Ingrebourne Valley	Dense scrub, arable fields and Low Street Pit Local Wildlife Site unimproved acid grassland	1	Dense scrub and unimproved acid grassland

Transect number	Transect		Automated static detectors	
	Location	Habitats covered	Position	Habitats covered
12	Coalhouse Fort	Swamp in northern section, neutral semi-improved and amenity grassland around Coalhouse Fort, and arable fields	1	Arable field, hedgerow and ditch
			2	Arable field and hedgerow
13	East of Low Street Lane, which incorporates the Tilbury Loop railway and Lake	Mainly arable fields with dense scrub and a lake surrounded by broadleaved plantation woodland	1	Dense scrub
			2	Hedgerow, lake and arable field
			3	Broadleaved plantation woodland and poor semi-improved grassland
14	Hoford Road	Arable fields, hedgerows, cultivated/disturbed land (emphemeral/short perennial) and poor semi-improved and improved grassland encroached with scattered scrub	1	Improved grassland, semi-improved grassland and scattered scrub
			2	Broadleaved semi-natural woodland, other tall ruderals, cultivated/disturbed land (ephemeral/short perennial)
15	Orsett Golf Club	Dense scrub around course perimeter, acid grassland and amenity grassland	1	Scattered scrub and acid grassland
			2	Dense scrub around course perimeter
16	North of Brentwood Road	Arable	1	Along farm track between arable field and copse
17	Hangman's Wood and Deneholes SSSI	Broadleaved woodland	1	Broadleaved woodland
			2	Broadleaved woodland
18	Green Lane	Mainly arable with small area of broadleaved woodland to the west	1	Semi-natural broadleaved woodland and arable
19	North of Green Lane	Arable with hedgerows	1	Arable hedgerow
			2	Arable hedgerow

Transect number	Transect		Automated static detectors	
	Location	Habitats covered	Position	Habitats covered
20	West of Parker's Farm Road	Arable with a small block of broadleaved plantation/semi-natural woodland	1	Broadleaved plantation woodland, hedgerow and arable
			2	Broadleaved semi-natural woodland and arable
21	Between Mardyke Farm Landfill and Veolia Landfill	Arable with Mardyke along the eastern edge and small areas of semi-natural plantation woodland	1	Arable and semi-natural plantation woodland
22	The Wilderness	Broadleaved semi-natural woodland, arable and hedgerows	1	Broadleaved semi-natural woodland and arable
			2	Broadleaved semi-natural woodland
23	Thames Chase Forest Centre	Arable, broadleaved plantation woodland and poor semi-improved grassland	1	Broadleaved woodland and grassland
			2	Arable and broadleaved plantation woodland
			3	Broadleaved plantation woodland and poor semi-improved grassland
24	Thames Chase Forest Centre	Woodland broadleaved plantation, neutral semi-improved and poor semi-improved grassland	1	Broadleaved plantation woodland, neutral semi-improved grassland and poor semi-improved grassland
			2	Broadleaved plantation woodland and neutral semi-improved grassland
			3	Broadleaved plantation woodland and grassland

Transect number	Transect		Automated static detectors	
	Location	Habitats covered	Position	Habitats covered
25	North of St. Mary's Lane	Amenity grassland and woodland broadleaved plantation	1	Broadleaved plantation woodland
			2	Broadleaved plantation woodland
			3	Neutral semi-improved grassland and broadleaved plantation woodland
26	South of M25	Semi-natural broadleaved woodland and arable	1	Arable
			2	Arable
			3	Semi-natural broadleaved woodland
27	East of the M25	Cultivated/disturbed land (arable), semi-natural broadleaved woodland and plantation broadleaved woodland	1	Cultivated/disturbed land (arable) and semi-natural broadleaved woodland
			2	Cultivated/disturbed land (arable) and semi-natural broadleaved woodland

Annex C Transect and Automated Static Detector Locations

C.1 Woodland assessment survey methodology

C.1.1 This paper is intended to set out a proposed alternative approach, and associated reasoning, to the surveying and assessment of potential bat roost features in trees within areas of woodland that could be affected, either directly or indirectly, by National Highways' proposed Lower Thames Crossing project (the Project). This follows the completion of ground-level tree assessments within the Design Release (DR) 2 Order Limits plus a 50m buffer.

Background information

Tree-roosting bat species

C.1.2 Eleven[32] of the 17 resident UK bat species are known to roost exclusively or primarily in trees, for part or all of the year (Collins, 2016). All 11 of these species have been recorded, to a greater or lesser degree within one or both of the counties Essex (Dobson & Tansley, 2014) and Kent (Young *et al*. 2015) affected by the Project. In addition, three species[33] occasionally recorded roosting in trees are also known to be present in both counties (Dobson & Tansley 2014 and Young *et al*. 2015).

C.1.3 The use of tree roosts has been subject to an increasing amount of academic research, the findings of which have highlighted the frequency with which tree-roosting bats change roosts. This research has shown roost switches to occur over large areas, including noctule roost switches within 200ha and at distances of up to 12km (Dietz *et al*. 2011), and roost switching occurring over short time periods, as detailed for several species below:

a. Natterer's bat summer roost switching every two to five days (Smith & Racey, 2008; Dietz *et al.,* 2011).

b. Bechstein's bat roost switching every two to three days (Dietz *et al.,* 2011; Kühnert *et al.,* 2016).

c. Leisler's bat roost switching every two to 10 days (Waters *et al.*, 1999).

d. Frequent Barbastelle roost switching (Billington, 2003; Greenaway, 2001; Zeale, 2011; Kühnert *et al.,* 2016).

e. Roost switching between neighbouring tree roosts in Brandt's bats (Dense & Rahmel, 2002).

[32] Alcathoe bat, Barbastelle, Bechstein's bat, Brandt's, brown long-eared bat, Daubenton's bat, Leisler's bat, Nathusius' pipistrelle, Natterer's bat, noctule and whiskered bat.
[33] Common pipistrelle, soprano pipistrelle and serotine.

Survey limitations

C.1.4 Difficulties associated with the identification of bat roosts in trees are widely recognised. These difficulties include the likelihood of encountering a bat in a tree roost at the time of survey, the lack of persistence of evidence associated with tree-roosting bats and the limited visibility of potential roost features in trees.

C.1.5 As detailed above, tree-roosting bat species have been shown to regularly move between roosts and therefore there is a reduced likelihood that a bat will be present in a specific roost feature at the time of survey. A study by Andrews & Gardener (2015) has highlighted this issue. It details, as shown in Table C.1 (adapted from Andrew & Gardener, 2015), the level of survey effort required to reach specific percentage probabilities of encountering bats in tree roosts.

Table C.1 The number of sequential visits required to reach the key percentage probabilities of encountering bats when observing 1, 2, 5, 10, 20, 30 and 40 potential roost features (PRFs)[34]

Number of PRFs	May/June			July			August		
	50%	80%	95%	50%	80%	95%	50%	80%	95%
1	14	31	57	14	31	-	9	21	-
2	9	21	38	9	21	-	7	16	28
5	5	10	18	5	10	19	4	9	16
10	3	5	10	3	5	10	2	5	9
20	1	3	4	1	3	4	1	3	4
30	1	2	3	1	2	3	1	1	2
40	1	1	1	1	1	1	1	1	1

C.1.6 While the presence of bat(s) in a roost feature at the time of survey is not the only evidence that can be used to determine use of a feature by bats, other forms of evidence, such as droppings, often do not persist in tree roosts for as long as they may do in other locations (i.e. roosts in buildings) (Collins, 2016). This is due to their greater exposure to the elements and/or the increase likelihood of disturbance from other wildlife.

C.1.7 The use of emergence and/or re-entry surveys for the identification of tree roosts also faces limitations with many tree-roosting bat species either not echolocating at all or doing so only very quietly on emergence, making them difficult to detect with bat detectors (Collins, 2016). Additionally, some tree-roosting bat species emerge from tree roosts very late and often return very

[34] The number of PRFs checked each day is shown in the left column and the number of sequential visits to yield 50%, 80% and 95% probability of encounter is given for each survey period.

early and are therefore easily missed during typical emergence/re-entry survey timeframes (Collins, 2016). As emergence/re-entry surveys are carried out throughout the bat's active season, such surveys can also be hampered by the growth of tree foliage which can obscure potential roost features or form a canopy that reduces light levels. This reduces the ability of surveyors to observe emerging or re-entering bats (Collins, 2016). Furthermore, potential tree roost features are often located at considerable heights with surveyors on the ground unable to closely observe any associated activity, particularly at low light levels (Collins, 2016).

C.1.8 Therefore, while detailed surveys of individual trees may enable confirmation of presence, it is extremely unlikely that absence can be conclusively determined. So there is a growing argument that likely impacts, and their extent, should be assessed on the basis of all trees with bat roosting potential within a given area as a roost resource which may, at one time or another, be used by tree-roosting bats (Collins, 2016).

Survey results to date

C.1.9 An initial assessment of the tree resource throughout the Project was obtained during the Extended Phase 1 and protected species surveys carried out within the Development Boundary plus a 50m buffer during 2017. There have been a number of changes to the development boundary since then. Extended Phase 1 surveys identified the presence of trees, treelines and/or woodland blocks that may be suitable for roosting bats. Initially, these surveys did not specifically inspect individual trees and as such these locations were reassessed during specific ground-level bat tree inspections in 2018, 2019, 2020 and 2021. However, a proportion of these trees were considered in greater depth, with potential roost features described in limited detail.

C.1.10 Specific ground-level bat tree inspections began in January 2018 and have, to date, primarily focused on the single trees located along hedgerows, and small groups of trees that make up the large majority of the tree resource between the A2/M2 and M25, within the DR2 Development Boundary plus a 50m buffer. Trees within woodland blocks that are within the Order Limits have been ground assessed, excluding the woodland at the north-western corner of Shorne Wood and the woodland adjacent to Thong Lodge, where further surveys are planned.

C.1.11 To date, 2018, 2019, 2020 and 2021 ground-level tree assessments have identified 253 trees as being suitable for tree-roosting bats within woodland blocks:

a. Low suitability = 35

b. Moderate suitability = 114

c. High suitability = 101

d. Confirmed roosts = 3

Proposed approach to assessments and further surveys

C.1.12 Initial consideration of more extensive woodland blocks, in particular The Wilderness, have identified that many of these trees are not only suitable for roosting bats, but contain multiple potential roost features. In some cases, up to eight potential roost features have been identified on a single tree. Full, detailed assessment of each potential roost feature on each tree within this area of woodland would therefore require significant survey effort and would result in the identification of a large number of further survey requirements. Such further surveys would be significantly impacted by the survey limitations detailed above.

C.1.13 An alternative approach is therefore being proposed for such areas of woodland, considered at present to include, but potentially not limited to: The Wilderness; Claylane Wood; Shorne and Ashenbank Wood SSSI; and Thames Chase Community Forest.

C.1.14 It is therefore considered that the approach described below is suitable for these information requirements, while remaining practical within the limited timeframe available.

C.1.15 Detailed assessment from the ground of the trees present within the Order Limits within woodland blocks was carried out in 2018, 2019, 2020 and 2021, with the type and suitability of any potential roost features recorded. The results of this exercise would then provide an indication of the nature of the overall bat tree roost resource present within an entire woodland block[35].

C.1.16 Aerial photographs were considered, and a walkover survey of the area carried out to assess the size and connectivity of the woodland block as well as the type and quality of its surrounding habitats. This information was brought together to enable an assessment of the suitability of the bat tree roost resource within a woodland as a whole.

C.1.17 Further pre-construction surveys are required to determine the species of bat present, the likelihood of roosting bats and the nature of any roosts, if present, within these woodland blocks. Survey would be carried out on those individual trees assessed from the ground, with tree-climbing surveys used in preference to other survey methodologies (i.e. emergence/re-entry), where safe to do so, due to the more definitive results that can be obtained.

C.1.18 Additional surveys in the form of monthly walked transects and static detector deployments (between April and October 2018) were carried out throughout a selection of the woodland blocks affected by this proposed methodology. Further surveys during pre-construction are required on the woodland blocks outstanding. The results of these surveys were used together to identify and assess the bat species using the woodland habitat and assess the likelihood of roosting bats being present and, if present, the nature of any roost(s).

[35] Total woodland area including woodland that is not within the Order Limits.

C.1.19 This information would then be used to assess the roost resource value of a given woodland block and, on this basis, the likely impacts of the Project would be assessed.

C.1.20 Detailed assessment and further surveys (as required) of individual trees within the woodland blocks would subsequently be carried out, as required and dependent on final design decisions, during the course of pre-construction surveys.

C.1.21 Single trees, treelines and trees within hedgerows will continue to be assessed in detail on an individual basis, with further surveys carried out, as required, in line with BCT guidelines (Collins, 2016). The variation in methodology between trees of this nature and those within woodland blocks is due to the greater variation (e.g. in terms of extent and surrounding habitats) of trees in these locations compared with trees within a single woodland block. In addition, detailed individual inspection of these trees will help assess connectivity between woodland blocks and across the wider landscape.

C.2 Woodland assessment survey results

Table C.2 Woodland assessment survey results

Woodland	Trees with confirmed roosts, and high or moderate bat roosting suitability within the Order Limits	Trees with confirmed roosts, and high or moderate bat roosting suitability outside the Order Limits
Rochester & Cobham Park Golf Club	0	8
Ashenbank Wood	6	16
Brewers Wood	0	7
Shorne Wood	19	5
Woodland at the north-western corner of Shorne Wood[36]	2	5
Woodland adjacent to Thong Lodge[37]	0	2
Claylane Wood	34	5
Cobham Hall Wood	0	2
Gravelhill Wood	9	0
East Tilbury Battery	0	4
Rainbow Shaw	57	1
The Wilderness	34	2

[36] Further ground tree assessment surveys required. Due to access restrictions, no further surveys were carried out in 2021.
[37] Further ground tree assessment surveys required. Due to access restrictions, no further surveys were carried out in 2021.

Annex D Structure Assessment Survey Results

D.1 South of the River Thames

D.1.1 Table D.1 details the results of the structure assessment surveys of structures south of the River Thames and their reference number to use in conjunction with Environmental Statement Chapter 8: Terrestrial Biodiversity, Figure 8.24 (Application Document 6.2).

Table D.1 Structure assessment survey results from the south of the River Thames

Structure	Sub-structure	Structure reference number	Assessment result (constraint)
St Marys Church	-	335	Confirmed Roost
1 Longview	Building 1 - External building	331	Low
	Building 2 - External garage	307	Low
	Building 3 - Main building	2	Confirmed Roost
13 Squires Close	-	128	No access
2 Longview, Henhurst Road	-	7	No access
Anchorage	-	15	High
Ashenbank Wood Underground Air Raid Shelter	-	284	No access
Bat Barns MJ	-	330	Moderate
Bat Building MJ1	-	329	High
Brewers Road Bridge	-	139	Moderate
Depot adjoining The Retreat, Henhurst Road	-	3	No access
Esso Garage	Building 1 - Electrical outbuilding	359	Negligible
	Building 2 - Main building	5	Negligible
Harlex Yard	Building 1 - Old Barn	13	Moderate
	Building 2 - New Barn	247	Low
	Building 3 - Workshop	248	Negligible
	Building 4 - Office	249	Low
	Building 5 - Electrical Building	250	Negligible
	Building 6 - Storage	251	Negligible

Structure	Sub-structure	Structure reference number	Assessment result (constraint)
Hartshill Bungalow House	-	18	Low
Hartshill Nursery	Building 1 - 2 main warehouse buildings and ply board cabin	115	Negligible
	Building 2 - 2 main warehouse buildings and ply board cabin	261	Negligible
	Building 3 - 2 main warehouse buildings and ply board cabin	262	Negligible
Helen Ansell Buildings	Building 1 - Large Barn	272	High
	Building 2 - Open Barn	273	Low
	Building 3 - Open Barn	274	Low
	Building 4 - Open Garage	275	High
	Building 5 - Wooden Barn	276	High
	Building 6 - Nissan Building	277	Moderate
	Building 7 - Main House	278	High
	Building 8 - Derelict Barn	308	High
Hever Court Road Bat Bridge	-	286	No access
Highview, Watling Street, Gravesend, DA12 5UD	-	16	No access
Horseshoe Meadow	-	12	No access
Inn on the Lake Hotel -	Building 1 - Entrance and restaurant	8	Moderate
	Building 2 - Guest accommodation	205	Moderate
	Building 3 - Staff accommodation	252	Low
Land south of Rochester Road	-	9	No access
Marling Cross Lodge	-	10	Moderate
Marling Manor	Building 1 - Breeze house	327	Low
	Building 2 - Brick house	14	Confirmed Roost
Nells Café	Building 1 - Café	4	High
	Building 1 - Garage	204	High
Oakdene	-	6	No access
Park Pale Bat Bridge	-	287	Low

Structure	Sub-structure	Structure reference number	Assessment result (constraint)
Scalers Hill House	Building 1 - Kennels	148	Moderate
	Building 10 - Stables	156	Moderate
	Building 11 - Stables	157	Moderate
	Building 12 - Stables	158	Moderate
	Building 13 - Stables	159	Moderate
	Building 14 - Stables	160	Moderate
	Building 15 - Workshop	161	Moderate
	Building 2 - Kennels	149	Moderate
	Building 3 - Kennels	150	Moderate
	Building 4 - Shed	151	Moderate
	Building 5 - Shed	152	Moderate
	Building 6 - House	120	High
	Building 7 - Stables	153	Moderate
	Building 8 - Stables	154	Moderate
	Building 9 - Stables	155	Moderate
Shearer Barns Two Barns	-	138	Negligible
Shorne Wood Underground Air Raid Shelter 1	-	49	Confirmed Roost
Shorne Wood Underground Air Raid Shelter 2	-	328	Confirmed Roost
Singlewell	Building 1 - Feeder Station	121	No access
	Building 2 - Premier Inn	316	No access
Southern Valley Golf Course Main Building	-	52	High
St. Theresa	-	11	No access
Structure 2	Horse Stable	51	Negligible
Structure 3	Horse Stable	50	Negligible
Substation, Watling Street Electrical Substation	-	68	Low
The Nook	Building 1 - Garage	202	High
	Building 2 - Main House	117	High
	Building 3 - Outbuilding	201	High
	Building 4 - Shed	203	Negligible
Thong Lane Bridge	-	140	Moderate

Structure	Sub-structure	Structure reference number	Assessment result (constraint)
Thong Lodge	Building 1 - Main Lodge	279	High
	Building 2 - Brick Barn	280	High
	Building 3 - Wooden Barn	281	Moderate
	Building 4 - Garage	282	High
	Building 5 - Wooden Barn	283	Moderate
White Horse Cottage	Building 1 - Barn	206	High
	Building 2 - House	136	High
White House	Building 1 - House	1	Moderate
	Building 2 - Shed	163	Negligible
Winslow House	-	17	Moderate

D.2 North of the River Thames

D.2.1 Table D.2 details the results of the structure assessment surveys of structures north of the River Thames and their reference number to use in conjunction with Environmental Statement, Chapter 8: Terrestrial Biodiversity, Figure 8.24 (Application Document 6.2).

Table D.2 Structure assessment survey results from the north of the River Thames

Structure	Sub-structure	Structure reference number	Assessment result (constraint)
1 & 2 Bridge Cottages	Building 1 - Main House (A)	29	Confirmed Roost
	Building 2 - Shed B	212	Negligible
	Building 3 - Shed C	167	Negligible
	Building 4 - Shed D	213	Negligible
1 Cherry Orchard Cottages	Building 1 - Garage/Shed (A)	165	Negligible
	Building 2 - Garage/Shed (B)	209	Negligible
	Building 3 - Garage/Shed (C)	208	Negligible
	Building 4 - Garage/Shed (D)	210	Negligible
	Building 5 - Garage/Shed (E)	164	Low
	Building 6 - House	31	Negligible
	Building 7 - Outhouse Shed	166	Negligible
	Building 8 - Shed	211	Negligible
1 Evergreens	-	94	No access

Structure	Sub-structure	Structure reference number	Assessment result (constraint)
1 Grays Corner Cottages	-	36	No access
1 Potash Cottages	-	39	No access
1 Springfield Cottages	-	129	No access
1 Townfield Cottages	-	32	No access
1 Woolings	Building 1 - Main building	135	Moderate
1&2 5 Chimney Cottages	Building 1 - Garage	299	Moderate
	Building 2 - Main building	298	Moderate
	Building 3 - Shed	306	Low
	Building 4 - Utility room	305	Low
1 & 2 Whitfield Cottages	-	34	No access
17 Woolings Close garage	-	311	Low
2 Cherry Orchard Cottages	Building 1 - Main House	70	Negligible
2 Evergreens	Building 1 - House	33	Moderate
	Buidling 2 - Shed	264	Negligible
2 Grays Corner Cottage	-	42	Confirmed Roost
2 Potash Cottages	Building 1 - Main House	38	Negligible
2 Springfield Cottage	-	131	No access
2 The Goslings	-	315	No access
206 Heath Road	-	90	No access
212 Heath Road	-	93	No access
218 Heath Road	-	91	No access
222 Heath Road	Building 1 - Main House	300	Negligible
224 Heath Road	-	83	No access
246 Heath Road	Building 1 - House	285	No access
3 Bridge Cottage	Building 1 -Extension	169	Moderate
	Building 2 - Garage	168	Negligible
	Building 3 - House	26	Moderate
	Building 4 - Rear extension	170	Moderate

Structure	Sub-structure	Structure reference number	Assessment result (constraint)
3 Townfield Cottages		95	Access granted, not surveyed
4 Bridge Cottage	Building 1 - Garage	171	Negligible
	Building 2 - House	30	Low
	Building 3 - Shed 1	172	Negligible
	Building 4 - Shed 2	173	Negligible
4 Five Chimneys Cottage House	-	40	Moderate
Alde Cottage	Building 1 - Brick garage	356	Probable Roost
	Building 2 - Main house	81	Moderate
	Building 3 - Swimming pool	354	Low
	Building 4 - Wooden shed	355	Negligible
2 Townfield Cottage (April Cottage)	Building 1 - Main House	122	Access granted, not surveyed
Ashlea Farm	Building 1 - House	114	Low
	Building 2 - Barns Back concrete barn	113	Low
	Building 3 - Barns Front metal barn	263	Negligible
Bankes House	-	20	No access
Becklands Farm	-	141	No access
Brook Farm (and part of Becklands Farm)	Building 1 - a	85	No access
	Building 2 - b	84	No access
Brook Farm	Building 1 - House	137	Moderate
	Building 2 - Kennel	258	Negligible
	Building 3 - Outbuilding 1	259	Moderate
	Building 4 - Outbuilding 2	260	Negligible
	Building 5 - Stable	257	Negligible
Carol Lawson's Stables	Building 1 - Stable (1)	268	Low
	Building 2 - Stable (2	270	Negligible
	Building 3 - Stable (3)	271	Negligible
Cole Commercial Yard	Building 1 - KLT Area	256	Negligible
	Building 2 - Rigid Workshop	130	Negligible

Structure	Sub-structure	Structure reference number	Assessment result (constraint)
Condovers Farm, Manor Farm and part of Becklands Farm c	-	87	No access
Cranham Place	-	22	No access
Cranham Solar Farm - Storage container	-	357	Negligible
Culvert St Andrew's Road	-	332	Low
Dennis Lane Bridge	-	325	Low
East Tilbury Battery	Building 1	310	Moderate
	Building 10	294	High
	Building 11	295	High
	Building 12	314	High
	Building 2	301	High
	Building 3	290	High
	Building 4	302	High
	Building 6	292	High
	Building 7 - Line of three similar buildings	293	High
	Building 8	313	Low
	Building 9	309	Low
	Building 5 - Line of three similar buildings	291	High
Estate house	Building 1 - Garage	175	Moderate
	Building 2 - House	28	Confirmed Roost
	Building 3 - Utility room	176	High
Farm Chalet	-	24	No access
Gammon Staples Farmhouse	Building 1 - Main building	43	Possible Roost
	Building 2 - Shed	342	Negligible
	Building 3 - Summer house	343	Negligible
Grafton	Building 1 - Detached Garage	246	Moderate
	Building 2 - Garden Office	200	Negligible
	Building 3 - Main House	23	High

Structure	Sub-structure	Structure reference number	Assessment result (constraint)
Grey Goose Farm	Building 1 - a	132	No access
	Building 2 - b	133	No access
	Building 3 - c	134	No access
	Building 4 - d	124	No access
Hall Farm (Nuture Nursery)	Building 1 - Portacabin toilets	19	Low
	Building 2 - Workshop	254	High
	Building 3 - Storage shed	265	Moderate
	Building 4 - Stables	266	Low
	Building 5 - Greenhouse	267	Negligible
	Building 6 - Workshop	255	High
Heath Place	Building 1 - Barns	244	Negligible
	Building 2 - Bungalow	245	No access
	Building 3 - Farm House	47	High
	Building 4 - Grain Store	242	Moderate
	Building 5 -Greenhouse	243	Negligible
	Building 6 -Outbuilding	241	Negligible
	Building 7 -Outbuilding/Garage	239	Moderate
	Building 8 -Toilet	240	Negligible
High Ash House	-	46	Negligible
Holford Farm	-	125	No access
Horse Field Building 1	-	55	Moderate
House next to old white horse pub	-	333	Moderate
Land Adjoining 1 Grays Corner Cottage	-	72	No access
Land adjoining 222 Heath Road	-	92	Access granted, not surveyed
Land at Chapel Farm	-	96	No access
Land east of Brentwood Road, Orsett (Land Title No. EX655537)	-	45	No access
Land North of Hornsby Lane 1	-	89	No access

Structure	Sub-structure	Structure reference number	Assessment result (constraint)
Land north of Hornsby Lane 2	-	97	No access
Land North of Stanford Road	Building 1 - Stable	71	Low
	Building 2 - Metal container	253	Negligible
	Building 3 - Wooden storage box	207	Negligible
Land North-West of Long Lane	-	116	No access
Land South-West of Baker Street	-	44	No access
Land West of Baker Street	-	98	Access granted, not surveyed
Larwood cottage	-	358	High
Latchford Farm	Building 1 - Farm Building (7)	237	Negligible
	Building 2 - Garage (9B)	199	Negligible
	Building 3 - Horse Stable (8)	238	Negligible
	Building 4 - Luton (3d)	323	Negligible
	Building 5 - Main House (9)	198	Negligible
	Building 6 - Shed (3c)	322	Negligible
Latchford Farm Shed (3a). Require separate lines for Latchford Farm Shed 3b and 3c, and Latchford Farm Luton (3d).	-	234	Negligible
Latchford Farm	Building 1 - Shed (3b)	321	Negligible
	Building 2 - Shed (4)	197	Low
	Building 3 - Shed (5)	235	Negligible
	Building 4 - Shop (2)	233	Moderate
	Building 5 - Storage Building (1)	196	Low
	Building 6 - Substation (6)	236	Negligible
Mangrove	-	123	No access
Manor Farm	Building 1 - North Barn	177	High
	Building 10 - Garage 2	218	Low
	Building 11 - Manor Farm barn (annex)	219	High
	Building 12 - Manor Farm barn	183	Confirmed Roost

Structure	Sub-structure	Structure reference number	Assessment result (constraint)
	Building 13 - Manor Farm House	67	Confirmed Roost
	Building 2 - Wooden Barn	178	Moderate
	Building 3 - East Barns	179	Low
	Building 4 - Hay Barn	180	Negligible
	Building 5 - Manor Farm Shop	181	Low
	Building 6 - Manor Farm Shop Barn	215	Negligible
	Building 7 - West Barn	216	Negligible
	Building 8 - Pea Barn and Machine Barns	182	Negligible
	Building 9 - Garage	217	Low
Metal Recycling Plant	Building 1	53	Moderate
	Building 2	56	Moderate
	Building 3	54	Moderate
	Building 4	288	Moderate
Mr Rodger's Stable	-	269	Low
Murrells Cottage	Building 1 - Brick summer house	344	Moderate
	Building 2 - Garden office	346	Moderate
	Building 3- Main building	74	Moderate
	Building 4 - Neighbouring garage	348	High
	Building 5 - Treehouse	350	Negligible
	Building 6 - Wendy house	345	Low
	Building 7- Wooden shed	349	Low
	Building 8 - Workshop	347	Moderate
Neviles Farm	-	35	No access
No. 10 Woolings Close	Building 1 - House	99	Moderate
No. 11 Woolings Close	Building 1 - House	100	Moderate
No. 12 Woolings Close	Building 1 - Garage	162	Low
	Building 2 - House	101	Moderate
No. 13 Woolings Close	Building 1 - House	102	Negligible

Structure	Sub-structure	Structure reference number	Assessment result (constraint)
No. 14 Woolings Close	Building 1 - House	103	Low
No. 15 Woolings Close	Building 1 - House	104	Low
No. 16 Woolings Close	Building 1 - House	105	Low
No. 18 Woolings Close	Building 1 - House	106	Low
No. 19 Woolings Close	Building 1 - House	107	Moderate
No. 2 Woolings Row	-	127	Negligible
No. 2 Woolings Row	Building 1 - House	108	Negligible
No. 20 Woolings Close	Building 1 - House	109	Low
No. 21 Woolings Close	Building 1 - House	312	No access
No. 22 Woolings Close	Building 1 - House	110	Negligible
No. 23 Woolings Close	Building 1 - House	111	Moderate
No. 24 Woolings Close	Building 1 - House	112	No access
No. 3 Woolings Row	Building 1 - House	126	Low
No. 4 Woolings Row	Building 1 - House	118	Negligible
No. 5 Woolings Row	Building 1 - House	78	Low
No. 6 Woolings Row	Building 1 - House	79	Low
No. 7 Woolings Close	Building 1 - House	80	Negligible
No. 8 Woolings Close	Building 1 - House	73	Low
No. 9 Woolings Close	Building 1 - House	119	Moderate
Polwick's Farm	-	319	No access
Poplars Farm	Building 1 - House	86	Low

Structure	Sub-structure	Structure reference number	Assessment result (constraint)
	Building 2 - Sauna shed	144	Negligible
	Building 3 - Garage	145	Low
	Building 4 - Stables	146	Low
	Building 5 - Hay barn	147	Low
Rose Cottage	-	48	No access
Springfield Farm	Building 1 - Barn	220	Moderate
	Building 2 - Cattery Reception	184	High
	Building 3 - 'About Skin'	221	Moderate
	Building 4 - Cattery building	222	Moderate
	Building 5 - Barn	64	Low
	Building 6 - Pump Room	185	High
	Building 7 - Main House	223	Moderate
St Mary Magdalene Church, North Ockendon	-	334	Confirmed Roost
St. Mary's Lane Bat Bridge	-	326	Negligible
Steven Thacker (Land Title No. EX623539)	-	320	No access
Stifford Clays Rd Bat Bridge	-	324	Moderate
Structure 18	Building 1 - Pump Building	57	Negligible
Structure 19	Building 1 - Pump Building	58	Negligible
Structure 21	-	59	No access
Structure 22	-	60	No access
Structure 23	-	61	No access
Structure 27	-	62	No access
Benton Farmyard (Structure 28)	Building 1 - Barn	224	Moderate
	Building 10 - Barn	190	Negligible
	Building 11 - Barn	191	Negligible
	Building 12 - Barn	229	Confirmed Roost
	Building 13 - Pump Room	192	Low
	Building 14 - Barn	193	Moderate
	Building 15a - End store room	303	High
	Building 15b - Workshop	289	Confirmed Roost

Structure	Sub-structure	Structure reference number	Assessment result (constraint)
	Building 15c - Stable	230	Low
	Building 16	194	Low
	Building 17 - Barn	195	Negligible
	Building 18a - Underground machinery space	231	Moderate
	Building 18b - Barn	232	Moderate
	Building 2 - Bridge and Wall	186	Moderate
	Building 20 - Stables	69	Moderate
	Building 3 - Calving Shed	187	Low
	Building 4 - Veranda	225	Moderate
	Building 5 - Barn	226	Moderate
	Building 6 & 19 - Barn	227	Moderate
	Building 7 - Barn	228	Moderate
	Building 8 - Barn	188	Low
	Building 9 - Barn	189	Low
Structure 33	-	63	Access granted, not surveyed
Substation, Baker Street	-	77	Access granted, not surveyed
Thatched Cottage	Building 2 - Open fronted party shed	304	Low
	Building 3 (a, b and c) - L shaped workshop/2 small apartment	296	High
	Building 4 - Shed	318	Negligible
	Building 5 - Potting shed	297	Low
	Building 6 - Chinese circle shed	317	Negligible
	Building 1 - Main house	37	High
The Old Coach House	-	21	No access
The Rosary	Building 1 - Main building	25	Confirmed Roost
	Building 2 - Shed	340	Moderate
	Building 3 - Stable	341	High
	Building 4 - Wooden Shed	339	Low
The Thatches	Building 1 - Garage	351	Moderate
	Building 2 - House	76	High

Structure	Sub-structure	Structure reference number	Assessment result (constraint)
	Building 3 - Shed	353	Moderate
	Building 4 - Treehouse	352	Moderate
Readman's Industrial Estate	Building 1 - Unit 8	88	No access
	Building 1 - Unit 7	41	No access
Welcome Service Station	Building 1 - Garage	338	Moderate
	Building 2 - Kennel	336	Low
	Building 3 - Main building	75	Moderate
	Building 4 - Pool House	82	Moderate
	Building 5 -Portacabin	337	Negligible
Welcome Villa	-	122	No access
Wilderness Buildings	Building 1 - East Barn	142	Negligible
	Building 2 - West Barn	65	High
	Building 3 - Wood Barn	143	High
	Building 4 - Wilderness House	66	Moderate
Yellowstock mews	Building 1 - Log cabin	214	Low
Yellowstock mews	Building 2 - Mews 1	174	Possible Roost
Yellowstock mews	Building 3 - Mews 2-5	27	Moderate

Annex E Tree Climbing and Emergence/Re-entry Survey Results

E.1.1 Table E.1 and 0Table E.2 present the results of emergence/re-entry surveys carried out in 2018, 2019 and 2021 for the south and north of the River Thames, respectively.

Table E.1 Emergence/re-entry survey metadata for structures south of the River Thames

Structure reference	Survey date	Start time	Number of surveyors	Weather conditions[38]	Results
White House	20 May 2019	20:35	4	Dry, clear, 8/8, 13ºC	No emergence
White House	24 May 2021	20:42	1	Light-dry, light, 8/8, 11ºC	No emergence
White House	15 September 2021	04:48	3	Dry,Light,2/8, 15 ºC	No re-entry
Southern Valley Golf Club	21 May 2019	20:37	4	Dry, clear,14ºC	No emergence
1 Longview	26 May 2021	20:43	4	Dry, light, 4/8, 12ºC	No emergence
1 Longview	07 September 2021	19:33	5	Dry,Light,2/8, 24 ºC	x3 common pipistrelle emergences
1 Longview	15 September 2021	18:59	4	Dry,Light,0/8, 18 ºC	x1 common pipistrelle emergence

[38] Cloud is measured in oktas, ranging from 0, no cloud, to 8, completely overcast

Table E.2 Emergence/re-entry survey metadata and results for trees south of the River Thames

Tree reference	Survey date	Start time	Number of surveyors	Weather conditions	Results
T273 Survey 1	28 June 2018	21:05	2	Dry, clear, 15ºC	No emergence
T273 Survey 2	11 September 2018	19:14	2	Dry, breezy, 5/8, 20ºC	No emergence
T284 Survey 1	27 June 2018	21:05	2	Dry, clear, 15ºC	No emergence
T284 Survey 2	13 September 2018	19:06	2	Dry, light air, 2/8, 16ºC	x1 soprano pipistrelle seen emerging from a tree
T284 Survey 3	23 June 2021	21:05	2	Dry, light, 1/8, 19ºC	x1 brown long-eared emergence
T285 Survey 1	26 June 2018	21:05	2	Dry, clear, light breeze, 15ºC	No emergence
T285 Survey 2	4 October 2018	18:30	2	Dry, clear, 15ºC	No emergence
T287	25 June 2018	21:05	2	Dry, clear, 21ºC	No emergence
T554	4 June 2019	20:52	2	Clear, 1/8, 16ºC	No emergence
T575	3 June 2019	20:53	2	Clear, 1/8, 18ºC	No emergence
T910 Survey 1	2 June 2021	20:48	2	Dry, light, 7/8, 19ºC	No emergence
T910 Survey 2	14 September 2021	19:01	2	Dry, light, 8/8, 18ºC	No emergence
T911 Survey 1	2 June 2021	20:48	2	Dry, light, 7/8, 19ºC	No emergence
T911 Survey 2	14 September 2021	19:01	2	Dry, light, 8/8, 18ºC	No emergence

Table E.3 Emergence/re-entry survey metadata and results for structures north of the River Thames

Tree/structure reference	Survey date	Start time	Number of surveyors	Weather conditions	Results
1 and 2 Bridge Cottages	15 May 2019	20:28	5	Dry, clear, 3/8, 9ºC	x1 common pipistrelle emerged
1 and 2 Bridge Cottages	14 April 2021	21:02	4	Dry, heavy rain, 8/8, 24ºC	No emergence
10 Woolings Close	24 April 2021	21:05	2	Dry, light, 7/8, 21ºC	No emergence
2 Grays Corner	17 April 2021	21:03	5	Drizzle, light breeze, 8/8, 19ºC	x1 common pipistrelle emerged
2 Grays Corner	06 October 2021	05:22	5	Dry, breeze, 1/8, 10ºC	No emergence
3 Bridge Cottages	01 April 2021	20:48	4	Dry, light, 8/8, 17ºC	No emergence
3 Bridge Cottages	15 April 2021	21:03	3	Dry, calm, 1/8, 17ºC	No emergence
4 Bridge Cottages	11 May 2021	20:20	3	Dry, light air, 4/8, 14ºC	No emergence
5 Woolings Row	13 May 2021	20:25	3	Dry, light air, 1/8, 10ºC	No emergence
6 Woolings Row	15 April 2021	N/A	2	Dry, heavy showers, 0/8, 20ºC	No emergence
8 Woolings Close	09 April 2021	21:08	3	Dry, light, 3/8, 22ºC	No emergence
8 Woolings Close	15 April 2021	N/A	N/A	N/A	No emergence
9 Woolings Close	09 April 2021	21:00	3	Dry, light, 3/8, 22ºC	No emergence
9 Woolings Close	08 September 2021	04:30	2	Dry, Calm, 0/8, 17ºC	No re-entry
Alde Cottage	10 April 2021	21:00	3	Dry, light, 0/8, 25ºC	x1 common pipistrelle, potential emergence
Alde Cottage	07 September 2021	19:18	2	Dry, light, 7/8, 21ºC	No emergence
Estate House	16 May 2019	20:30	6	Dry, 1/8, light breeze, 11ºC	No emergence

Tree/structure reference	Survey date	Start time	Number of surveyors	Weather conditions	Results
Estate House	12 May 2021	20:20	3	Dry, calm, 1/8, 15ºC	No emergence
Estate House	31 August 2021	19:30	3	Dry & drizzle, light, 7/8, 20ºC	x1 common pipistrelle emerged
Estate House	11 October 2021	18:13	3	Dry & drizzle, light, 7/8, 14ºC	No emergence
Gammon Staples Farmhouse	03 June 2021	20:48	4	Dry, light breeze, 7/8, 22ºC	No emergence
Gammon Staples Farmhouse	04 October 2021	18:15	3	Dry, drizzle, light, 7/8, 14.6ºC	No emergence
Gammon Staples Farmhouse	12 October 2021	18:13	4	Dry, light, 0/8, 13ºC	No emergence
Larwood Cottage 1	17 April 2021	21:03	5	Heavy, light showers, 8/8, 25ºC	No emergence
Larwood Cottage 2	24 April 2021	21:05	3	Dry, calm, 8/8, 22ºC	No emergence
Larwood Cottage 1 & 2	06 September 2021	18:13	6	Dry, calm, 2/8, 25ºC	No emergence
Marling Cross Lodge 1	25 May 2021	20:43	1	Dry, calm, 6/8, 12ºC	No emergence
Marling Cross Lodge 2	08 April 2021	20:58	4	Dry, light air, 1/8, 22ºC	No emergence
Marling Manor	27 May 2021	20:43	4	Dry, light, 1/8, 15ºC	No emergence
Marling Manor	02 September 2021	19:28	4	Dry, light, 8/8, 18ºC	x1 probable long eared emerged
Marling Manor	08 September 2021	19:15	6	Dry, light, 5/8, 23ºC	No emergence
Marling Manor	04 October 2021	18:15	2	Shower, slight, 6/8, 14ºC	No emergence
Marling Manor	14 October 2021	17:55	4	Dry, light, 6/8, 16ºC	x1 common pipistrelle, potential emergence
Marling Manor	16 September 2021	19:57	3	Dry, calm, 0/8, 19ºC	x2 common pipistrelle emerged

Tree/structure reference	Survey date	Start time	Number of surveyors	Weather conditions	Results
Murrells Cottage	08 April 2021	03:21	3	Dry, calm, 0/8, 19ºC	No emergence
Murrells Cottage	07 October 2021	19:57	5	Dry, calm, 8/8, 21.1ºC	No emergence
Thatched Cottage	10 May 2021	20:10	3	Dry, light air, 0/8, 13ºC	No emergence
Thatched Cottage	05 October 2021	18:13	5	Dry, light, 8/8, 16.3ºC	No emergence
The Rosary	19 May 2021	20:36	2	Dry, gentle, 0/8,14ºC	No emergence
The Rosary	01 September 2021	20:36	4	Dry, Light/Mid, 5/8, 20ºC	x4 common pipistrelle emerged
The Rosary	13 October 2021	17:54	4	Dry, Light, 3/8, 14ºC	x1 soprano pipistrelle, possible emergence
The Thatches	21 April 2021	21:05	5	Dry, heavy showers, 8/8, 12ºC	No emergence
The Thatches	09 September 2021	19:13	5	Dry, calm,0/8,24ºC	No emergence
Welcome Break service station	07 April 2021	20:55	4	Dry, calm, cloud 1/8, 12ºC	No emergence
Welcome Break service station	08 September 2021	04:30	3	Dry, Light,2/8, 20ºC	No re-entry
Yellowstock Mews	14 May 2019	20:27	6	Dry, 0/8, light breeze, 9ºC	No emergence
Yellowstock Mews	20 May 2021	20:36	1	Dry, strong breeze to fresh gale, 7/8, 15ºC	x2 common pipistrelle, potential emergences
Yellowstock Mews	13 September 2021	19:03	4	Dry,Light,8/8, 18 ºC	No emergence

Table E.4 Emergence/re-entry survey metadata and results for trees north of the River Thames

Tree reference	Survey date	Start time	Number of surveyors	Weather conditions	Results
T8 Survey 1	16 July 2018	20:39	2	Dry, 1/8, 26ºC	No emergence
T8 Survey 2	29 August 2018	04:06	2	Dry, 8/8, 15ºC	No emergence
T8 Survey 3	23 May 2019	20:39	2	Light breeze, dry, 3/8, 20ºC	No emergence
T72 Survey 1	26 June 2018	21:05	3	Clear, light breeze, dry, 20ºC	No emergence
T72 Survey 2	20 May 2019	20:35	2	Dry, 6/8, 18ºC	No emergence
T96 Survey 1	13 August 2018	20:11	2	Clear, dry, 20ºC	No emergence
T96 Survey 2	18 September 2018	18:58	2	Windy, dry, clear, 18ºC	No emergence
T116 Survey 1	15 May 2018	20:28	2	Dry, clear, 18ºC	No emergence
T116 Survey 2	22 August 2018	03:55	2	Dry, clear, 18ºC	No emergence
T124 Survey 1	11 September 2018	04:26	2	Dry, 1/8, 18ºC	No emergence
T124 Survey 2	25 September 2018	18:35	2	Clear, dry, 16ºC	No emergence
T130 Survey 1	14 August 2018	20:05	2	Dry, 5/8, 22ºC	No emergence
T130 Survey 2	19 September 2018	18:15	2	Dry, windy, 7/8, 17ºC	No emergence
T130 Survey 3	9 October 2018	18:04	2	Dry, clear, 17ºC	No emergence
T143 Survey 1	11 September 2018	19:08	2	Dry, light breeze, 7/8, 21ºC	No emergence
T143 Survey 2	21 May 2019	20:37	2	Dry, 2/8, 18ºC	No emergence
T151 Survey 1	10 October 2018	18:02	2	Dry, clear, 15ºC	No emergence
T151 Survey 2	20 May 2019	20:35	2	Dry, clear, 17ºC	No emergence
T153 Survey 1	13 August 2018	20:10	2	Dry although has been drizzle, 7/8, 21ºC	No emergence

Tree reference	Survey date	Start time	Number of surveyors	Weather conditions	Results
T153 Survey 2	20 September 2018	18:56	2	Scattered rain, 8/8, windy	No emergence
T183 Survey 1	12 September 2018	19:06	2	Dry, 5/8, 15ºC	No emergence
T183 Survey 2	21 May 2019	20:37	2	Dry, clear, 13ºC	No emergence
T185 Survey 1	20 September 2018	18:45	2	Light rain, 8/8, 20ºC	No emergence
T185 Survey 2	18 June 2019	20:35	2	Dry, 8/8, 17ºC	No emergence
T230 Survey 1	15 August 2018	20:05	2	Dry, 1/8, moderate breeze, 20ºC	No emergence
T238 Survey 1	17 July 2018	20:53	2	Dry, light wind, 1/8, 21ºC	No emergence
T238 Survey 2	30 August 2018	03:56	2	Dry, 8/8, 13ºC	No emergence
T364 Survey 1	13 May 2019	20:25	2	Dry, clear, 12ºC	No emergence
T364 Survey 2	5 June 2019	20:55	2	Dry, 1/8, 16ºC	No emergence
T382	23 May 2019	20:39	2	Dry, 2/8, 17ºC	No emergence
T398	22 May 2019	20:38	2	Dry, clear, 19ºC	No emergence
T427	22 May 2019	20:38	2	Dry, 1/8, 20ºC	No emergence

Table E.5 Tree climbing results for trees south of the River Thames

Tree reference	Survey 1 date	Survey 2 date	Survey 3 date	Tree suitability
272	26.09.2018	Not required	Not required	Low
274	26.09.2018	Not required	Not required	Negligible
276	26.09.2018	13.10.2018	09.11.2018	High
277	26.09.2018	Not required	Not required	Negligible
278	26.09.2018	Not required	Not required	Low
280	26.09.2018	Not required	Not required	High
281	26.09.2018	Not required	Not required	Low
286	26.09.2018	12.10.2018	Not required	Moderate
552	09.09.2021	-	Not required	Moderate
563	12.05.2019	Not required	Not required	Negligible
564	12.05.2019	Not required	Not required	Low

Tree reference	Survey 1 date	Survey 2 date	Survey 3 date	Tree suitability
565	12.05.2019	Not required	Not required	Negligible
566	12.05.2019	Not required	Not required	Negligible
567	12.05.2019	07.10.2021	Not required	High
568	Not required	Not required	Not required	Moderate
571	12.05.2019	04.06.2019	07.10.2021	High
572	12.05.2019	-	Not required	Moderate
573	12.05.2018	-	-	High
713	12.06.2019	Not required	Not required	Negligible
714	12.06.2019	Not required	Unsafe	High
721	17.10.2019	Not required	Not required	High
722	17.10.2019	Not required	Not required	Negligible
723	17.10.2019	Not required	Not required	Low
724	17.10.2019	Not required	Not required	Negligible
727	17.10.2019	Not required	Not required	Low
728	17.10.2019	Not required	Not required	Negligible
729	17.10.2019	Not required	Not required	Low
730	15.11.2019	26.10.2021	Not required	Low
859	15.11.2019	Not required	Not required	Negligible
860	15.11.2019	Not required	Not required	Negligible
870	19.11.2019	Not required	Not required	High
871	19.11.2019	Not required	Not required	Negligible
873	19.11.2019	-	-	High
874	19.11.2019	16.09.2022	Not required	Low
875	19.11.2019	Not required	Not required	Negligible
886	06.07.2021	-	-	High
889	18.11.2019	Not required	Not required	Low
890	18.11.2019	Not required	Not required	Negligible
890.1	07.06.2021	Not required	Not required	Negligible
891.1	12.02.2019	Not required	Not required	Negligible
892	18.11.2019	Not required	Not required	Low
893	15.11.2019	Not required	Not required	High
893.1	18.11.2019	Not required	Not required	Low
896	18.11.2019	-	-	High
897	18.11.2019	-	-	High
905	12.03.2019	-	Not required	Moderate

Tree reference	Survey 1 date	Survey 2 date	Survey 3 date	Tree suitability
909	12.03.2019	Not required	Not required	Low
910	12.03.2019	06.02.2021	14.09.2021	High
911	12.03.2019	06.02.2021	14.09.2021	Confirmed
913	12.03.2019	-	Not required	Moderate
914	12.03.2019	-	Not required	Moderate
915	12.03.2019	Not required	Not required	High
918	12.02.2019	Unsafe	Not required	High
919	12.02.2019	Not required	Not required	Moderate
920	12.02.2019	Not required	Not required	Negligible
921	12.04.2019	Not required	Not required	Negligible
922	12.04.2019	-	Not required	High
927	12.04.2019	Not required	Not required	Low
928	12.04.2019	Not required	Not required	Negligible
929	12.04.2019	-	-	High
930	12.04.2019	Not required	Not required	Low
940	19.12.2019	19.08.2021	Not required	Negligible
942	20.12.2019	19.08.2021	Not required	Negligible
949	20.12.2019	-	-	High
950	20.12.2019	-	-	High
952	20.12.2019	-	Not required	Moderate
954	20.12.2019	Not required	Not required	Negligible
956	20.12.2019	-	Not required	Moderate
957	19.12.2019	06.10.2021	Not required	Moderate

Table E.6 Tree climbing results for trees north of the River Thames

Tree reference	Survey 1 date	Survey 2 date	Survey 3 date	Tree suitability
4	29.08.2018	Not required	Not required	Negligible
7	29.08.2018	Not required	Not required	Moderate
9.1	12.04.2019	-	Not required	Moderate
10	29.08.2018	Not required	Not required	Negligible
11	Not required	Not required	Not required	Low
13	29.08.2018	Not required	Not required	Negligible
14	29.08.2018	Not required	Not required	Low
16	19.07.2018	30.08.2018	Not required	Negligible

Tree reference	Survey 1 date	Survey 2 date	Survey 3 date	Tree suitability
17	29.08.2018	Not required	Not required	Negligible
18	29.08.2018	Not required	Not required	Negligible
19	29.08.2018	10.10.2018	Not required	Moderate
21	29.08.2018	Not required	Not required	Negligible
22	29.08.2018	Not required	Not required	Negligible
23	29.08.2018	Not required	Not required	Moderate
24	29.08.2018	Not required	Not required	Negligible
27	30.07.2018	Not required	Not required	Negligible
28	30.07.2018	10.10.2018	Not required	Moderate
30	30.07.2018	Not required	Not required	Moderate
30.1	28.09.2018	10.10.2018	29.10.2018	High
30.2	28.09.2018	Not required	Not required	Negligible
30.3	28.09.2018	10.10.2018	29.10.2018	High
32	30.07.2018	Not required	Not required	Low
34	20.07.2018	Not required	Not required	Low
37	19.07.2018	Not required	Not required	Moderate
38	29.10.2018	Not required	Not required	Moderate
39	19.07.2018	Not required	Not required	High
39.1	21.02.2018	12.09.2018	Not required	Moderate
42	20.07.2018	24.09.2018	08.10.2018	Moderate
43	20.07.2018	Not required	Not required	Moderate
44	28.02.2018	19.07.2018	30.08.2018	Moderate
45	19.07.2018	29.10.2018	8.2018.2021	Low
47	20.07.2018	24.09.2018	Not required	Moderate
48	27.03.2018	12.09.2018	Not required	High
52	18.07.2018	Not required	Not required	Low
53	18.07.2018	27.09.2018	Not required	Moderate
54	18.07.2018	Not required	Not required	High
57	31.10.2018	Not required	Not required	Low
58	10.09.2018	31.10.2018	Not required	Low
59	18.07.2018	Not required	Not required	Low
60	18.07.2018	Not required	Not required	Low
63	18.07.2018	-	Not required	Moderate
64	18.07.2018	27.09.2018	Not required	High
67	13.09.2018	10.10.2018	Not required	Moderate

Tree reference	Survey 1 date	Survey 2 date	Survey 3 date	Tree suitability
68	18.07.2018	27.09.2018	Not required	High
70	19.07.2018	Not required	Not required	Negligible
71	19.07.2018	Not required	Not required	Low
72	26.03.2018	26.06.2018 (Dusk)	20.05.2019 (Dusk)	High
72.1	11.10.2018	Not required	Not required	Moderate
72.2	11.10.2018	06.10.2021	-	High
72.3	11.10.2018	06.10.2021	-	High
78	22.03.2018	10.10.2018	Not required	Moderate
79	17.09.2018	Not required	Not required	Low
80	23.04.2018	-	Not required	High
82	18.09.2018	Not required	Not required	Moderate
83	18.09.2018	Not required	Not required	Low
85	18.09.2018	09.10.2018	Not required	Moderate
86	18.09.2018	Not required	Not required	Negligible
88	17.09.2018	Not required	Not required	Negligible
90	17.09.2018	Not required	Not required	Negligible
91	19.09.2018	Not required	Not required	Negligible
93	19.09.2018	Not required	Not required	Negligible
94	19.09.2018	Not required	Not required	Negligible
97	18.09.2018	Not required	Not required	Negligible
99	19.09.2018	Not required	Not required	Moderate
100	21.09.2018	01.11.2018	Not required	Moderate
101	19.08.2018	09.10.2018	01.11.2018	High
103	21.09.2018	Not required	Not required	Negligible
104	21.09.2018	01.11.2018	Not required	Moderate
105	19.09.2018	Not required	Not required	Moderate

Annex F Limitations

F.1 Walked transect and transect point activity survey limitations

F.1.1 Table F.1 below presents the limitations and restrictions associated with the walked transect and transect point activity surveys.

Table F.1 Limitations and restrictions associated with the walked transect and transect point activity surveys

Survey type	Restriction	Transect number(s)	Month(s)	Additional comments
Walked transects and/or automated detector deployment	Access not granted	1, 2, 4, 25, 26 and 27	April 2018	-
		22 and 25	May 2018	-
		13, 14, 16, 18, 19 and 20	June 2018	-
		18, 19, 20, 26 and 27	July 2018	-
		25, 26 and 27	August, September and October 2018	-
	Health and safety constraints	2, 3, 8 and 9	July and August 2018	Transect 2 and 3 not cancelled but minor adjustments made to transect route
		7	September 2018	Followed by unknown individual
		11	October 2018	Poachers
	Weather conditions	3, 7 and 12	April 2018	Surveys where sunset temperatures below 10oC were recorded at Transects 3 (8oC), 7 (9oC) and 12 (9oC), with these surveys also experiencing drizzle to light rain

Survey type	Restriction	Transect number(s)	Month(s)	Additional comments
Retrieval of automated static detectors	Technical malfunction of automated detectors	15 (position 1)	April 2018	Only four nights of data collected from T15 P1
		26 (position 1)	June 2018	-
		19 (position 1)	September 2018	-
	Health and safety	6	April 2018	Security concerns
	Survey logistics	7 (position 2)	May 2018	Not deployed
		7 (position 1)	June 2018	-
		24 (position 3)	September 2018	-
	Theft	13 (position 2)	May 2018	Detector stolen
	Unforeseen circumstances/weather conditions	7, 18, 19, 20, 25, 26 and 27	Multiple months	Impacted on one occasion
		7	September 2018	Impacted on two occasions (2.5 hours of three hours of this survey being carried out)
		18, 19, 20	June and July 2018	Impacted on two occasions
		25, 26 and 27	Multiple months	Only surveyed twice in 2018

F.2 Crossing point activity survey limitations

F.2.1 Table F.2 below presents the limitations and restrictions associated with the crossing point activity surveys.

Table F.2 Limitations and restrictions associated with the crossing activity surveys

Survey type	Restriction	Crossing point/position number(s)	Month(s)/year	Additional comments
Automated static detector not deployed/retrieved	Access not granted	6.5	April 2018	-
		13	May 2018	-
		5, 6, 6.5, 7, 8 and 9	June 2018	-
		8 and 9	July 2018	-
		12.5 and 14	October 2019	-
	Technical malfunction of detectors	12 (position 2), 2 (position 4) and 11 (position 2)	April 2018	-
		6 (position 5)	May 2018	Final night of recording stopped at midnight
		6.5 (position 4)	July 2018	-
		12 (position 1)	August 2018	-
		2 (position 4), 6 (position 2)	September 2018	CP2 P4 recorded no data, CP6 P2 recorded only two nights of data recorded
		6 (position 3)	October 2018	-
		0.5 (position 2) and 12.5 (position 2)	June 2019	-
		7.5 (position 2) and 7.5 (position 3)	July 2019	CP7.5 (position 2) recorded no data, CP7.5 (position 3) only had two nights of data recorded
		7.75 (position 1)	August 2019	-
		4.5 (position 3)	September 2019	-

Survey type	Restriction	Crossing point/position number(s)	Month(s)/year	Additional comments
	Health and safety constraints	3 (position and 4)	October 2018	Poachers
		6 (positions 4 and 5)	October 2019	-
		5 (position 1) and 7.75	June 2019	Security reasons and hedge flaying
		3, 4, 4.5, 7.75, 12.5, 13 and 14	N/A	Impacted on a single occasion
		2, 5, 7.75, 8, 9 and 12	N/A	Impacted on two occasions

F.3 Woodland assessment survey limitations

F.3.1 Table F.3 below presents the limitations and restrictions associated with the woodland assessment surveys.

Table F.3 Limitations and restrictions associated with the crossing activity surveys

Survey type	Restriction	Crossing point/position number(s)	Year	Additional comments
Woodland ground tree assessments not completed	Access not granted	Woodland at the north-western corner of Shorne Wood	2021	Further ground-level tree assessments for trees within the Order Limits could not be carried out due to access not being granted.
		Woodland adjacent to Thong Lodge		

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