Appendix 10.1c
Extension Area – Bat Survey Report

LINHAY HILL QUARRY: EXTENSION AREA

BAT SURVEY REPORT

On behalf of E & JW Glendinning Ltd.

MARCH 2016

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SUMMARY

E&JW Glendinning Ltd. is proposing an extension of their existing operation at Linhay Hill limestone quarry, near Ashburton. The site being considered for the extension lies immediately north-east of the existing quarry and is currently managed as mixed farmland associated with Alston Farm.

The range of habitats across the Site had been assessed to provide optimal foraging habitat for bats, in particular, the network of hedges, green lanes sheep and cattle grazed pasture and woodland edges. These onsite habitats were also noted to be well connected to the wider landscape (via hedges, tree lines, lanes and woodlands. Onsite buildings within the Alston Farm and Alston Cottage complex were identified to have suitable features for roosting bats, as were a small number of scattered hedgerow trees. Along the south-eastern site boundary with the A38, a portion of the Site was noted to fall within a 'strategic flyway' for the Greater Horseshoe bat population within the South Hams Special Area for Conservation (SAC).

Bat activity and roost surveys were undertaken over a 7 month period during 2014 and 2015, in line with published best practice guidance at the time (Hundt [2012], and as extended in relation to Greater Horseshoe Bats by Natural England [2010]). Survey methodologies included internal and external inspection of buildings and trees, dusk emergence and dawn re-entry surveys, manual transect surveys and automated (static) detector surveys.

Activity surveys identified the Site to be utilised by an assemblage of at least 10 different species of bat, including species considered to be rare (Barbastelle & Lesser Horseshoe Bat) and very rare (Greater Horseshoe Bat) in a UK context. The greatest activity levels (and diversity of species) were generally within the northern part of the Site, along hedges, woodland edges and green lanes and farm tracks.

Roosts for five species were confirmed within the onsite buildings: a small maternity colony of Brown Long-eared bats, and non-breeding roosts for small numbers of Greater Horseshoe, Lesser Horseshoe, Natterer's and Common Pipistrelle. Interpretation of the results of the activity surveys also suggested the likely presence of Greater and Lesser Horseshoe roosts offsite to the east, and a Lesser Horseshoe roost to the west (the latter confirmed to be at Lower Waye). The presence of early/late records of Noctule and Myotis bats also were suggestive of likely nearby (offsite) roosts. No direct evidence of use of trees by roosting bats was obtained during the surveys.

Based on the landscape context, national statuses of the species present and their activities on the Site, the bat assemblage present is considered to be of up to **County** value.

1.0 INTRODUCTION

1.1 OVERVIEW & SURVEY OBJECTIVES

Woodfield Ecology was commissioned to carry out bat surveys on behalf of E&JW Glendinning Ltd. within / surrounding land to the north-east of Linhay Hill Quarry near Ashburton, Devon. The area of land is being proposed for a quarry extension to extend the operational lifespan of this working limestone quarry.

The land for the proposed extension is owned by E&JW Glendinning Ltd. is situated within the south-eastern edge of Dartmoor National Park, in and around Alston Farm (centred on NGR SX776717). For the purposes of this and all other ecological baseline surveys, a main survey area of c. 47 ha was defined (and is hereafter referred to as "the Site") which included the area of the proposed quarry extension, as well as surrounding habitats.

The purpose of the bat surveys was to:

- Complete internal and external inspections of all buildings present on Site to search for evidence indicating current, and historic use by roosting bats and fully assess their potential to support roosting bats;
- Complete emergence and re-entry surveys of buildings and trees identified as having potential to support bats to determine the likely presence / absence of bat roosts and establish their status (species, size of colony etc.); and
- Complete a bat activity survey (comprising walked transects and deployment of static detectors) to assess the bat species assemblage using the Site as foraging / commuting habitat and determine key habitat features.

The above surveys were completed in the active period for bats during 2014-2015. The results of the surveys, together with an evaluation of the importance of the Site with regards bat species are detailed within the following report.

1.2 CONSERVATION STATUS & PROTECTION

1.2.1 Conservation Status

Many bat species have declined in abundance and suffered a contraction in their range over the past century throughout Europe, including Britain. Notwithstanding this, Devon remains a national stronghold for bats and a total of 16 bat species have been recorded in Devon (out of a potential 18 found in Britain, 17 of which are known to be breeding). Devon supports such a significant proportion of UK bat species because of its mild climate,

its diverse landscape with a complex pattern of different natural and farmed habitats for feeding and roosting, and it's generally low levels of light pollution.[1]

1.2.2 Legislation

Conservation of Habitats and Species Regulations 2010 (as amended) and the Wildlife and Countryside Act 1981 (as amended)

All bats are classified as "European Protected Species" (EPS) and are listed on Schedule 2 of the Conservation of Habitats and Species Regulations 2010 (as amended) (HMSO 2010). These species are subject to the provisions of Regulation 41 of those Regulations. All bats are also protected under the Wildlife and Countryside Act 1981 (as amended) (HMSO 1981). Taken together, these pieces of legislation make it an offence to:

- intentionally or deliberately capture, injure or kill any wild animal included amongst these species;
- possess or control any live or dead specimens or any part of, or anything derived from a these species;
- deliberately disturb wild animals of any such species; and
- intentionally, deliberately or recklessly damage or destroy a breeding site or resting place of such an animal, or obstruct access to such a place.

Disturbance of animals includes in particular any disturbance which is likely:

- to impair their ability to survive, to breed or reproduce, or to rear or nurture their young, or (in the case of animals of a hibernating or migratory species) to hibernate or migrate; or
- to affect significantly the local distribution or abundance of the species to which they belong.

Although the law therefore provides strict protection to bats, it also allows this protection to be set aside (derogation) through the issuing of licences. The licences in England are determined by Natural England (NE) for development works. In accordance with the requirements of the Regulations, a licence can only be issued where the following requirements are satisfied:

- The proposal is necessary 'to preserve public health or public safety or other imperative reasons of overriding public interest including those of a social or economic nature and beneficial consequences of primary importance for the environment';

[1] http://devonbatgroup.org/

- 'There is no satisfactory alternative'; and
- The proposals 'will not be detrimental to the maintenance of the population of the species concerned at a favourable conservation status in their natural range'.

The Natural Environment and Rural Communities Act, 2006

The Natural Environment and Rural Communities (NERC) Act (HMSO 2006) came into force on 1st October 2006. Section 41 (S41) of the Act requires the Secretary of State to publish a list of habitats and species which are of principal importance for the conservation of biodiversity in England. The list of Species and Habitats of Principal Importance (SPIs and HPIs) has been drawn up in consultation with NE, as required by the Act and is referred to as the Section 41 (S41) List.

The S41 list is used to guide decision-makers such as public bodies, including local and regional authorities, in implementing their duty under Section 40 of the NERC Act, to have regard to priority species and habitats in exercising their functions including development control and planning.

Seven species of bat (Soprano Pipistrelle *Pipistrellus pygmaeus*, Brown Long-eared bat *Plecotus auritus*, Noctule bat *Nyctalus noctula*, Bechstein's bat *Myotis bechsteinii*, Barbastelle *Barbastella barbastellus*, Greater Horseshoe bat *Rhinolophus ferrumequinum* and Lesser Horseshoe bat *Rhinolophus hipposideros*) appeared on the S41 list (and are also classified as UKBAP Priority Species – refer to Section 1.2.3 below).

1.2.3 Planning Policy

The National Planning Policy Framework (NPPF) (DCLG 2012) forms the basis for planning decisions with respect to conserving and enhancing the natural environment. The ODPM circular 06/2005 (DCLG 2005) provides supplementary guidance, including confirmation that the presence of a legally protected species may be a material consideration in the making of planning decisions.

The NPPF sets out, amongst other points, how at an overview level the 'planning system should contribute to and enhance the national and local environment' by:

- recognising the wider benefits of ecosystem services; and
- minimising impacts on biodiversity and providing net gains in biodiversity where possible, contributing to the Government's commitment to halt the overall decline in biodiversity, including by establishing coherent ecological networks that are more resilient to current and future pressures…'

A list of principles which local planning authorities should follow when determining planning applications is included in the NPPF. They include the following:

- 'if significant harm resulting from a development cannot be avoided…adequately mitigated, or, as a last resort, compensated for, then planning permission should be refused;
- …opportunities to incorporate biodiversity in and around developments should be encouraged.'

In addition, the Dartmoor National Park Core Strategy and Development Management and Delivery Development Plan Document (DPD) include a number of policies which include for protected species:

- protect, maintain or enhance the biodiversity interests, and seek opportunities to restore or recreate habitats or linkages between them;
- further the conservation and enhancement of nationally protected species or habitats;
- conserve, enhance or restore priority habitats and species;
- protect and where appropriate enhance other defined sites, features, habitats, species, networks or natural processes of ecological importance;
- ensure that effective avoidance or mitigation measures are implemented (which may include off-site compensation); and
- result in no net loss of biodiversity.

In 1994 the UK Government published a national strategy to conserve our threatened native species and habitats – the UK Biodiversity Action Plan (UKBAP). The UKBAP included detailed action plans for priority species to reduce or reverse declines in population size and range. The 'UK Post-2010 Biodiversity Framework', published in July 2012, has succeeded the UK BAP although the species and habitat action plans prepared as part of the UKBAP still form the basis of much biodiversity work carried out today. This includes action plans that were prepared for seven species of bat (these are the same seven species of bat now listed on the S41 list (refer to in Section 1.2.2 above).

With regards local conservation objectives and targets for bats, the Devon BAP and Living Dartmoor[2] strategies also include specific action / delivery plans for the Greater Horseshoe bat, given the national conservation significance of the population found in Devon.

[2] http://www.dartmoor.gov.uk/lookingafter/laf-naturalenv/living-dartmoor

1.3 PRE-EXISTING SURVEY INFORMATION & RECORDS

In April 2014, an Extended Phase 1 Habitat Survey was completed by Woodfield Ecology which was supported by an ecological desk study exercise (updated in 2016). A summary of the relevant results relating to bats is provided below, for further details refer to *Linhay Hill Quarry: Extension Area - Extended Phase 1 Habitat Survey Report (Woodfield Ecology, March 2016).*

1.3.1 Desk Study

Designated Sites for Bats

During the desk study, information regarding statutory and non-statutory sites designated for nature conservation value was gathered. This identified that the South Hams Special Area of Conservation (SAC) falls within the 10km search area for European designated sites, which includes Annex II Greater Horseshoe bat (GHS) as one of its qualifying interests. The South Hams SAC is composed of 5 interconnected Sites of Special Scientific Interest spread across South Devon as follows (with the closest distance of each to the Site is shown in brackets):

- Berry Head to Sharkham Point (21.5km)
- Buckfastleigh Caves (5.7km)
- Chudleigh Caves and Woods (9.2km)
- Bulkamore Iron Mine (8.5km)
- Haytor and Smallacombe Iron Mines (4.4km)

Natural England has prepared guidelines to enable local planning authorities to obtain sufficient information to determine if a planning application will have an adverse impact on GHS bats within the SAC (Natural England, 2010). To aid this process, important strategic flyways and key foraging/sustenance zones have been identified and mapped. Any development which could potentially affect a strategic flyway or sustenance zone must follow the survey specification detailed within the guidance. Data received from Devon Biodiversity Records centre (DBRC) indicates that the south-eastern part of the Site overlaps with a GHS bat strategic flyway (which follows the route of the A38 corridor) and the closest sustenance zone is 300m north of the Site at its closest.

Bat Records

Both Devon Biodiversity Records Centre (DBRC) and Devon Bat Group (DBG) were also asked to provide records of bat species within a 5km radius of the Site in March 2016 and August 2014 respectively. Collectively these records indicated that at least 12 species of

bat occur within 5km of the Site, with a summary of the records obtained for each provided in Table 1 below.

The closest bat records to the Site include a probable Lesser Horseshoe bat maternity roost (based on numbers and anecdotal information provided by the client team [Adam Somerscales, E&JW Glendinning Ltd. pers. comm]), Brown Long-eared bat and Greater Horseshoe bat (no details given), all of which were dated 2012. These records are understood to be from Lower Waye, a tenanted property owned by the client, immediately adjacent to the north-west of the Site. This property was subject to further surveys as part of a suite of ecology surveys carried out to assess and inform the Waye Lane Replacement Route (refer to *Linhay Hill Quarry: Waye Lane Replacement Route – Bat Report, (Woodfield Ecology, March 2016)*).

No other records were retrieved from within the Site itself or immediate surrounds, although records of Common Pipistrelle and Whiskered bat were identified within close proximity (<0.5km) to the Site.

Table 1: Summary of Bat Records within 5km Study Area (DBRC and DBG data combined)

Bat Species	No. of Records	Distance to closest record	Summary of Records	Status / Protection Error! Bookmark not defined.
Barbastelle *Barbastella barbastellus*	7	2.2km	Sparse but widely distributed records across study area. Roost records are all hibernation sites, predominantly near Buckfastleigh & along the River Dart corridor.	Habitat Regs (2010), W&CA(1981); Schedule 5, NERC (2006) SPI, UKBAP
Brown Long-eared Bat *Plecotus auritus*	78	Adjacent	Frequent and widely distributed across the study area with numerous records of roosts (especially in dwellings), including historic and recent records. Closest record is from Lower Waye to the north-west (BCT, 2012).	Habitat Regs (2010), W&CA(1981); Schedule 5, NERC (2006) SPI, UKBAP
Common Pipistrelle *Pipistrellus pipistrellus*	80	0.3km	Frequent and widely distributed across the study area with numerous records of roosts (especially in dwellings), including historic and more recent records.	Habitat Regs (2010), W&CA(1981); Schedule 5
Daubenton's *Myotis daubentonii*	11	2.4km	Widely distributed records (but sparse) with slight concentration along the River Dart corridor. All roosting records are hibernation sites- no maternity colony records present in study area.	Habitat Regs (2010), W&CA(1981); Schedule 5

Bat Species	No. of Records	Distance to closest record	Summary of Records	Status / Protection[Error! Bookmark not defined.]
Greater Horseshoe bat *Rhinolophus ferrumequinum*	82	Adjacent	Widely distributed records which broadly correspond with the sustenance zone and strategic flyways, with the majority of records in close proximity to woodland areas. Records include a mixture of incidental and flying bats, summer roosts (day and night) and includes several breeding site records in buildings as well as underground hibernation sites, the majority of which are in / around Buckfastleigh and along the River Dart corridor. Closest record is from Lower Waye to the north-west (BCT, 2012).	Habitat Regs (2010), W&CA(1981); Schedule 5, NERC (2006) SPI, UKBAP, DevBAP, DartBAP
Lesser Horseshoe bat *Rhinolophus hipposideros*	107	Adjacent	Records are frequent and widely distributed across study area and include additional breeding sites, non-breeding, night roosts and hibernation sites, the latter showing a similar distribution to Greater Horseshoe bats. The closest record is from Lower Waye to the north-west (BCT, 2012), with 40 LHS bats recorded from this location. Given this, together with anecdotal information provided by E&JW Glendinning Ltd. (Adam Somerscales pers. comm.), this is assumed to be a LHS breeding colony.	Habitat Regs (2010), W&CA(1981); Schedule 5, NERC (2006) SPI, UKBAP
Whiskered / Brandt's *Myotis mystacinus / brandtii*	5	3.3km	Sparse records which includes a breeding site record from 2005. No records of hibernation sites.	Habitat Regs (2010), W&CA(1981); Schedule 5
Nathusius's' Pipistrelle *Pipistrellus nathusii*	2	4.9km	Two distant records including 1 record of a transitional roost for an individual near Buckfastleigh (2011) and another incidental (non-roosting) record near Stover Lake (2010).	Habitat Regs (2010), W&CA(1981); Schedule 5
Natterer's *Myotis nattereri*	19	1.4km	Closest record is for an historic (1991) house roost of unknown status. Scattered records across the study area including breeding and hibernation roosts.	Habitat Regs (2010), W&CA(1981); Schedule 5
Noctule *Nyctalus noctula*	13	3.4km	No records close to the Site and all but one are incidental / non-roosting records (although likely to be under-recorded).	Habitat Regs (2010), W&CA(1981); Schedule 5, NERC (2006) SPI, UKBAP

Bat Species	No. of Records	Distance to closest record	Summary of Records	Status / Protection Error! Bookmark not defined.
Serotine *Eptesicus serotinus*	6	1.9km	Scattered records across study area, including several historic / recent roosting records (no maternity / hibernation sites identified).	Habitat Regs (2010), W&CA(1981); Schedule 5
Soprano Pipistrelle *Pipistrellus pygmaeus*	17	1.4km	Very few records compared to Common Pipistrelle which are widely distributed across the study area. Closest record is to the north and is a non-breeding roost recorded in 2013.	Habitat Regs (2010), W&CA(1981); Schedule 5, NERC (2006) SPI, UKBAP
Whiskered Bat *Myotis mystacinus*	7	0.4km	Records predominantly found in southern part of study area and generally south of the A38. All records are of roosting bats (no breeding sites identified) and include a well-recorded hibernation site at Dyer's Wood in the south of the study area.	Habitat Regs (2010), W&CA(1981); Schedule 5
Unidentified horseshoe bat *Rhinolophus spp.*	1	3.1km	Record of an unconfirmed roost site.	Habitat Regs (2010), W&CA(1981); Schedule 5
Unidentified *Myotis* bat *Myotis spp.*	6	4.7km	Scattered records of flying bats as well as hibernation records from Dyer's Wood.	Habitat Regs (2010), W&CA(1981); Schedule 5
Unidentified long-eared bat *Plecotus spp.*	26	1.4km	Most likely additional records for Brown Long-eared Bat given that study area falls outside of the recorded distribution of Grey Long-eared bats. Most records are for roosts found in buildings, including several maternity sites and an historic record of a hibernation site.	Habitat Regs (2010), W&CA(1981); Schedule 5
Unidentified pipistrelle *Pipistrellus spp.*	19	1.6km	Scattered records (several in Ashburton) which include non-breeding and & breeding roosting sites.	Habitat Regs (2010), W&CA(1981); Schedule 5
Unidentified bat *Chiroptera*	84	0.5km	Large number of records for unidentified bats, many of which are unconfirmed roosting sites based on homeowner information and observations (but no specific surveys were undertaken).	Habitat Regs (2010), W&CA(1981); Schedule 5

1.3.2 Extended Phase 1 Habitat Survey

During the Extended Phase 1 Habitat Survey carried out in April 2014, suitable habitat for roosting bats was identified within both buildings and trees present within the Site.

Alston Farm comprises a large Georgian farmhouse with numerous roosting opportunities for bats within the external fabric as well as two roof voids, with bat access tiles noted along the ridge line of the main roof. The latter were understood to have been incorporated as part of a mitigation licence required when the property was re-roofed several years ago, due to the recorded presence of bats (Keith Davis, Tenant Farmer, pers. comm). Nearby farm outbuildings comprised a group of old stone barns including a former threshing mill with water wheel and a further group of single-storey open-fronted barns arranged around a courtyard, all of which were found to contain numerous access points for bats (with open doorways, windows and / or gaps present).

Alston Cottage (in close proximity to the farm) also appeared to offer suitable roosting sites for bats including within the cottage loft space and around the eaves / under roof slates. An old open-fronted barn used as a garage was recorded close by and also offered suitable roosting features for bats including for free-hanging species inside the barn as well as crevice-dwelling species within gaps in the original stone / cob walls and around timber door lintels.

A total of 14 mature trees (standards within hedges) were found to contain features conferring potential for use by roosting bats such as cavities, splits and / or a moderate-dense covering of Ivy, as reported within *Linhay Hill Quarry: Extension Area - Extended Phase 1 Habitat Survey Report (Woodfield Ecology, March 2016).* Of these trees, all except two were categorised as having 'low' or 'Category 2' potential to support roosting bats in accordance with Hundt (2012) and the remaining two trees were assessed as having 'medium' or Category 1' potential to support roosting bats.

The Site was assessed as providing optimal habitat for foraging bats with its extensive network of hedges, green lanes, occasional mature trees, sheep and cattle-grazed pasture, hay meadows and woodland edges in the north of the Site. With the exception of security lighting in / around the farm buildings, no artificial light sources were noted anywhere within the Site itself. A high degree of habitat connectivity both within the Site and within the surrounding landscape was also recorded, although the A38 Devon Expressway was considered to reduce habitat connectivity to the south-east.

2.0 METHODOLOGY

2.1 ROOST SURVEYS

2.1.1 Preliminary Roost Assessments

Buildings

Building inspections were completed at Alston Farm and Alston Cottage on May 25th and June 17th 2014 respectively by a team of two experienced bat surveyors (refer to Section 2.5 for details). The locations of all buildings within the Site which were subject to detailed internal / external inspections are shown on Figure 1.

The exterior of all buildings was searched (from ground level) using a high-powered torch, close-focusing binoculars and an endoscope (where necessary) for:

- Features which could provide bats with access into roosting spaces or provide roosting locations themselves (such as gaps under roofing tiles, ridge tiles, soffit boxes, behind fascia boards, under lead flashing as well as cracks and crevices in stonework); and
- Evidence of the presence of bats such as bat droppings on windowsills, walls and the ground, or scratch marks or staining around possible roost access / egress points.

Where safe access was possible, all buildings were also inspected internally to assess their suitability to support roosting bats, including an inspection of any loft voids present. This involved a systematic search with the use of high powered torches and an endoscope where required for bats or evidence of bats such as droppings, characteristic staining around potential roosting features, urine staining or scratches marks. Possible entry points into the buildings were also noted.

Based on the above inspections, all buildings within the Site were assigned a category defining their potential to support roosting bats in accordance with Table 2 below:

Table 2: Rationale used to define categories of bat potential of buildings

Level of Bat Potential	Rationale
Negligible	Building or structure with no or very limited roosting opportunities for bats, no evidence of use by bats and where the feature is isolated from potential foraging habitat.
Low	Building or structure with a limited number of roosting opportunities and where the feature is poorly connected to foraging habitat.

Level of Bat Potential	Rationale
Low-Moderate	Building or structure with several roosting opportunities for one or more species of bat, with reasonable connectivity to foraging habitat.
High	Building or structure with multiple roosting opportunities for one or more species of bat, and with good connectivity to high quality foraging habitat.
Confirmed Roost	Presence of bats or evidence of recent use by bats.

Where buildings were found to be unsuitable for use as day-roosting sites for bats (e.g. due to ingress of daylight where buildings were open-fronted) but were suitable as potential night-roosting sites, this was also recorded.

Trees

The assessment of the potential bat roosting opportunities within trees was carried out in conjunction with the Extended Phase 1 Habitat Survey on 24th & 29th April 2014, an optimal time of year for this type of survey (prior to the majority of trees being in leaf).

Trees were categorised in accordance with the categories set out below in Table 3 below, with reference to categories described in Hundt (2012).

Table 3: Criteria for assessing bat roosting potential of trees

Level of Potential (Tree Category as defined in Hundt, 2012)	Example Tree Features
Negligible potential (Category 3)	No cracks, splits, loose bark, hollow in trunk, holes or ivy
Low potential (Category 2)	Light ivy or any of the below features but in an isolated situation without surrounding trees or hedges
Medium potential (Category 1)	Heavy ivy and or presence of downward developing holes in a wooded situation or close to hedges
High potential (Category 1*)	Trees next to hedges or in a wooded situation with upward developing holes and or loose bark, splits, hollows, woodpecker holes

2.1.2 Emergence / Re-entry Surveys

Buildings

Based on the preliminary roost assessment of the buildings, those buildings that were assessed as offering negligible potential to support roosting bats due to a lack of roosting features were not subject to further surveys. In addition, those buildings considered to offer potential as night roosting sites only were also excluded from the emergence / return to roost surveys, although these buildings were included with the automated survey (refer to Section 2.1.3 below).

Within Alston Farm, 12 adjacent / inter-connected buildings were subject to two dusk emergence surveys and a dawn return to roost survey within the period May – August 2014, undertaken by a team of four experienced surveyors. This included the main farmhouse (Building AF1), the group of old stone barns including a former threshing mill immediately to the north (Buildings AF2-5) and a further group of single-storey open-fronted barns arranged around a courtyard to the east of the farmhouse (Buildings AF6-9).

At Alston Cottage, a total of 3 adjacent / inter-connected buildings were subject to two dusk emergence surveys within the period June – August 2014, undertaken by a team of two experienced surveyors. This included Alston Cottage itself (Building AC1), the adjacent stone barn / garage (Building AC2) and a small lean-to outbuilding to the west of the cottage (Building AC3).

The survey dates, times and weather conditions are detailed in Table 4 below. The surveys were undertaken at an optimal time of year, when bats are active and likely to be using summer / maternity roosts. The dusk emergence surveys began approximately 20 minutes before sunset and continued until 2 hours after sunset. The dawn return to roost surveys began 1.5 hours before sunrise and finished at or soon after sunrise.

Table 4: Building Emergence / Re-entry Survey Dates & Summary Weather Conditions

Buildings	Survey Date / Type	No. of Surveyors	Sunset / Sunrise	Survey Start – End Times	Summary Weather Conditions
Alston Farm (main house and outbuildings)	28/05/2014 Dusk emergence	4	21:13	20:50-23:13	Dry, 60% cloud cover, still (Beaufort Scale 1), temperature range 13-11.7°C
	16/07/2014 Dusk emergence	4	21:21	21:00-23.20	Dry, 90% cloud cover, still (Beaufort Scale 1), temperature range 17-15°C
	14/08/2014 Dawn re-entry	4	06:01	04:30-06:00	Dry, 80% cloud cover, light breeze (Beaufort Scale 2), temperature range 14.5-13°C
Alston Cottage (main house and outbuildings)	17/06/2014 Dusk emergence	2	21:29	21:10-23:30	Dry, 10% cloud cover, light breeze (Beaufort Scale 2), temperature range 15-13.7°C
	14/08/2014 Dusk emergence	2	20:37	20:15-22:40	Dry, 10% cloud cover, light-gentle breeze (Beaufort Scale 2-3), temperature range 14-12.3°C

Surveyor locations were selected to ensure full coverage of all potential roosting features identified on buildings and are shown on Figure 1. On each occasion, surveyors used an EM3 or EM3+ bat detector to listen to and record echolocation calls of bats during the

survey. Notes were made on any observations of bats emerging from or re-entering buildings including times, flight lines and the features / areas used by bats to exit / enter buildings. In additional, incidental bat activity within the vicinity of the buildings was also recorded with the species of bat noted. The recorded calls were later analysed using computer software to confirm the identification of the species recorded as far as possible (refer to Section 2.3 below).

Trees

A total of 14 trees were identified as having potential features to support roosting bats, only two of which were assessed to be of greater than low / category 2 potential. Of the 14 trees, five trees were subject to targeted emergence / re-entry surveys as shown on Figure 1. This included the two trees assessed as having medium / category 1 bat roost potential (T3 & T4) and three trees assessed as having low / category 2 potential which were surveyed incidentally due to their proximity to T3 (T1 & T2) or on a precautionary basis (T5).

Although all trees identified as containing features suitable for use by roosting bats would require further precautions to be adopted where impacts are considered highly likely, for the purposes of the baseline assessment, survey effort focussed on those trees with the greatest potential to support bats (in the context of the Site), or those where uncertainty regarding the preliminary roost assessment merited further survey effort.

Table 5 below details the survey dates, times, number of surveyors and summary weather conditions for all tree emergence / re-entry surveys completed. Further details regarding the potential roosting features found within each of these trees are given in Section 3.1.1. The dusk emergence surveys began approximately 20 minutes before sunset and continued until 2 hours after sunset. The dawn return to roost surveys began 1.5 hours before sunrise and finished at or soon after sunrise. Surveyors used either an EM3 or EM3+ bat detector to listen to and record echolocation calls of bats during the surveys.

Table 5: Tree Emergence / Re-entry Survey Dates & Summary Weather Conditions

Tree Reference	Survey Date / Type	No. of Surveyors	Sunset / Sunrise	Survey Start – End Times	Summary Weather Conditions
T1, T2, T3	17/09/2014 Dawn re-entry	2	06:53	05:20-06:55	Dry, 20% cloud cover, light-gentle breeze (Beaufort Scale 2-3), temperature 16°C
T4	16/09/2014 Dusk emergence	1	19:28	19:10-21:30	Dry, 30% cloud cover, light-gentle breeze (Beaufort Scale 2-3), temperature range 19-17°C

Tree Reference	Survey Date / Type	No. of Surveyors	Sunset / Sunrise	Survey Start – End Times	Summary Weather Conditions
T5	16/09/2014 Dusk emergence	1	19:28	19:10-21:30	Dry, 30% cloud cover, light-gentle breeze (Beaufort Scale 2-3), temperature range 19-17°C

2.1.3 Automated Detector Surveys of Alston Farm Buildings

To supplement the emergence / re-entry surveys of buildings at Alston Farm outlined in section 2.1.2 and, with a particular aim of determining the likely presence of night roosts in outbuildings, automated detectors (AnaBat Express) were left inside buildings at Alston Farm at regular intervals throughout the main active period for bats during 2014 as detailed in Table 6 below.

Table 6: Dates of Static Detector Surveys at Alston Farm

Building Reference	Static Detector Recording Period (2014)	Location within Building	Total No. of recording nights
AF2	28th May – 1st June 29th July – 6th August	1st floor	12
	22nd – 28th July	Ground floor	6
AF3	29th July – 3rd August	1st floor	6
	26th September – 2nd October	Ground floor	7
AF4	28th May – 7th June	1st floor	11
	26th September – 8th October	Ground floor	13
AF5	25th June – 1st July	1st floor	7
	25th June – 1st July 25th August – 1st September	Ground floor	15
AF6	28th May – 7th June	Ground floor (single-storey)	11
AF7	29th July – 3rd August	Ground floor (single-storey)	6
AF8	28th May – 8th June	Ground floor (single-storey) – by doorway leading into Building 11	12
AF9	27th June – 1st July	Ground floor (single-storey)	5
AF10	27th-28th June	Ground floor (single-storey)	2

On each deployment, the detector was set to record continuously (triggered by bat passes) between half an hour before sunset until half an hour after sunset. On completion of the survey, the data was downloaded for analysis to species-level wherever possible.

2.2 ACTIVITY SURVEYS

Due to the presence of a Greater Horseshoe bat strategic flyway along the south-eastern boundary of the Site, bat activity survey methods adopted were those set out within the

South Hams SAC Greater Horseshoe Bat Consultation Zone Planning Guidance (Natural England, 2010) which specifically requires the following:

- *Manual surveys should be carried out on ten separate evenings; at least one survey should be undertaken in each month from April to October as bats' movements vary throughout the year.*
- *Automatic bat detector systems should be deployed at an appropriate location. The period of deployment should be at least 50 days from April to October and would include at least one week in each of the months of April, May, August, September and October.*

2.2.1 Manual Transect Surveys

Manual bat surveys were carried out across the Site on ten separate evenings between April – October 2014 by a team of two experienced bat surveyors. During each survey visit, the Site was split into two pre-determined transect routes to adequately cover all habitat features, as shown on Figure 2.

Each manual transect survey began approximately 10 minutes before sunset and continued for 3 hours after. The start point of the transect routes and the direction of travel were varied across the survey period to ensure that all points along the transect routes were adequately covered at different times of the evening.

During the surveys, notes were made on the bat species heard and seen, including time, location, activity and, where possible, direction of flight. Surveyors were equipped with time expansion bat detectors (EM3 or EM3+) with a GPS receiver / antenna to accurately log the location of all bat passes heard.

The dates, times and summary weather conditions of each transect survey visit are shown in Table 7 below.

Table 7: Manual Transect Survey Dates & Summary Weather Conditions

Transect No.	Survey Date	Sunset / Sunrise	Survey Start – End Times	Summary Weather Conditions
1	29/04/2014	20:31	20:20-23:30	Dry, 10% cloud cover, still (Beaufort Scale 1), temperature range 11.3-9°C
2	25/05/2014	21:09	20:55-00:10	Dry, 20% cloud cover, light breeze (Beaufort Scale 2), temperature range 12-10.4°C
3	10/06/2014	21:25	21:05-00:25	Dry, 20% cloud cover, gentle breeze (Beaufort Scale 3) at start, still by end (Beaufort 1), temperature range 16-11°C

Transect No.	Survey Date	Sunset / Sunrise	Survey Start – End Times	Summary Weather Conditions
4	27/06/2014	21:31	21:15-00:15	Dry until 00:15 then persistent heavy rain, 80% cloud cover, still (Beaufort 1), temperature range 14-12°C
5	23/07/2014	21:13	21:05-00:15	Dry, 30% cloud cover, still to light breeze (Beaufort 1-2), temperature range 22-19°C
6	08/08/2014	20:48	20:45-23:45	Dry, 15% cloud cover, light to gentle breeze (Beaufort 2-3), temperature range 16.4-15.5°C
7	20/08/2014	20:26	20:20-23:25	Dry, 5% cloud cover, still to light breeze (Beaufort 1-2), temperature range 13-9.5°C
8	02/09/2014	19:58	19:50-23:00	Dry, 100% cloud cover, still to light breeze (Beaufort 1-2), temperature 17°C
9	24/09/2014	19:10	19:00-22:10	Dry, 30% cloud cover, still (Beaufort 1), temperature range 15-11°C
10	14/10/2014	18:26	18:20-21:30	Very light drizzle at start then dry, 100% cloud cover, still (Beaufort 0-1), temperature range 13-12°C

2.2.2 Automated Detector Surveys

In combination with the walked transect surveys, additional bat activity data was gathered by means of an automated detector survey. Automated bat detectors (AnaBat Express) were installed within the Site in the same locations between May to October 2014 and in April 2015.

A total of 5 detectors were deployed at any one time and were rotated at intervals each month to cover a total of 10 different static locations which are shown on Figure 3 and described in Table 8 below. At each location, detectors were attached to 1.5m high wooden stakes and were set to record between 30 minutes before sunset until 30 minutes after sunrise each night for a minimum of 5 nights each month (typically 7 nights or longer).

For the analysis of horseshoe bat activity, the full dataset was used and at each of the 10 static locations, the total number of recording nights exceeded the minimum requirements of 50 nights specified within survey guidelines (Natural England, 2010), as shown in Table 8. The complete dataset was scanned using AnaLook software to automatically identify all LHS and GHS calls, as described further in section 2.3 below.

With regards species within the Vespertilionidae or Vesper bat family, a smaller sub-set of the data recorded during the automated detector surveys was analysed, in accordance

with standard best practice at the time (Hundt, 2012). Six static locations were chosen (ensuring all habitat types and different areas within the Site were represented) and from each, 5 recording nights each month were subject to full species analysis, with all calls manually identified and labelled.

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Table 8: Automated Detector Survey Recording Dates

N.B. Shaded cells denote data used for horseshoe bat analysis, unshaded denotes sub-set of recording nights used for Vesper bat analysis (statics 1, 4, 5, 7, 8 & 9 only)

Detector Location	Description of Surrounding Habitats	May 2014	June 2014	July 2014	August 204	September 2014	October 2014	April 2015	No. of Recording Nights
1	In corner of turf field, within an overgrown area containing young Lawson's Cypress trees. A38 immediately south (Alston Cross).	9-13th	9-12th; 25th-30th	8th-11th; 22nd-28th	6th-10th; 25th-29th	2nd-6th; 9th-13th	8th-12th; 14th-15th	7th-13th	**60**
		9th-13th	25th-29th	22nd-26th	25th-29th	9th-13th	8th-11th, 14th	7th-11th	**35**
2	Within field managed as pasture / meadow, on edge of mature broadleaved plantation alongside A38.	9th-15th	9th-16th	8-14th	6th-12th	2nd-15th	14th-15th; 23rd-30th	7th-13th	**60**
		N/A							
3	At junction of several well-managed hedgerows, surrounding fields managed for cattle/ sheep grazing and hay.	9th-15th	9th-16th	8-12th; 22nd-26th	6-8th; 25th-27th	2nd-15th	8th-15th	7th-13th	**60**
		N/A							
4	Along farm access track / drive (lined with well-managed hedges on both sides). Adjacent fields used for grazing and hay.	9th-15th	9th-16th	8-14th	6th-12th	2nd-3rd; 9th; 23rd-30th	1st-3rd; 8th-15th	7th-13th	**58**
		9th-13th	9th-13th	8th-12th	6th-10th	23rd-27th	1st-3rd, 8th-9th	7th-11th	**35**
5	On field side of a well-managed hedge alongside Alston Lane. Field used for sheep-grazing / hay crop.	9th-15th	9th-16th	8-14th	6th-12th	2nd-7th; 9th-12th; 23rd-30th	1st-4th; 8th-15th	7th-13th	**66**
		9th-13th	9th-13th	8th-12th	6th-10th	2nd-6th	1st-4th, 8th	7th-11th	**35**
6	On green lane, lined with well-managed hedges on both sides. Adjacent fields used for cattle / sheep and hay crops.	21st-27th	17th-20th; 25th-26th	15th-18th; 22nd-25th	13th-19th; 25th-26th	17th-20th; 23rd-30th	16th-20th; 23rd-26th	14th-20th	**58**
		N/A							
7	On overgrown green lane which connects to Caton Lane c. 30m to east. Lined with shrubby hedges on both sides. Surrounding fields used for hay / cattle.	16th-24th	17th-24th	15th-21st	13th-23rd	16th-22nd	16th-20th; 23rd-31st	14th-20th	**63**
		16th-20th	17th-21st	15th-19th	13th-17th	16th-20th	16th-20th	14th-18th	**35**
8	On well-managed hedge with occasional mature trees, adjacent to cattle-grazed pasture.	16th-24th	17th-24th	15th-21st	13th-22nd	17th-25th	16th-21st; 23rd-28th	14th-20th	**62**
		16th-20th	17th-21st	15th-19th	13th-17th	17th-21st	16th-20th	14th-18th	**35**
9	On mature tree-line with scrubby outgrowth into steeply-sloping (species-rich) grassland managed for hay.	16th-24th	17th-24th	15th-21st	13th-24th	16th-22nd	21st; 23rd-28th	14th-20th	**57**
		16th-20th	17th-21st	15th-19th	13th-17th	16th-20th	16th-20th	14th-18th	**35**
10	Along scrubby hedge lining track on the edge of Alston Wood. Within sheep-grazed, steeply sloping field.	16th-24th	17th-26th	15th-21st	13th-23rd	18th-25th	17th-22nd	14th-20th	**58**
		N/A							

2.3 DATA ANALYSIS

2.3.1 Detector Settings & Defining a Bat Pass

Bats generate echolocation calls which were recorded by the detectors during the roost and activity surveys. These calls were analysed using Analook software to give an indication of the species of bat present and their relative abundances.

The number of 'bat passes' (sound files) was used as a measure of bat activity. It should be recognised however that a series of separate sound files could represent multiple bats calling infrequently (e.g. as they each pass overhead moving in one direction) or a small number of bats (or even one individual) calling frequently (e.g. bats making repeated foraging passes up and down a hedgerow). This cannot be determined without ground-truthing (i.e. unless bats can be directly observed at all times). While this is often impractical, the walked transects, do provide supporting information of this nature. Measuring bat activity provides the best available surrogate for bat density since most species show a strong fidelity to roosting and foraging sites, although the home range often contains multiple sites for roosting and foraging.

During the emergence / re-entry surveys and walked transect surveys, surveyors used EM3 bat detectors in time expansion mode (RTE). For these surveys, a single bat pass was defined as one or more clearly recognisable echolocation calls from a single species, separated from the next pass by a gap of at least two seconds. The EM3 settings used throughout the surveys were as follows:

- Recording in WAC format (maximum duration of 15 minutes)
- Sample Rate: 256K
- Trigger: 16KHz with a threshold level of 12dB, trigger window = 2secs.

All recordings made during the emergence / re-entry surveys and manual transect surveys were converted into Zero-Crossing (ZC) files using Kaleidoscope software, prior to analysis using AnaLookW software. The Kaleidoscope settings used were as follows:

- Kaleidoscope Version 3.1.4
- Outputs – ZC files using a division ratio of 8
- Noise files filtered, kept (& subsequently analysed)
- Signal of interest settings: (8-120KHz, 2-500ms and minimum no. of calls = 2)

For the automated detector surveys, AnaBat Express detectors were deployed. These detectors are equipped with an omnidirectional broad-band microphone and use Frequency Division to produce data files which can be analysed using Zero-Crossing

Analysis (ZCA).The AnaBat Express uses little power and has highly efficient data storage capabilities which allow the system to be used for long term passive monitoring. For these surveys, a single bat pass is defined as one or more clearly recognisable echolocation calls from a single species, separated from the next pass by a gap of at least one second with a maximum duration of 15 seconds. The AnaBat Express settings used throughout the surveys were as follows:

- Recording mode: night only (the detector is on from 30 mins before sunset until 30 mins after sunrise)
- Sensitivity of 8 (High)
- Division ratio of 8

2.3.2 Species identification

Vesper Bats

All ZC files were analysed as sonograms (time x frequency graphs) using AnaLookW computer software to confirm the identification of the species recorded in the field if possible, with reference to published call parameters (Russ, 2012). Exceptions to this were as follows:

- For long-eared bats (*Plecotus* species), bat sound files were not identified to species level due to the overlapping call parameters. It should be noted that these are considered most likely to be Brown long-eared bat *Plecotus auritus;* Grey long-eared bats *Plecotus austriacus* have been recorded in Devon, although only rarely and with a very restricted coastal distribution (Harris & Yalden, 2008);
- Species of the genus *Myotis* were grouped together as their calls are similar in structure and have overlapping call parameters, making species identification problematic (Russ, 2012). Desk study records confirmed the presence of Natterer's, Daubenton's, Whiskered and Whiskered / Brandt's within the 5km study area, all of which may occur within the Site;
- Bats of the genera *Myotis* and *Plecotus* are notoriously difficult to differentiate based on echolocation call structure alone (Russ, J., 2012) and therefore, where call parameters were found to be indeterminate, these records have not been positively identified to species-level on a precautionary basis; and
- Identification of calls in the *Nyctalus* genera can be problematic due to overlapping characteristics and where this was the case, calls were identified as Noctule / Leisler's on a precautionary basis. However, it should be noted that these are most likely Noctule records, based on the known distribution of Leisler's bat and rarity of records in Devon (Harris & Yalden, 2008).

For bats of the *Pipistrellus* genus the following criteria based on measurements of peak frequency were used to classify calls:

- Common Pipistrelle ≥ 42 and <49KHz;
- Soprano Pipistrelle ≥ 51KHz;
- Nathusius Pipistrelle <39KHz;
- Common/Soprano Pipistrelle ≥49 and <51KHz; and
- Common/Nathusius Pipistrelle ≥39 and <42KHz.

Horseshoe Bats

A horseshoe scan was created in AnaLookW to provide an efficient and standardised means of identifying LHS and GHS bat passes within the complete dataset. The key parameters used in the filters (combined into a scan) were as follows:

- GHS filter: Body of call >1000ms, Fc min 75KHz – Fc mx 86KHz
- LHS filter: Body of call >1000ms, Fc min 106.5KHz – Fc max 115KHz

In addition to these, and following repeated manual checking and refinement to ensure the number of false positive / negatives was minimised as far as possible, a number of advanced settings were also applied to the filters, relating to call slope / smoothness.

2.3.3 Analysis & Data Interpretation

Due to the fact that the number of nights / hours recorded each month and at each location was not consistent, the number of bat passes per hour (B/hr) was used to provide a standard index of relative activity to enable comparisons to be made in order to establish seasonal and locational patterns.

Basic descriptive statistics were generated in MS Excel, and detailed statistical analysis was undertaken using RStudio (RStudio Team, 2015) and R version 3.1.2 with specific use of the packages nortest[3] and pgirmess[4].

2.4 BASELINE EVALUATION CRITERIA

The ecological valuation is based on the guidelines set out in Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal (CIEEM, 2016). The known or potential value of an ecological resource or feature is determined within the following geographical context:

[3] Juergen Gross & Uwe Ligges 2015
[4] Patrick Giraudoux 2014

- International and European;
- National;
- Regional (i.e. South West England);
- County (Devon); and
- Local

To inform the assessment in this report, the level of activity of each bat species identified, the frequency of records made during the surveys, the abundance of the species at the national level, the quality of the habitat present and the geographical range of the species concerned have been considered, based on published accounts (Bat Conservation Trust (BCT) 2014; Battersby, 2005; or Harris et al, 1995).

Consideration has been given to which habitats/parts of the survey area are of highest value to bats based on the survey data. For example, this may include regular commuting flight lines or areas most frequently used by foraging bats.

In evaluating the relative importance of the Site to different bat species, consideration was given to the relative frequency of each species (based on the survey results) in the context of their UK status and population estimates. The following categories for relative frequency (in terms of results of this survey) have been used:

- Very frequent – recorded on all or most surveys with high numbers of calls/levels of activity;
- Frequent – recorded on all or most visits but with medium numbers of calls/levels of activity;
- Regular – recorded on most visits but with low numbers of calls/levels of activity;
- Infrequent – scattered records through the survey programme, generally low numbers of calls;
- Very infrequent – very few calls recorded on a low number of occasions; and
- No confirmed activity – no confirmed bats of this species recorded in this survey area.

2.5 PERSONNEL

All surveys were led by Becky Prudden MCIEEM, Woodfield Ecology who has worked as an ecological consultant for over 10 years and specialises in survey and assessments in relation to bats. Becky holds a Natural England bat licence: Class Survey Licence - Level 2 (registration no. 2015-13148-CLS-CLS at time of surveys).

Other ecologists who assisted with the completion of the surveys were also all experienced ecologists who are very familiar with the bat species assemblage found in

south-west England and who are fully conversant with standard bat survey methods and current best practice.

The team was as follows:

- Mark Tunmore (Self-employed Ecologist – Licence Registration No. 2015-14995-CLS-CLS)
- Jennifer Reid (Tor Ecology – Licence Registration No. 2015-15427-CLS-CLS)
- Oliver Prudden (Woodfield Ecology)
- Laura Snell (Tor Ecology)

2.6 SURVEY LIMITATIONS

2.6.1 Internal and External Building Inspections

With the exception of one of the outbuildings at Alston Farm (Building AC3), all buildings could be accessed and inspected in full.

Building AC3 could not be accessed due to health and safety reasons as the roof structure had partially collapsed. It was however possible to view the internal areas of this building from an external opening at first floor level (west gable) and via a ground floor doorway on the eastern gable. Given this, together with the fact that the building was subject to further emergence / re-entry and automated detector surveys, it is considered unlikely that the presence of a roost would have gone undetected.

2.6.2 Emergence / Re-entry Surveys

Notwithstanding the transient nature of some bat roosts and in particular, those for low numbers / individual (non-breeding) bats, the emergence / re-entry surveys of buildings and trees were all completed without any significant constraints. All of the surveys were carried out during optimal weather conditions (refer to Tables 4 & 5) and encompassed the optimal period when bats are active and likely to be using summer / maternity roosts.

2.6.3 Manual Transect Surveys

No significant limitations were encountered during the manual transect activity surveys which were undertaken in accordance with the methods prescribed within (Natural England, 2010). All surveys were completed during optimal weather conditions, on dry evenings with temperatures typically 10^{o}c or above, with little or no wind (refer to Table 7). The only exception to this was the survey completed on 27th June 2014 when heavy rain was recorded in the latter part of the surveys. However, given that this only affected

the final 15 minutes of the survey, this is not considered to reduce confidence in the overall results.

2.6.4 Automated Detector Surveys

As previously stated, AnaBat Express detectors were used during the automated detector surveys. There are acknowledged limitations with using frequency division and ZC file formats, principally in terms of their relatively lower sensitivity and incomplete representation of bat calls (no display of harmonics and amplitude). However, AnaBat Express detectors are highly suitable for long-term passive monitoring (due to battery life and small file size which permits longer recording periods without data loss), which is considered to outweigh any perceived disadvantages.

Weather variables such as temperature, wind and rainfall influence bat activity. The online resource wunderground.com was used to obtain weather data for Ashburton during the automated monitoring periods in 2014-2015 (refer to Appendix B) to assist with data interpretation. Weather conditions recorded throughout the monitoring period were considered to be fairly typical for the location with no unseasonal extremes / anomalies noted. However, as would be expected, weather conditions varied both seasonally as well as between individual nights which undoubtedly would have resulted in some nights being quieter with regards bat activity. However, as far as practicable, care was taken to check weekly weather forecasts before deployment to ensure optimal recording periods were selected during each month. This, in combination with the fact that data was gathered over a long monitoring period, means that any short-lived periods of poor weather, would not significantly have affected the overall mean number of bat passes recorded at each location.

3.0 RESULTS

3.1 ROOST SURVEYS

3.1.1 Summary

The results of the roost surveys carried out at Alston Farm and Alston Cottage are summarised below and on Figure 4.

Roosting was confirmed within nine of the buildings or structures within the Site, with the key findings as follows (based on combined results of all surveys):

- **Brown Long-eared bat:** a small maternity colony was identified within Alston Farmhouse (Building AF1) and evidence of individual / low numbers was found within Alston Cottage (Building AC2) and adjacent barn / garage (Building AC2);
- **Common Pipistrelle:** low numbers were recorded roosting within Alston Farmhouse (Building AF1) and an adjacent outbuilding (Building AF1) as well as within Alston Cottage (Building AC1);
- **Myotis species (probable Natterer's):** evidence of a small roost for individual / low numbers within a barn at Alston Farm (Building AF5);
- **Greater Horseshoe bat:** evidence of day and night roosts for low numbers (<5) GHS bats was found within outbuildings at Alston Farm (Buildings AF2-4 and AF8-9); and
- **Lesser Horseshoe bat:** evidence of day and night roosts for low numbers (<5) LHS bats was found within outbuildings at Alston Farm (Buildings AF2-5 and AF8).

The results of the roost surveys confirmed the presence of roosts of small numbers of rarer bats (GHS and LHS bats) as well as maternity roosts and non-breeding roosts for small numbers of more common species (Brown Long-eared bat, Common Pipistrelle and Natterer's bat) (BCT, 2014). Overall, these roosts are therefore considered to be of low-medium conservation significance in accordance with guidelines set out in English Nature, 2004.

In addition, 14 trees were identified as offering potential to support roosting bats (12 were assessed as having low / Category 2 potential and two trees categorised as medium / Category 1), although no evidence of roosting was confirmed.

The following section provides further details of the findings of the roost surveys carried out at buildings and trees across the Site.

3.1.2 Preliminary Roost Assessments

Buildings

The locations of all buildings surveyed within the Alston Farm complex and at Alston Cottage are shown on Figure 1. Tables 1 & 2 in Appendix A detail the findings of the external / internal inspections, including a detailed description of any potential roosting sites or evidence of bats found as well as photographs of building.

An overview of the findings is given below:

Table 9: Key Findings from Building Inspections

Building / group	Summary of evidence found / potential roosting features	Preliminary Roost Assessment (Hundt, 2012)
ALSTON FARM		
AF1 (Alston Farmhouse)	Evidence of a Brown Long-eared bat roost was found within the main loft void as well as a smaller loft void within an extension on the rear of the property (an individual bat was observed roosting at the main ridge and moderate accumulations of mixed age droppings found, indicative of a small / medium colony). In addition the building was assessed as having high potential to support other species within the external fabric of the building, including gaps behind fascia boards / at the top of wall plates and small gaps under roof slates. Ridge access tiles were recorded which were understood to have been installed as part of a mitigation licence during re-roofing works completed several years ago (Keith Davis (tenant farmer) pers. comm.).	Confirmed roost for Brown Long-eared bats, high potential for additional species
AF2-AF5 (group of old two-storey stone barns to the north of the farmhouse)	Evidence of LHS and GHS bat roosts for low numbers (in the form of small accumulations of droppings and feeding remains) was found in several different locations within the complex of barns. No bats themselves were found during the inspection. All barns were also found to offer multiple roosting opportunities for crevice bats within gaps under roof slates, in the stonework and structural timbers (mortice joints / lintels) as well as behind dense ivy on external walls.	Confirmed roost for low numbers of LHS and GHS bats, high potential for additional species

Building / group	Summary of evidence found / potential roosting features	Preliminary Roost Assessment (Hundt, 2012)
AF6-AF10 (single-storey barns to the east of the farmhouse)	The majority of these barns were open-fronted on one side and were considered to offer limited potential for free-hanging bats as day-roosting sites due to ingress of daylight and exposure as well as disturbance from regular use as kennels and housing for poultry / livestock. Opportunities for crevice roosts included features such as a gap along the ridge beam and occasional gaps within the stone walls.	AF6-AF9 Low-moderate roost potential; AF10 low roost potential
AF11 & AF12 (large modern steel barns)	No suitable roost sites were identified given their construction type but large sheds may offer sheltered indoor flying space for foraging bats (due to presence of livestock) and / or warming-up / light sampling areas for bats roosting elsewhere within the farm complex.	Negligible roost potential
ALSTON COTTAGE		
AC1 (Alston Cottage)	Evidence of a small long-eared bat roost was found within the loft void in the form of low numbers of scattered droppings (mixed ages), mostly beneath the ridge line. Other opportunities for crevice roosting bats within the external fabric of the cottage included small gaps under roof slates and the gap between the soffit and walls, particularly on the front and north-east gable walls.	Confirmed roost for long-eared bats (presumed to be Brown Long-eared), high roost potential for additional species
AC2 (old barn to the north of AC1)-	Much of the internal space was found to be well-lit by large doorways (former cart entrances) and the barn was assessed as being sub-optimal for free-hanging bats as a day roost, with potential for use as a night roost. Numerous opportunities for crevice-dwelling bats were noted in between ridge beams, gaps in stonework and cavities around timber door frames / lintels.	High roost potential
AC3 (small lean-to stone barn adjacent to AC1)	Assessed as having limited potential for use as night roost by free-hanging bats (too well-lit / small to be used as a day roost). Potential crevice roosts within gaps in stonework.	Low roost potential

Trees

The preliminary roost assessment of trees carried out as part of the Extended Phase 1 Habitat Survey identified a total of 14 mature trees within the survey area which contained features conferring potential for use by roosting bats such as cavities, splits and / or a moderate-dense covering of Ivy. Of these trees, all except two were categorised as

having 'low' or 'Category 2' potential to support roosting bats in accordance with Hundt (2012).

Table 10 below provides further details of those trees identified as containing potential features for roosting bats (refer to Figure 1 for their location):

Table 10: Results of Preliminary Roost Assessment of Trees

Tree Reference	Tree Species	Description of Features	Level of Bat Potential
T1	Pedunculate Oak	Several small dead limbs containing longitudinal splits	Low / Category 2
T2	Pedunculate Oak	Knot hole on main trunk at height of 4m (appeared fairly shallow as viewed from ground level).	Low / Category 2
T3	Pedunculate Oak	Several small limbs containing longitudinal splits and small knot-holes	Medium / Category 1
T4	Horse Chestnut	Contains at least five knot-holes with dense Ivy growth on part of main trunk	Medium / Category 1
T5	Pedunculate Oak	Mature pollard with no obvious features visible, but may harbour suitable features given age.	Low / Category 2
T6	Pedunculate Oak	Mature, stag-headed tree with much dead wood in the upper canopy, some of which were noted to contain small longitudinal splits / cracks.	Low / Category 2
T7	Ash	Mature Ash pollard with hollow trunk at base (considered sub-optimal as a roost site due to high degree of exposure) and sparse covering of Ivy.	Low / Category 2
T8	Ash	Mature multi-stemmed Ash with no obvious decay / damage features, but a moderate covering of Ivy.	Low / Category 2
T9	Ash	Mature Ash pollard with hollow trunk at base and moderate covering of Ivy.	Low / Category 2
T10-T12	1x Ash 2 x Pedunculate Oak	Group of 3 trees, none of which had any obvious decay / damage features but all were found to contain deadwood in upper canopies which was likely to harbour small splits / cracks.	Low / Category 2
T13-T14	2 x Pedunculate Oak	Group of 2 trees noted to have moderate Ivy covering on main stems.	Low / Category 2

3.1.3 Emergence / Re-entry Surveys

Buildings

Alston Farm

The emergence / re-entry surveys completed at Alston Farm confirmed the presence of roosts for:

- a small maternity colony for long-eared bats (presumed to be Brown Long-eared based on geographic location) (maximum count of 12 bats);
- low numbers of Common Pipistrelle (non-breeding, maximum count of 4 bats);
- low numbers of GHS bats (night roost, maximum count of 2 bats).

The key findings of the building emergence / re-entry surveys are presented for each building within the Alston Farm complex in turn in Table 11 below.

Table 11: Summary of Key Findings from Dusk emergence / Dawn Re-entry Surveys at Alston Farm

Building Reference	Dusk emergence survey 28/05/2014	Dusk emergence survey 16/07/2014	Dawn re-entry survey 14/08/2014
AF1	4 Common Pipistrelle bats emerged from rear (north roof) – exact location unseen approximately 25 mins after sunset. 2 long-eared bats emerged from behind soffit on south-west corner of house approximately 30 mins after sunset.	1 Common Pipistrelle bat emerged from rear (north) roof pitch – exact location unseen – at 7 mins after sunset. A total of 12 long-eared bats emerged (10 from ridge line of lower extension roof, 1 from behind soffit on south-west corner and 1 from behind fascia on north side) between 35-50 mins after sunset.	1 Common Pipistrelle bat returned to roost in main house c. 15 mins before sunrise (exact egress location unseen). Between c. 55-30 mins before sunrise a total of 9 long-eared bats were seen repeatedly flying along the valley between main / rear roof and circling both chimneys. Bats were observed returning to roost via a ridge access tile, a gap under flashing close to the eastern chimney and a further location out of view in the roof valley.
AF2	No roosts identified.	1 Common Pipistrelle bat emerged from behind dense ivy on western gable wall at 8 mins after sunset.	2 GHS bats emerged via the hole in the roof approx. 70 mins before sunrise and headed south, past the farmhouse (presumed to be night roosting in barn).
AF3		No roosts identified.	No roosts identified.
AF4			
AF5			
AF6			
AF7			
AF8			
AF9			
AF10			

During the surveys, incidental activity recorded in and around Alston Farm was predominantly Common Pipistrelle bats foraging, commuting and social calling. Infrequent passes were also recorded for Soprano Pipistrelle, long-eared bat (presumed

to be the same bats recorded roosting within Building AF1), Serotine, Noctule, a Myotis bat, GHS and LHS bats. Key areas of activity included the track which runs through the centre of the group of buildings and the line of mature shrubs which form the western boundary of the farmhouse garden, both of which were also identified as commuting routes for GHS bats.

Alston Cottage

The emergence / re-entry surveys completed at Alston Cottage (comprising the main cottage and outbuildings) confirmed the presence of roosts for:

- individual / low numbers of long-eared bats (presumed to be Brown Long-eared) (non-breeding roost, maximum count 1 bat); and
- low numbers of Common Pipistrelle (non-breeding roost, maximum count of 3 bats).

Further details of the results of the building emergence / re-entry surveys are presented for each building within the Alston Cottage group in turn in Table 12 below.

Table 12: Summary of Key Findings from Dusk emergence / Dawn Re-entry Surveys at Alston Cottage

Building Reference	Dusk emergence survey 17/06/2014	Dusk emergence survey 14/08/2014
AC1	1 Common Pipistrelle was seen emerging from north-east gable soffit (approx. 1 m below apex on northern roof pitch) c. 20 mins after sunset.	2 Common Pipistrelle bats emerged from beneath the soffit at the apex of a dormer window on the front of the cottage (the first emerged 13mins after sunset, the second approx. 15 mins later). A third Common Pipistrelle bat emerged from behind the soffit on the north-east gable end (north corner) at 20 mins after sunset.
AC2	1 long-eared bat emerged from barn via end open doorway at c. 65 mins after sunset.	1 long-eared bat flew from the direction of the barn at c. 50mins after sunset and was presumed to have emerged.
AC3	No roosts identified	No roosts identified

During both surveys, general bat activity around the cottage / adjacent outbuildings was dominated by Common Pipistrelle bats feeding up and down the farm track, around mature trees on the boundary with Alston Farm and over the small donkey paddock to the rear of Alston Cottage. Other species were recorded as single / infrequent passes only and during the latter part of the surveys, and included records of Noctule, GHS (along the farm track as well as within the paddock to the north-west), a Myotis species and Barbastelle.

Trees

Emergence / re-entry surveys carried out at trees T1-T5 during September 2014 found no evidence of roosting bats to be present within any of the trees at the time of survey.

A summary of the incidental activity recorded is provided for each of the three survey locations in turn below:

- T1-T3 – incidental records included more or less constant foraging activity along the green lane by Common Pipistrelle with infrequent passes recorded for Soprano Pipistrelle, a Myotis bat and Serotine.

- T4 - early Common Pipistrelle bat activity was recorded within the garden of the farmhouse (from approximately 11 mins after sunset) and, based on the building emergence survey results, was most likely bats that had emerged from Building AF1. Other species recorded in this location as infrequent passes included Noctule and a Myotis bat.

- T5 – incidental bat activity included intermittent feeding by Common Pipistrelle along the hedges, and brief commuting passes for Noctule, Serotine, a long-eared bat and Soprano Pipistrelle.

3.1.4 Static Detector Surveys of Alston Farm Buildings

The automated detector surveys carried out within outbuildings at Alston Farm provided additional information regarding use of the farm buildings by roosting bats across the main active period for bats in 2014. A summary of records indicating roosting activity within the barns is given in Table 13 below and included on Figure 4.

Table 13: Summary of Key Findings from Static Detector Surveys of Alston Farm Buildings

Species	Key Findings	Interpretation of results
GHS	<u>Evidence Indicating Day roosts:</u> - Early and constant GHS calls were recorded within AF2 (first floor) during deployment on 28/05/2014, 29/05/14 and 31/05/14. Calls were recorded from or just before sunrise on each night and again for several hours after sunrise. <u>Evidence Indicating Night roosts:</u> - Constant or frequent GHS passes were recorded during the middle of the night within AF2 (upper floor) on the nights of 28/05/14-31/05/14, 29/07/14-05/08/14; - Intermittent GHS passes were recorded during the middle of the night within AF2 (lower floor) on the	GHS day roost within Building AF2 (upper floor). GHS night roosts / temporary rest sites within Buildings AF2 (upper and lower floors), AF3 (predominantly lower floor), AF4 (upper floor), AF8 and AF9.

Species	Key Findings	Interpretation of results
	nights of 22/07/14, 24/07/14, 26/07/14, 27/07/14 and 28/07/14; - Intermittent GHS passes were recorded in AF3 (lower floor on 30/07/14 and between 01/08/14 and 03/08/14; - Intermittent GHS passes were recorded in the middle of the night over 8 consecutive nights within AF4 (upper floor) between 28/05/14 and 08/06/14; - Occasional GHS passes were recorded at the doorway between AF8 & AF9 during 30/05/14 over a c2.5 hr period; - Intermittent passes were recorded over a c. 10 min period in the middle of the night within AF9 on 29/06/2014.	
LHS	<u>Evidence Indicating Day roosts:</u> - Constant LHS activity was recorded within AF2 (first floor) on 28/05/14 from 1 minute before sunset until c. 4 hrs after sunrise. - Early LHS passes were recorded within AF3 (first floor) on 7 consecutive nights between 26/09/14 and 02/10/14 (on each night activity commenced just before or within 20 mins of sunset). - Early and frequent LHS passes were recorded in the ground floor room of AF4 over 10 consecutive nights between 26/09/2014 and 05/10/2014. On each night activity commenced between c. 30 mins before and 20 mins after sunset. - Several early records of LHS activity were made during deployment in the ground floor room of AF5 on 25/08/2014 and 29/08/14 (intermittent passes from 3 mins after sunset). - During collection of detectors, an incidental record was made on 14/10/14 of a single adult LHS bat (torpid) seen hanging from floor joist on lower floor. <u>Evidence Indicating Night roosts:</u> - Brief / single LHS passes were recorded on the upper floor of AF2 throughout the middle of the night on 30/07/14, 31/07/14, 03/08/14, 04/08/14, 05/08/2014 and on the ground floor on the nights of 22/07/14, 25/07/14, 26/07/2014 and 28/07/14; - Brief / single LHS passes were recorded in the middle of the night on the ground floor of AF3 on the nights of 30/07/2014 and 01/08/2014; - Intermittent / frequent LHS activity was recorded throughout the night from c. 1 hour after sunset on the upper floor of AF4 between 28/05/14 - 02/06/2014 and 05/06/2014 and 08/06/2014; - Intermittent LHS activity was recorded within AF5 upper floor on the 28/06/14 and in AF5 lower floor on consecutive nights between 25/06/14 and 01/07/14	LHS day roosts within Buildings AF2 (upper floor), AF3 (upper floor), AF4 (lower floor), AF5 (lower floor). LHS night roosts / temporary rest sites within Buildings AF2 (upper and lower floors), AF3 (lower floor), AF4 (upper floor), AF5 (upper and lower floors) and AF8.

Species	Key Findings	Interpretation of results
	and on 25/08/2014, 26/08/2014, 28/08/2014, 29/08/2014 and 01/09/2014. - Brief LHS activity was recorded during the night-time within AF8 on 30/05/2014 and 02/06/2014.	
Myotis – probable Natterer's	<u>Evidence Indicating Day roosts:</u> - Early Myotis calls were recorded within AF5 (upper floor) over four consecutive nights between 27/06/14 and 30/06/14. Each night activity commenced between c.10mins before and after sunset and typically ended c. 45-50mins after sunset when the bat(s) was presumed to have emerged. On analysis, the call was considered to show characteristics (slope parameters in particular) of Natterer's bat.	Probable Natterer's roost within AF5 (upper floor).

It should be noted that due to numerous internal doorways / openings, it is highly likely that several different night / day-roosting locations are used by GHS and LHS bats at Alston Farm and that bats make use of the whole complex of buildings, regularly moving between different roosting sites throughout the night as well as possibly during the daytime.

Other bat activity recorded by the automated detectors within the farm buildings was considered to be from bats flying outside (based on weak / faint calls), or bats flying through, rather than roosting within the barns (based on call times and brevity). This included occasional passes of Noctule, Serotine, Common Pipistrelle, Soprano Pipistrelle and long-eared bat.

3.2 ACTIVITY SURVEYS

3.2.1 Summary

The combined results of the manual and automated activity surveys confirmed that at least 10 different bat species / species groups use the Site for commuting and / or foraging activity. A summary for each is provided below (with reference to relative frequencies defined in section 2.4):

- **Common Pipistrelle** - very frequent and widespread within the Site. Focussed foraging activity along hedges / lanes / woodland edge in the north-east, north-west and around Alston Farm & Alston Cottage;
- **Noctule** - frequent and widespread within the Site. Foraging records concentrated in the south-west corner over turf fields / hedges and hedgerow network due east of Alston Farm;

- **Myotis bats** – frequent and widespread within the Site. Foraging activity was concentrated in the east, particularly along hedges surrounding cattle-grazed pasture close to Alston Farm. Where call characteristics were apparent (e.g. call shape, slope and / or bandwidth), identification to species level was attempted and based on this, it is considered likely that the Myotis bat assemblage using the site includes (as a minimum) Natterer's, Whiskered and Daubenton's bat.;

- **Barbastelle** - regular, with records widely distributed with most activity recorded in September. Concentrated foraging activity recorded along hedge / access track to the west of Alston Cottage and in north-east corner;

- **Soprano Pipistrelle** – regular and present across the Site with concentrations of records from the network of hedges to the east of Alston Farm;

- **Long-eared Bat** – infrequent and scattered records from across the Site (but likely under-recorded due to their quiet echolocation);

- **Serotine –** very infrequent with sparsely distributed across the Site, including low-level foraging activity along the edge of Alston wood and along hedges in the north-west.

- **Nathusius' Pipistrelle** – very infrequent and sparsely distributed with main activity in September – October.

- **GHS** – frequent but unevenly distributed with concentrated activity in the northern half of the Site, especially the north-east corner. Results and observations suggest that foraging activity across the Site is limited, with the exception of the north-eastern corner. Present throughout the active period, with a significant peak in activity recorded during May.

- **LHS** – regular but unevenly distributed with concentrated activity in the northern half of the Site, especially along the north-east and north-west boundaries where foraging was observed / presumed. Present throughout the active period, with a slight peak in activity during June.

Taking into account the combined results for all bat species, key habitats for commuting and foraging bats include:

- Corridor of hedges formed by the north-west boundary and green-lane connecting Alston Lane to Alston Wood / Alston Farm;
- Edge of Alston Wood and contiguous hedges forming north-east Site boundary;
- Hedges surrounding cattle-grazed pasture / meadows to the east of Alston Farm, including the green lane connecting to Caton Lane; and

- Existing farm access track.

Unconfirmed evidence of likely nearby roosts within the surrounding area was also gathered during the activity surveys (from early / late records obtained during the activity surveys). In addition to those species confirmed roosting within the Site, the activity survey results also strongly indicate the presence of nearby roosts for Myotis bats, Soprano Pipistrelle, Noctule and Barbastelle. Furthermore, for those species confirmed roosting within the Site, evidence to suggest additional roost sites was obtained for LHS, GHS and Common Pipistrelle bats.

3.2.2 Manual Transect Surveys

At least nine different bat species were recorded during the walked transect surveys. The confirmed species or / species groups include:

- Common pipistrelle;
- Soprano pipistrelle;
- Myotis spp;
- Noctule;
- Serotine;
- Greater Horseshoe bat;
- Lesser Horseshoe bat;
- Barbastelle;
- a long-eared bat.

In addition to the species / species groups which were positively identified, a number of intermediate calls were recorded during the manual transect surveys and, with reference to the call parameters set out within section 2.3.2, were assigned to one of the following over-lapping species groups:

- Common / Nathusius' Pipistrelle
- Common / Soprano Pipistrelle
- a long-eared / Myotis bat

The calls recorded during each of the 10 manual transect surveys completed at the Site are summarised in Table 14 below. Locations of bats encountered during these surveys are shown on Figures 5a-5f, these figures display all calls recorded during the manual activity transects compiled for both transect routes and from all survey visits.

Table 14: Bat Species Recorded (No. of Soundfiles) during each Walked Transect Survey

Transect No./ Date	Transect Route	Barbastelle	Serotine	Myotis spp.	Noctule	Common / Nathusius' Pipistrelle	Common / Soprano Pipistrelle	Long-eared / Myotis	Long-eared bat	Common Pipistrelle	Soprano Pipistrelle	GHS	LHS	Grand Total
1 29/04/14	1			3			3		1	19		2	1	29
	2									11		1		12
	Total			**3**			**3**		**1**	**30**		**3**	**1**	**41**
2 25/05/14	1						4			31		7	6	48
	2				27					11		1		39
	Total				**27**		**4**			**42**		**8**	**6**	**87**
3 10/06/14	1			6			5			68			5	84
	2			1					1	30	2			34
	Total			**7**			**5**		**1**	**98**	**2**		**5**	**118**
4 27/05/14	1			6	1		2		1	73	6			89
	2				1					11				12
	Total			**6**	**2**		**2**		**1**	**84**	**6**			**101**
5 23/07/14	1			1	3		3			65	1	1	3	77
	2		1	2	14	1	1		5	31	3			58
	Total		**1**	**3**	**17**	**1**	**4**		**5**	**96**	**4**	**1**	**3**	**135**
6 08/08/14	1			7	1	1	8			77	1	4	4	103
	2		1	1	12		4			127	2			147
	Total		**1**	**8**	**13**	**1**	**12**			**204**	**3**	**4**	**4**	**250**
7 20/08/14	1	2			3					39		5		49
	2			4			1		1	16				22
	Total	**2**		**4**	**3**		**1**		**1**	**55**		**5**		**71**
8 02/09/14	1	9	34	9	3		18		1	90	9		3	176
	2	2		17	5		10	3	1	102	15		1	156
	Total	**11**	**34**	**26**	**8**		**28**	**3**	**2**	**192**	**24**		**4**	**332**
9 24/09/14	1	2	2	7	8		2			37	6	1	2	67
	2	4		5	48		8		3	11	2	4		85
	Total	**6**	**2**	**12**	**56**		**10**		**3**	**48**	**8**	**5**	**2**	**152**
10 14/10/14	1			1	38		3			32	2		1	77
	2			13	41	4	10			78	9			155
	Total			**14**	**79**	**4**	**13**			**110**	**11**		**1**	**232**
Grand Total		**19**	**38**	**83**	**205**	**6**	**82**	**3**	**14**	**959**	**58**	**26**	**26**	**1519**
% of Total		**1.3**	**2.5**	**5.5**	**13.5**	**0.4**	**5.4**	**0.2**	**0.9**	**63.1**	**3.8**	**1.7**	**1.7**	

The following section summaries bat activity recorded during the manual transect surveys for each species / species group in turn:

Pipistrelle Bat Species

Collectively, pipistrelle bats (Common, Soprano and intermediate calls) accounted for 73% of all bat activity recorded on Site during the transect surveys.

Common Pipistrelle was the most frequently encountered species of bat overall, accounting for 63% of the total calls recorded. This species was regularly observed / heard commuting across the Site, foraging along hedgerows, tree-lines and over fields and along woodland edges forming the northern Site boundary. The distribution of records across the Site (as shown on Figure 5a) was widespread with no parts of the Site found to be unutilised by this species. Whilst the majority of records represented individual bats, concentrated foraging activity for groups of 4 or more Common Pipistrelle bats was regularly observed within cattle-grazed pasture and surrounding hedges immediately to the east of Alston Farm. Early Common Pipistrelle activity was recorded during Transect 2 on 20th August 2014 close to Caton Lane (first record was at 20 minutes after sunset) and again in a similar location on 14th October (first record was at 15 minutes after sunset) which falls within their typical emergence period. This would indicate that in addition to the Common Pipistrelle roosts identified at Alston Farm and Alston Cottage, it is likely that additional nearby roosts may also be present within properties bordering the east of the Site.

Compared to Common Pipistrelle, Soprano Pipistrelle activity levels were found to be much lower during the transect surveys, accounting for 3.8% of the overall number of sound files recorded. This species was again found to be using all areas within the Site (refer to Figure 5b), with concentrated foraging activity recorded in a similar location to that described above for Common Pipistrelle. The earliest Soprano Pipistrelle records made during the transect surveys were from c.25 minutes after sunset (recorded on a hedge to the south-east of Alston Farm during Transect 2 on 14th October 2014).

Intermediate Common / Soprano Pipistrelle calls accounted for 5.4% of the overall no. of sound files and the distribution of these records followed that of both Common and Soprano Pipistrelles. Intermediate Common / Nathusius' Pipistrelle calls were recorded much more infrequently during the surveys (total of 6 sound files, representing 0.4% of the overall activity).

Noctule

After Common Pipistrelle, Noctule bats were the next most frequently recorded species of bat during the transect surveys, accounting for 13.5% of the overall activity. As well as widespread records of Noctule commuting across the Site, foraging activity was observed in several locations which included the turf fields in the south-west of the Site (close to Alston Cross) as well as within cattle-grazed pasture to the south-east of Alston Farm and along the green lane (H12 / H13) in this location.

The earliest records of Noctule were made 21 minutes after sunset on 14th October 2014 along H11 / H12 in the north-east of the Site. Given that Noctule typically emerge early in the evening in daylight, approximately from sunset (Hundt, 2012), this would suggest that the Site is regularly used by bats that are roosting close by.

Myotis bats

Myotis bats were the next most frequently recorded bats during the transect surveys after pipistrelle bats and Noctule, accounting for 5.5% of the overall activity levels recorded. Records were frequent across the whole survey period and were widespread across the Site (refer to Figure 5d). The vast majority of records were for commuting bats, although occasional foraging activity was recorded, particularly along hedges to the south-east of Alston Farm.

During the transect surveys, several early Myotis species calls were recorded, including two records c. 30 minutes after sunset (a record of a bat seen commuting south-west along H19 close to Caton on 20th August and a further record on the green lane to the west of Alston Farm on 2nd September 2014). Given that this falls within the early part of the emergence period for this species group (typically between 30 and 70 minutes after sunset, (Hundt, 2012)) this would strongly indicate that one or more Myotis species may be roosting within / near to the Site.

Serotine

Serotine bats were recorded at a much lower frequency (a total of 38 soundfiles / 2.5% of the overall activity) and were only recorded during transect surveys completed between July - September. The majority of these records were made during Transect 1 on September 2nd 2014 when concentrated Serotine feeding / social calling was observed along a hedge in the west of the Site (H37) for several minutes (see Figure 5c). A Serotine was also observed foraging briefly during Transect 1 on September 24th 2014, where it was seen feeding along the edge of Alston wood and low over pasture in the north-east of the Site.

Based on the timings of the records (from 62 minutes after sunset), the records do not seem to suggest the presence of a nearby roost, given that this species typically emerges in the early evening, from approximately 15 minutes after sunset (Hundt, 2012).

Long-eared Bats

Long-eared bats (presumed to be Brown long-eared for the reasons previously stated within this report) accounted for just 0.9% of the total activity recorded during the transect surveys. Given their quiet echolocation however, this should not be treated as a reliable measure of their abundance within the Site. Records made were relatively widespread across the Site and were predominantly brief passes of bats seen / heard commuting along hedges, however foraging was also observed on a couple of occasions where a long-eared bat(s) was seen gleaning from the canopy of mature trees in hedges, including around T5 (refer to Figure 5d).

A number of early records of long-eared bats were recorded during the transect surveys (between 50-70 mins after sunset) from scattered locations. Brown long-eared bats

typically emerge during completely darkness, from one hour after sunset (Hundt, 2012) and these early records therefore strongly indicate the presence of a nearby roost (as corroborated by the findings of the roost surveys, refer to Section 3.1.2 above).

Barbastelle

A total of 19 sound files were identified as Barbastelle (equivalent to 1.3% of the total bat passes recorded during the transect surveys), with all records made during surveys completed between late-August & September 2014.

Records were made on both transects 1 & 2 and were fairly widespread across the Site (refer to Figure 5e) and were mostly brief passes of bats commuting across the Site. Foraging activity was however recorded in a couple of locations including along the green lane (H12 / H13) in the north-east of the Site, (Transect 1 on 20th August 2014) and along a hedge (H37) in the west of the Site (Transect 1 on September 2nd).

Barbastelle bats were recorded from 63 until 169 minutes after sunset indicating that this species may be roosting in the wider area as typical emergence times for this species are between 20 and 60 minutes after sunset (Hundt, 2012).

Lesser Horseshoe Bat

A total of 26 sound files were identified as LHS (1.7% of overall activity recorded during all of the transect surveys). Of these records, all but one were recorded along Transect 1 in the northern part of the Site, spread across all months between April – October (refer to Figure 5f).

The majority of records were brief passes and were of bats commuting across / within the Site, using hedges & woodland edges forming the northern boundary of the Site as well as the green lanes. Brief foraging activity was however recorded on two occasions along the same hedge in the north-west of the Site (H36) during transect surveys on 25th May and 10th June 2014. On both occasions bats were observed feeding up and down the hedge for a short period only (<1 minute).

Approximately half of the LHS calls recorded fell within the typical emergence period for this species (approximately 30-50 minutes after sunset, Hundt, 2012) which further corroborates the findings of the roost surveys which identified the presence of LHS roosts within the Site (at Alston Farm) and also immediately adjacent (at Lower Waye to the west - refer to *Linhay Hill Quarry: Waye Lane Bat Report*, Woodfield Ecology, March 2016 for further details). These early records included:

- During Transect 1 on 8th August 2014, three LHS bats were seen commuting north-east along H34 (north-western boundary) in close succession between 38-40 minutes after sunset and came from the direction of Lower Waye to the west where they were assumed to be roosting;

- A LHS pass recorded 30 minutes after sunset during Transect 1 on 2nd September 2014 along the green lane to the west of Alston Farm (H39a / H40a);
- A LHS bat was observed commuting north along H9 towards Alston Wood at 49 minutes after sunset during Transect 1 on 24th September 2014; and
- A LHS pass was recorded just 26 minutes after sunset during Transect 1 on 14th October along H12 (green lane) to the east of Alston Farm.

Greater Horseshoe Bat

As for LHS bats, a total of 26 sound files were identified as GHS (1.7% of overall activity recorded during all of the transect surveys), all of which were within the north and east of the Site (see Figure 5f) and the majority of which were recorded along Transect 1. Records were infrequent and spread across much of the survey period, although no records were made during either the June or October surveys.

Much like the LHS activity, records of GHS activity made during the transect surveys were primarily single / brief passes for bats commuting across the Site with key features being hedges and woodland edges forming the northern Site boundary and the two green-lanes.

Short periods of GHS foraging activity were recorded on a number of occasions, and given the short duration / low number of passes, were most likely bats 'feeding on the wing' as they commuted between roosting / feeding areas, as follows:

- During Transect 2 on 29th April 2014 a single GHS was observed foraging briefly (2 passes recorded) along H22 close to Caton;
- During Transect 1 on 20th August 2014 a GHS bats was seen foraging along a hedge (around a mature Oak standard) in the north-east of the Site for c. 30 seconds; and
- During Transect 2 on 24th September a GHS bat was recorded feeding for c. 2 minutes along H4 to the south-east of Alston Farm together with several other bat species (Common / Soprano Pipistrelle and Noctule).

Of the GHS records made during the transect surveys the vast majority were recorded between 60-180 minutes after sunset, with few records made during the typical emergence period for this species (approximately 25-50 minutes after sunset, Hundt, 2012), as follows:

- An individual GHS was seen commuting south-west along H16 in the north-east of the Site during Transect 1 on 20th August 2014 at 29 minutes after sunset (seen heading into the Site from the direction of Caton Lane, which could indicate proximity to an off-site roost to the north-east of the Site); and

- The aforementioned brief foraging activity along H4 during Transect 1 on 24th September was recorded between 42-44 minutes after sunset.

In addition to these early records which would indicate proximity to day-roosting sites, a GHS bat was seen commuting past Alston Farmhouse, heading north towards the group of old two-storey barns (AF2-5) during Transect 1 on 24th September at c. 180 minutes after sunset, where it may have been night-roosting.

3.2.3 Automated Detector Surveys – Vesper Bats

A total of 10,475 passes of Vesper bat species were recorded across the six static locations selected for sampling over the recording period between May – October 2014 and April 2015 (a total of 2054 recording hours over 210 recording nights). The results of this analysis confirmed the presence of the following eight species / species groups:

- Common Pipistrelle;
- Soprano Pipistrelle;
- Nathusius' Pipistrelle;
- Myotis spp;
- Noctule;
- Serotine;
- Barbastelle;
- a Long-eared bat.

In addition to the above, a number of intermediate calls were recorded during the automated detector surveys and, with reference to the call parameters set out within section 2.3.2, were assigned to one of the following over-lapping species groups:

- Common / Nathusius' Pipistrelle
- Common / Soprano Pipistrelle
- a Long-eared / Myotis bat

The bat data recorded during the static monitoring periods for each month are summarised in Table 15 below, with activity shown as an index (bat passes per hour) to allow direct comparison across different recording periods.

To assess the time distribution of bat passes recorded during each recording night, the night-time recording period was split into 13 time periods, according to time after sunset (SS) or prior to sunrise (SR), with summary data presented in Table 16 below.

Table 15: Mean No. of Bat Passes per Hour (b/hr) Recorded during Automated Survey - Vesper Bats Only, Sample Data from Selected Nights / Locations

Month	Static Location	Barbastelle	Serotine	Myotis spp.	Noctule	Common / Nathusius' Pipistrelle	Common / Soprano Pipistrelle	Long-eared / Myotis	Long-eared bat	Nathusius's Pipistrelle	Common Pipistrelle	Soprano Pipistrelle	Mean b/hr (all Vesper bats)
April 2015	1	0.000	0.000	0.114	0.171	0.076	0.000	0.019	0.000	0.000	0.702	0.019	**0.098**
	4	0.000	0.000	0.038	0.114	0.000	0.000	0.000	0.019	0.000	0.398	0.095	**0.057**
	5	0.000	0.000	0.000	0.000	0.000	0.019	0.000	0.000	0.000	0.171	0.000	**0.019**
	7	0.000	0.000	0.296	0.119	0.000	0.000	0.000	0.000	0.000	1.107	0.000	**0.169**
	8	0.000	0.020	0.810	0.158	0.000	0.079	0.000	0.000	0.000	2.984	0.573	**0.407**
	9	0.020	0.000	0.237	0.672	0.119	0.079	0.000	0.000	0.000	4.012	0.000	**0.572**
May 2014	1	0.000	0.023	0.069	0.391	0.023	0.000	0.000	0.000	0.000	1.357	0.000	**0.173**
	4	0.000	0.000	0.023	0.000	0.000	0.000	0.000	0.000	0.000	0.690	0.000	**0.071**
	5	0.000	0.000	0.023	0.000	0.000	0.000	0.000	0.000	0.000	0.138	0.000	**0.021**
	7	0.000	0.024	0.407	0.957	0.000	0.024	0.000	0.000	0.000	1.963	0.024	**0.376**
	8	0.024	0.048	0.670	0.383	0.000	0.096	0.000	0.000	0.000	8.233	1.460	**0.976**
	9	0.239	0.000	0.455	1.939	0.215	0.144	0.024	0.000	0.024	24.436	0.024	**2.599**
June 2014	1	0.185	0.079	0.211	0.845	0.238	0.106	0.079	0.264	0.000	2.193	0.053	**0.341**
	4	0.131	0.026	0.289	0.578	0.210	0.184	0.026	0.053	0.000	5.545	0.315	**0.649**
	5	0.079	0.053	0.053	0.026	0.000	0.026	0.026	0.000	0.000	0.552	0.000	**0.091**
	7	0.106	0.000	0.954	0.159	0.027	0.186	0.000	0.000	0.000	1.114	0.000	**0.235**
	8	0.345	0.000	1.697	0.186	0.000	0.080	0.053	0.000	0.000	4.985	0.504	**0.700**
	9	0.186	0.000	0.212	0.530	0.053	0.080	0.000	0.159	0.000	6.920	0.027	**0.765**
July 2014	1	0.048	0.000	0.694	4.739	0.024	0.096	0.144	0.455	0.000	8.520	0.215	**0.048**
	4	1.122	0.000	0.178	0.484	0.000	0.102	0.127	0.204	0.000	1.963	0.178	**1.122**
	5	0.408	0.051	0.025	0.535	0.000	0.025	0.025	0.000	0.000	1.555	0.051	**0.408**
	7	0.025	0.000	0.124	0.545	0.025	0.099	0.000	0.025	0.000	1.610	0.050	**0.025**
	8	0.149	0.000	0.867	0.595	0.198	0.000	0.000	0.050	0.000	5.202	0.273	**0.149**
	9	0.173	0.000	0.297	1.189	0.099	0.099	0.099	0.025	0.000	8.076	0.025	**0.173**

Month	Static Location	Barbastelle	Serotine	Myotis spp.	Noctule	Common / Nathusius' Pipistrelle	Common / Soprano Pipistrelle	Long-eared / Myotis	Long-eared bat	Nathusius's Pipistrelle	Common Pipistrelle	Soprano Pipistrelle	Mean b/hr (all Vesper bats)
August 2014	1	0.490	0.000	0.216	1.275	0.000	0.098	0.059	0.039	0.000	2.098	0.039	**0.336**
	4	0.330	0.000	1.385	0.110	0.022	2.857	0.066	0.044	0.000	6.242	0.044	**0.883**
	5	0.242	0.000	0.132	0.220	0.000	0.066	0.022	0.000	0.000	1.055	0.044	**0.152**
	7	0.211	0.000	1.391	2.003	0.000	0.527	0.000	0.000	0.000	1.033	0.042	**0.427**
	8	0.084	0.000	0.295	0.527	0.000	0.000	0.021	0.021	0.000	5.039	0.295	**0.522**
	9	0.738	0.000	0.843	1.307	0.000	0.190	0.063	0.042	0.000	6.261	0.084	**0.981**
September 2014	1	0.162	0.000	0.899	2.283	0.054	0.144	0.180	0.144	0.108	3.919	0.126	**0.643**
	4	1.532	0.050	0.850	0.233	0.000	0.566	0.083	0.117	0.000	5.730	0.416	**0.761**
	5	0.094	0.019	0.299	0.655	0.019	0.056	0.075	0.094	0.000	2.751	0.206	**0.364**
	7	0.657	0.000	0.605	0.744	0.000	0.017	0.035	0.017	0.017	1.263	0.069	**0.293**
	8	1.376	0.000	1.118	1.669	0.017	0.344	0.069	0.052	0.000	8.635	0.843	**1.130**
	9	1.712	0.000	0.848	2.283	0.035	0.277	0.086	0.086	0.017	3.044	0.346	**0.796**
October 2014	1	0.000	0.000	0.401	1.017	0.000	0.031	0.139	0.031	0.015	1.017	0.092	**0.231**
	4	0.206	0.000	0.428	0.159	0.000	0.159	0.048	0.000	0.000	1.078	0.032	**0.167**
	5	0.000	0.000	0.223	0.287	0.000	0.032	0.000	0.016	0.016	0.876	0.398	**0.159**
	7	0.015	0.000	0.045	0.357	0.000	0.015	0.015	0.000	0.000	0.134	0.000	**0.047**
	8	0.000	0.000	0.000	0.060	0.000	0.000	0.000	0.000	0.000	0.119	0.015	**0.021**
	9	0.015	0.000	0.015	0.000	0.000	0.000	0.000	0.000	0.000	0.030	0.000	**0.017**
April – October 2014 (all months combined)	1	0.126	0.015	0.372	1.532	0.059	0.068	0.088	0.133	0.018	2.829	0.079	**0.427**
	4	0.475	0.011	0.456	0.240	0.033	0.553	0.050	0.062	0.000	3.092	0.154	**0.432**
	5	0.117	0.017	0.108	0.246	0.003	0.032	0.021	0.016	0.002	1.014	0.100	**0.150**
	7	0.145	0.003	0.546	0.698	0.007	0.124	0.007	0.006	0.002	1.175	0.026	**0.254**
	8	0.283	0.010	0.780	0.511	0.031	0.085	0.020	0.017	0.000	5.028	0.566	**0.623**
	9	0.440	0.000	0.415	1.131	0.074	0.124	0.039	0.045	0.006	7.540	0.072	**0.956**
Mean b/hr (all months & locations)		**0.275**	**0.008**	**0.438**	**0.715**	**0.030**	**0.161**	**0.038**	**0.043**	**0.005**	**3.220**	**0.166**	**0.450**
% of overall activity (all months & locations)		**5.39%**	**0.16%**	**8.59%**	**14.02%**	**0.59%**	**3.16%**	**0.75%**	**0.85%**	**0.11%**	**63.12%**	**3.25%**	

Table 16: Bat Activity Recorded during Night Time Periods - Vesper Bats Only, Sample Data from Selected Nights / Locations

	0-20 mins after SS		21-40 mins after SS		41-60 mins after SS		61-80 mins after SS		81-100 mins after SS		101-120 mins after SS		Middle of the Night (121 mins after SS – 121 before SR)		120-101 mins before SR		100-81 mins before SR		80-61 mins before SR		60-41 mins before SR		40-21 mins before SR		0-20 mins before SR	
Species	**n**	***%***	**n**	***%***	**n**	***%***	**n**	***%***	**n**	***%***	**n**	***%***	**n**	***%***	**n**	***%***	**n**	***%***	**n**	***%***	**n**	***%***	**n**	***%***	**n**	***%***
Barbastelle	0	*0.00*	0	*0.00*	35	*6.20*	31	*5.50*	44	*7.80*	56	*9.90*	346	*61.20*	30	*5.30*	19	*3.40*	4	*0.70*	0	*0.00*	0	*0.00*	0	*0.00*
Serotine	0	*0.00*	0	*0.00*	2	*11.80*	0	*0.00*	0	*0.00*	3	*17.60*	11	*64.70*	0	*0.00*	1	*5.90*	0	*0.00*	0	*0.00*	0	*0.00*	0	*0.00*
Myotis sp.	0	*0.00*	18	*2.00*	52	*5.80*	44	*4.90*	41	*4.60*	35	*3.90*	605	*67.20*	15	*1.70*	18	*2.00*	36	*4.00*	33	*3.70*	2	*0.20*	1	*0.10*
Noctule	38	*0.03*	138	*9.40*	175	*11.90*	119	*8.10*	77	*5.20*	59	*4.00*	691	*47.00*	34	*2.30*	24	*1.60*	39	*2.70*	43	*2.90*	28	*1.90*	4	*0.30*
Common / Nathusius' Pipistrelle	0	*0.00*	1	*1.60*	5	*8.10*	10	*16.10*	6	*9.70*	9	*14.50*	26	*41.90*	0	*0.00*	0	*0.00*	3	*4.80*	1	*1.60*	1	*1.60*	0	*0.00*
Common / Soprano Pipistrelle	0	*0.00*	21	*6.30*	15	*4.50*	13	*3.90*	9	*2.70*	12	*3.60*	222	*67.10*	6	*1.80*	13	*3.90*	8	*2.40*	4	*1.20*	6	*1.80*	2	*0.60*
Long-eared / Myotis bat	0	*0.00*	3	*3.80*	4	*5.10*	6	*7.60*	5	*6.30*	3	*3.80*	47	*59.50*	0	*0.00*	4	*5.10*	3	*3.80*	4	*5.10*	0	*0.00*	0	*0.00*
Long-eared bat	0	*0.00*	0	*0.00*	5	*5.60*	3	*3.40*	3	*3.40*	3	*3.40*	63	*70.80*	2	*2.20*	1	*1.10*	3	*3.40*	6	*6.70*	0	*0.00*	0	*0.00*
Nathusius's Pipistrelle	0	*0.00*	1	*9.10*	0	*0.00*	0	*0.00*	0	*0.00*	1	*9.10*	9	*81.80*	0	*0.00*	0	*0.00*	0	*0.00*	0	*0.00*	0	*0.00*	0	*0.00*
Common Pipistrelle	9	*<0.01*	233	*3.50*	504	*7.60*	558	*8.40*	404	*6.10*	293	*4.40*	3243	*49.00*	250	*3.80*	288	*4.40*	407	*6.20*	294	*4.40*	80	*1.20*	49	*0.70*
Soprano Pipistrelle	0	*0.00*	27	*7.90*	36	*10.60*	20	*5.90*	10	*2.90*	6	*1.80*	201	*59.10*	15	*4.40*	5	*1.50*	3	*0.90*	8	*2.40*	5	*1.50*	4	*1.20*
All Vesper Bats Combined	**47**	***0.00***	**494**	***1.10***	**981**	***6.00***	**957**	***13.10***	**705**	***8.60***	**552**	***6.30***	**6139**	***42.40***	**396**	***3.80***	**468**	***7.80***	**600**	***5.40***	**465**	***3.60***	**137**	***1.40***	**65**	***0.60***

Pipistrelle Bat Species

As with the transect survey findings, the automated detector survey data found that Common Pipistrelle was the most frequent species (based on number of passes) within the Site, accounting for 63.12% of the overall activity (or a mean of 3.22 b/hr). Activity levels did however vary between the different locations, as shown on Figure 6a, as well as between months as demonstrated by the results for Static 9 which recorded both the peak number of passes in May (24.4 b/hr) as well as the lowest number recorded of all locations in October (0.03 b/hr). From the analysis shown in Table 16 it can be concluded that the Site is well-used by Common Pipistrelle bats throughout the whole night. The vast majority of records fell outside the typical emergence / return to roost periods, although several early records (0-20 mins after sunset) were recorded at Statics 4, 7, 8 and 9 (the latter two locations also recording late activity between 0-20 mins before sunrise) indicating close proximity to a roost(s).

Soprano Pipistrelle passes were once again far less numerous than Common Pipistrelle, and when totalled for all static locations / months, equated to just 3.25% of the overall activity. Although this species was recorded occasionally at each of the 6 static locations (see Figure 6b), the highest number of records was recorded at Static 8 during May (1.46 b/hr). As shown in Table 16, a number of late Soprano Pipistrelle passes were recorded within the period 0-20 minutes before sunrise (total of 4 passes all recorded from Static 8) which would indicate proximity to a roost. However, the vast majority of records were made during the middle of the night.

A total of 11 Nathusius' Pipistrelle passes were also recorded during the automated detector survey from four of the static locations (Statics 1, 5, 7 and 9), accounting for 0.11% of the overall Vesper bat activity. The majority of activity was recorded towards the end of the survey period, during September (peak activity was 0.11 b/hr recorded at Static 1 in September) and during October, although low levels of activity were also recorded in May at Static 9. The earliest record of a Nathusius' Pipistrelle bat was recorded from Static 1 in September at 38 minutes after sunset, with no other early or late passes recorded during the monitoring period.

Noctule

The automated detector survey results supported the findings from the transect surveys with regards high levels of Noctule activity within the Site, with total passes accounting for 14.02% of the overall activity recorded (or a mean 0.72 b/hr).

Noctule passes were occasional / frequent across each of the 6 sampled static locations, although based on the mean number of b/hr for all months combined, the highest activity was recorded at static locations 1 and 9 (1.5 b/hr and 1.1 b/hr respectively). This reflects

the findings of the transect surveys where low numbers of Noctule bats were seen feeding over the turf fields and along the A38 corridor.

Noctule activity was recorded across each of the night-time periods as shown in Table 16. A total of 38 Noctule passes were recorded between 0-20 minutes after sunset, predominantly from Static 9 during September, although other early records were made at each of the six sampled locations across the monitoring period (possibly the same bat(s) given that this species tends to fly at height and can cover large distances in a short space of time.

Serotine

Low levels of Serotine activity were recorded during the automated detector surveys with the total number of passes (for all locations) accounting for just 0.16% of the overall activity (equivalent to 0.008 b/hr).

Serotine activity appeared to be slightly higher (albeit still a low numbers of passes) in the western part of the Site (recorded by static locations 1, 4 and 5), with the highest overall mean (for all months combined) recorded at Static 5 (0.017 b/hr). No Serotine activity was recorded at Static 9 on the north-east Site boundary across the whole survey period.

Similar to the transect survey results; no early or late Serotine activity was recorded during the automated detector surveys (earliest serotine pass was recorded 48 mins after sunset at static 4) and the majority of passes were recorded during the middle of the night.

Myotis bats

Following a similar overall trend to the results obtained during the transect surveys, Myotis bats were found to be the third most abundant species group after Common Pipistrelle and Noctule bats, accounting for 8.59% of activity recorded by the automated detector survey (an overall mean of 0.44 b/hr).

Although this species group was recorded from each of the six sampled locations, the highest levels of Myotis activity were recorded at Static 8 (overall mean of 0.78 b/hr) which also tallies with the concentration of Myotis records obtained for fields to the south-east of Alston Farm during the transect survey results.

Analysis of the Myotis activity levels across the different night-time periods found that the majority (67%) of passes recorded during the middle of the night. No activity was recorded within the first 20 minutes after sunset; however 18 passes (2% of the activity) were recorded between 21-40 minutes (predominantly from Static 7 and 9 in the east of the Site) which coincides with the typical emergence period for several Myotis species. In addition a single late Myotis pass was recorded at Static 8 (16 minutes before sunrise).

Collectively these results indicate likely proximity to roosts for low numbers of Myotis bats.

Long-eared Bats

Long-eared bats (presumed to be Brown long-eared for the reasons previously stated) accounted for just 0.85% of the total activity recorded during the automated detector surveys (equivalent to 0.043 b/hr), excluding indeterminate calls with over-lapping parameters identified as Long-eared / Myotis. The quiet echolocation of the Brown long-eared bat is also likely to have meant some passes went undetected, and these activity levels should therefore be considered a conservative assessment of their frequency.

Whilst long-eared bat passes were recorded at all six locations, activity was highest at Static 1, where a mean of 0.13 b/hr was recorded across the whole survey period. Although the vast majority (71%) of long-eared bat calls were recorded during the middle of the night period, 6% of the activity (5 passes) fell within the peak emergence period for this species (41-60 minutes after sunset). These early records were from scattered across the Site (Statics 1, 4 and 8) and showed no clear distribution pattern.

Barbastelle

Barbastelle calls accounted for 5.39% of the overall activity (0.275 b/hr) recorded during the automated detector survey across the six sampled static locations. Passes were widely distributed and recorded at each of the six sampled static locations, although the highest mean b/hr were recorded at Static 9 and Static 4 (0.44 b/hr and 0.48 b/hr respectively), followed by Static 8 (0.28 b/hr). Statics positioned along the western Site boundary, adjacent to Alston Lane (Statics 1 and 5) recorded the lowest activity levels for this species overall.

Whilst this species was recorded during each month across the survey period with variable frequencies, activity levels peaked at four out of the six locations during September, suggesting that the Site is of greater value to this species outside of the peak maternity period.

With regards the distribution of records across the night-time period, whilst the majority of passes were recorded during the middle of the night, 35 passes (6.2%) were recorded from 41-60 minutes after sunset, which, similar to the findings from the transect surveys, may indicate that this species is roosting in the vicinity of the Site. There was however no clear distribution pattern detected with these early records which were predominantly recorded at static locations 4, 8 and 9 and were mainly during September.

3.2.4 Automated Detector Surveys – Horseshoe Bats

Across the whole monitoring period, a total of 602 recording nights, or 6074.2 hours of data from the ten static locations were analysed with regards horseshoe bat activity. A summary of the GHS and LHS bat data recorded during the 2014-2015 monitoring period is presented below and shown on Figure 6c.

Greater Horseshoe Bat

A total of 2482 GHS bat passes were recorded from all of the static locations across the monitoring period, which is equivalent to a mean of 0.41 B/h for the Site as a whole.

GHS passes were recorded across each of the 10 static detector locations, indicating that all parts of the survey area are used to varying degrees by this species across the active period. Levels of GHS activity were not however consistent across the Site, as indicated by Table 17 and Chart 1 below as well as Figure 6c.

Table 17: GHS Bat Passes Recorded per Location in 2014-2015 Monitoring Period

Static Detector Location	No. of Recording Nights	No. of Recording Hours	Total No. of Passes	Bats per night (B/n)	Bats per hours (B/h)	% of overall GHS activity (B/hr)
1	60	579.7	86	1.43	0.148	**4%**
2	60	604.5	236	3.93	0.390	**9%**
3	60	591.1	105	1.75	0.178	**4%**
4	58	584.5	209	3.60	0.358	**8%**
5	66	673.6	84	1.27	0.125	**3%**
6	58	589.8	355	6.12	0.602	**14%**
7	63	641.8	182	2.89	0.284	**7%**
8	62	627.4	297	4.79	0.473	**11%**
9	57	555.7	762	13.37	1.371	**32%**
10	58	558.9	166	2.86	0.297	**7%**
	Total: 602	**Total: 6074.2**	**Total: 2482**	**Mean: 4.12**	**Mean 0.41**	

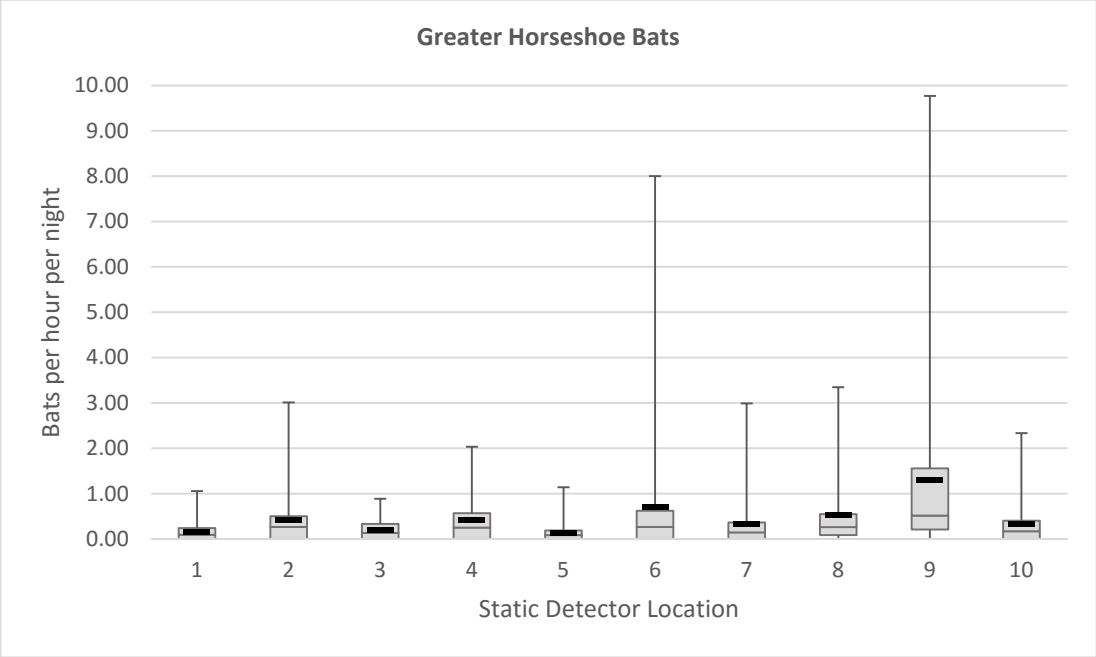
Static 9, which was positioned along the north-eastern Site boundary, recorded the highest GHS activity across the monitoring period, with an overall mean of 1.37 b/hr, equivalent to 32% of all GHS activity recorded across the 10 static locations. This was significantly higher ($p=<0.05$[5]) than activity levels recorded at each of the remaining nine locations, with the exceptions of Static 6 and 8 which showed the next highest GHS

[5] Anderson-Darling test for normality identified the data to be not normally distributed, therefore the non-parametric Kruskal-Wallis analysis with post-hoc testing was utilised to detect differences. All following quoted p values relate to the same method of analysis.

activity levels at 0.6b/hr (14%) and 0.47b/hr (11%) respectively. All three of these static locations were in the northern half of the Site, which mirrors the key findings for this species obtained during the manual transect surveys.

The lowest GHS activity was recorded at Static 5 in the west of the Site (adjacent to Alston Lane), with a mean activity index of just 0.13 b/hr across all months. Statics 1 and 3 also recorded comparatively low levels of activity, both of which are also located in the south-western half of the Site.

Chart 1: Comparison of GHS Bat Activity Index (b/hr) Across Static Detector Locations



The automated detector survey also identified seasonal variation in the use of the Site by GHS bats as shown in Chart 2 below. Activity levels peaked during May 2014, with a mean of 1.24b/hr recorded across the 10 static locations, significantly higher (p=<0.05) than all other months. Activity levels then fell to a much lower level for the rest of the active period (albeit with a smaller peak recorded in July) before falling to just 0.18b/hr in October.

Although it is not possible to be certain whether GHS passes recorded were from bats commuting or foraging within the Site, assuming some of the activity was attributable to foraging activity, it would appear that the Site is more important to GHS bats in spring rather than during mid / late summer. This distinction is of importance as mid-late summer is when one of their most important prey items (the dung beetle *Aphodius rufipes*) is typically most abundant (early August) and when young GHS bats begin their first feeding flights (English Nature, 2000). This peak of activity in May, with significantly

lower levels in August suggests that the Site is unlikely to form part of a key foraging area for a nearby (unidentified) maternity roost.

Chart 2: GHS Activity (b/hr) Recorded Each Month across all 10 Locations (April 2015, May – October 2014)

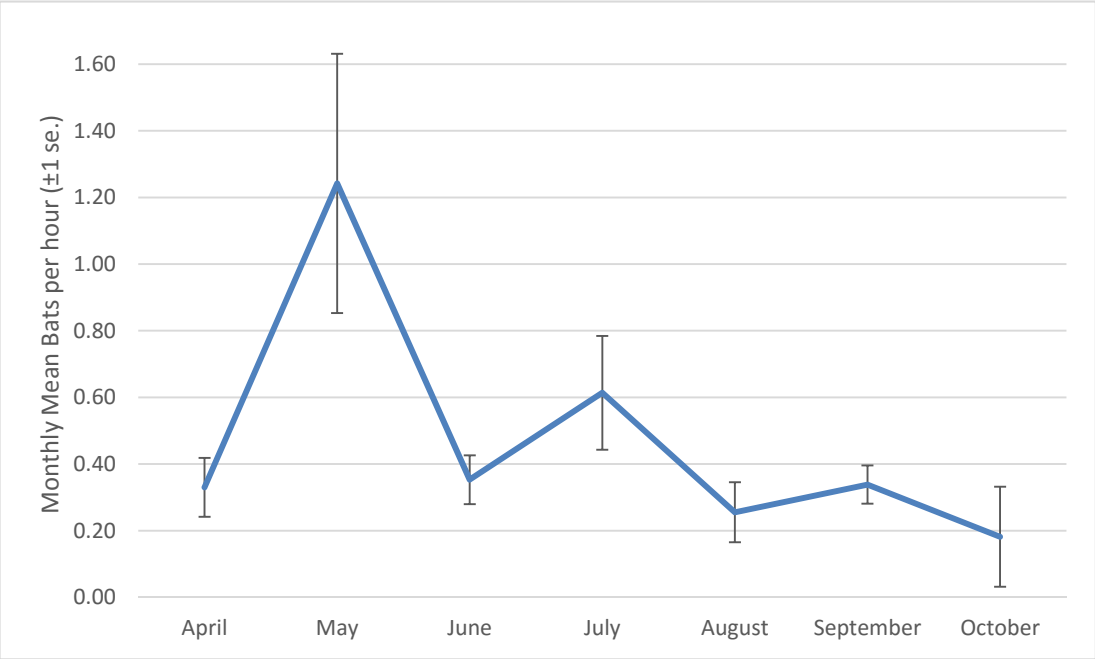


Table 18 below shows the timings of GHS passes recorded throughout the night as b/hr. The highest frequencies of GHS passes (as a mean for all locations) were recorded between 21-120 minutes after sunset. Activity then steadily decreased on average over the remainder of the night-time.

This analysis also highlights that in several static locations, early and late records were recorded (between 21-40 minutes after sunset and between 40 minutes and sunrise respectively), as follows:

- Static 2: Several passes were recorded in close succession within 10 minutes of sunrise on 12th June (2 passes), 14th June (4 passes) and 16th June (2 passes). In addition, two early records (between 21-40 minutes after sunset) were recorded on two separate evenings during September (8th & 13th). These early / late records strongly suggest that there is an occasional summer roost site located within a neighbouring property to the east in Caton;

- Static 3: A single late record (23 minutes before sunrise) was recorded on 16th May. Two early passes were recorded on 10th & 15th October at 35 and 39 minutes after sunset respectively, and given the location, it is possible that these were bat(s) roosting at Alston Farm;

- Static 5: A single early pass was recorded at 33 minutes after sunset on 14th July and it is possible that this bat may have emerged from Lower Waye or Waye to the west;

- Static 6: Two early passes were recorded on 23rd September in close succession at 31 minutes after sunset and again, may have been bats emerging from outbuildings at Alston Farm;

- Static 8: Between 17th and 24th May 2014, 40 GHS passes were recorded within 40 minutes of sunrise, including 6 passes recorded within 10 minutes of sunrise. These records were most likely for a bat(s) retuning to roost in outbuildings at Alston Farm given the timings, as reinforced by findings made during the automated detector surveys, which confirmed the presence of a GHS day roost within a barn (Building AF2) in late May 2015;

- Static 9: A total of 134 records fell within the time period 21-40 mins (equivalent to 8.09b/hr) recorded across the survey period during May, June, August, September and October. The majority of these passes were recorded on 24th Oct 2014 (continuous activity over a 12 minute time period which was presumed to be a foraging bat(s)). Two passes were recorded in close succession at c. 29 minutes after sunset on 20/08/2014 which coincides with a record made during a manual transect survey carried out on the same evening of an individual GHS bat seen commuting south-west along the hedgerow, having come from the direction of Caton Lane. Collectively, these results strongly indicate the likely presence of a regularly used GHS summer roost located within a neighbouring off-site property to the north-east.

Table 18: GHS Bat Activity (b/hr) Recorded during Night Time Periods

Static Location	0-20 mins after SS	21-40 mins after SS	41-60 mins after SS	61-80 mins after SS	81-100 mins after SS	101-120 mins after SS	Middle of the Night (121 mins after SS – 121 before SR)	120-101 mins before SR	100-81 mins before SR	80-61 mins before SR	60-41 mins before SR	40-21 mins before SR	0-20 mins before SR
1	0.000	0.000	0.186	0.429	0.229	0.086	0.182	0.129	0.268	0.125	0.043	0.000	0.000
2	0.000	0.061	0.429	1.078	0.980	1.179	0.422	0.230	0.191	0.031	0.176	0.214	0.536
3	0.000	0.107	0.493	0.000	0.421	0.157	0.186	0.262	0.133	0.270	0.184	0.061	0.000
4	0.000	0.000	0.740	1.487	1.579	1.326	0.300	0.215	0.614	0.261	0.537	0.000	0.000
5	0.000	0.061	0.408	0.327	0.156	0.151	0.115	0.176	0.273	0.230	0.122	0.000	0.000
6	0.000	0.071	2.616	4.079	2.337	0.913	0.507	0.579	0.940	1.283	0.889	0.000	0.000
7	0.000	0.000	0.616	1.786	0.779	0.801	0.297	0.310	0.257	0.447	0.087	0.000	0.000
8	0.000	0.000	0.717	0.606	0.385	0.582	0.405	1.481	1.545	0.947	0.571	1.048	0.857
9	0.000	8.085	2.724	5.974	3.446	2.012	0.864	0.692	1.300	1.036	1.385	0.000	0.000
10	0.000	0.000	0.272	0.775	0.612	0.985	0.302	0.143	0.526	0.480	0.358	0.000	0.000
Mean (all locations)	**0.000**	**0.839**	**0.920**	**1.654**	**1.092**	**0.819**	**0.358**	**0.422**	**0.605**	**0.511**	**0.435**	**0.132**	**0.139**

Lesser Horseshoe Bat

By comparison with GHS, LHS activity was lower across the whole monitoring period. An overall total of 1579 LHS bat passes were recorded, equivalent to a Site mean of 0.26 B/hr.

LHS passes were recorded across each of the 10 static detector locations, and as for GHS bats, the rate of bat activity varied between the static detector locations, as indicated by the summary results presented in Table 19 and Chart 3 below as well as Figure 6c.

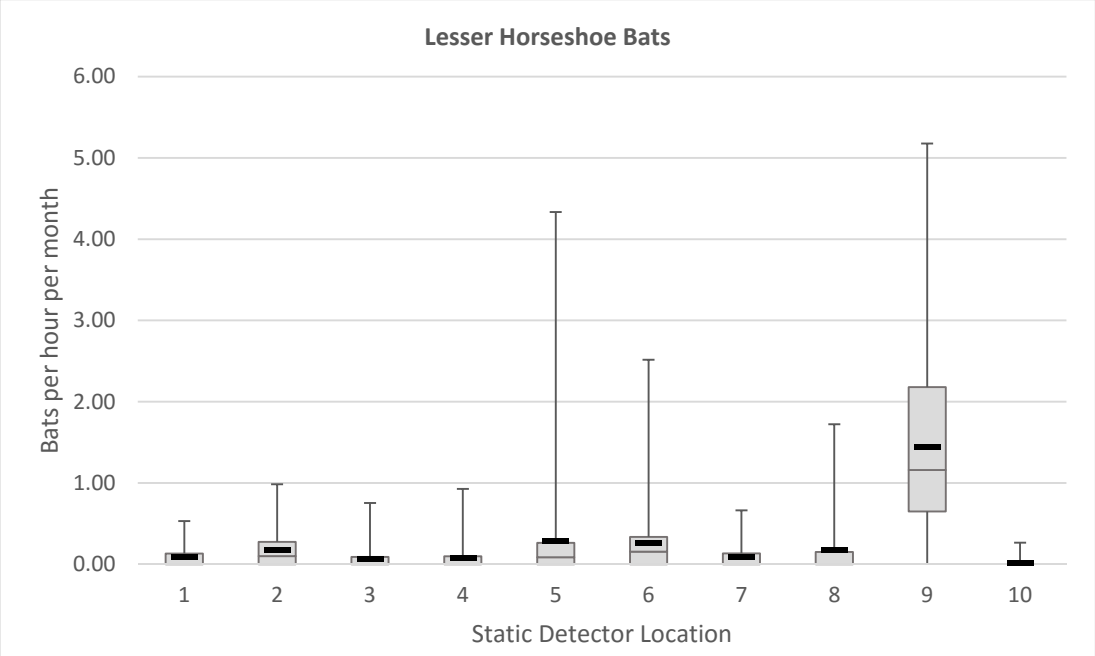
Table 19: LHS Bat Passes Recorded per Location in 2014-2015 Monitoring Period

Static Detector Location	No. of Recording Nights	No. of Recording Hours	Total No. of Passes	Bats per night (B/n)	Bats per hour (B/h)	% of overall LHS activity (B/hr)
1	60	579.7	53	0.88	0.091	3%
2	60	604.5	111	1.85	0.184	7%
3	60	591.1	42	0.70	0.071	3%
4	58	584.5	39	0.67	0.067	2%
5	66	673.6	226	3.42	0.336	12%
6	58	589.8	136	2.34	0.231	9%
7	63	641.8	52	0.83	0.081	3%
8	62	627.4	92	1.48	0.147	5%
9	57	555.7	818	14.35	1.472	55%
10	58	558.9	10	0.17	0.018	1%
	Total: 602	**Total: 6074.2**	**Total: 1579**	**Mean: 2.62**	**Mean: 0.26**	

Similar to the results for GHS, Static 9 in the north-east of the Site recorded the highest LHS activity across the monitoring period, with an overall mean of 1.47 b/hr which was significantly higher (p=<0.05) than LHS activity levels recorded at all other nine locations, accounting for 55% of the overall LHS activity.

For the remaining nine static locations, differences in LHS activity levels were less clear-cut, with activity at static 10 being the lowest (significantly different to 9, 6, 2 & 5 [p=<0.05]), and activity at static 6 being higher than 3, 4 and 10 (p=<0.05). These findings broadly mirrored the transect survey results, with higher levels of LHS activity in the north rather than the south of the Site.

Chart 3: Comparison of LHS Bat Activity Index (b/hr) Across Static Detector Locations



As shown in Chart 4 below, LHS activity varied slightly between recording months. Based on the combined data for all static locations, lowest activity levels were recorded in April (0.13 b/hr) and then rose steadily through May (0.27 b/hr) before reaching a peak in June (0.5b/hr), where activity levels were significantly higher than in April, May July or August (p=<0.05). From July, overall LHS activity levels fell (0.17 b/hr) and then remained consistent between August and October (0.26 b/hr).

Chart 4: LHS Activity (b/hr) Recorded Each Month across all 10 Locations (April 2015, May – October 2014)

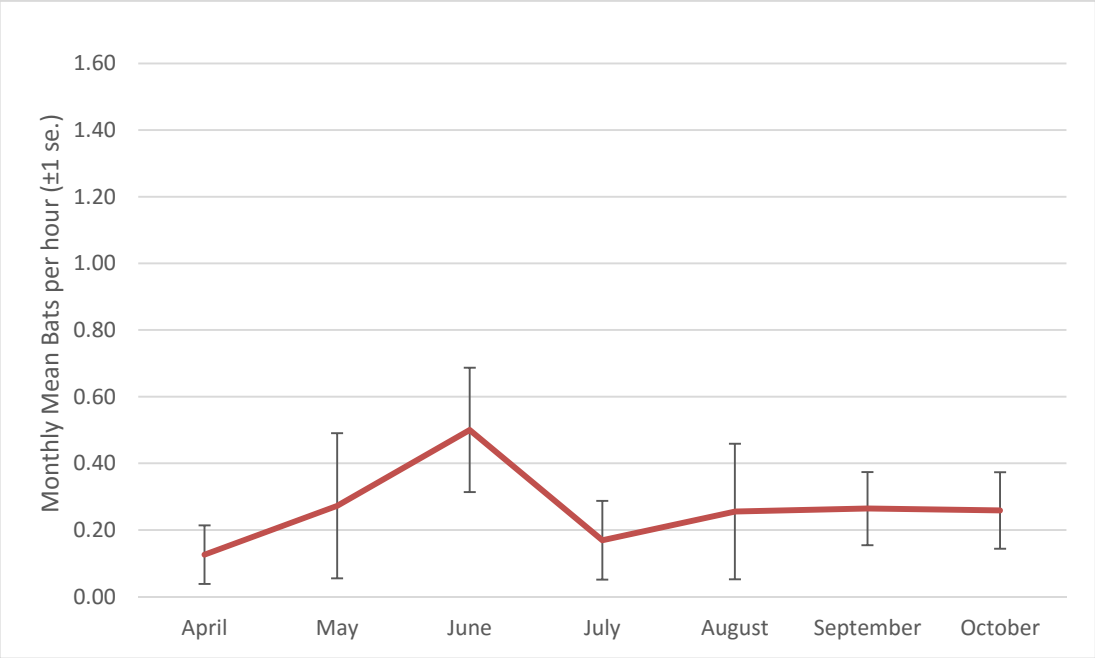


Table 20 below shows the timings of LHS passes recorded throughout the night as b/hr. The peak period of LHS activity (as a mean for all locations) was between 41-60 minutes after sunset (0.05 b/hr). On average, activity decreased thereafter, with a smaller peak in LHS activity recorded again between 80-41 minutes before sunrise.

This analysis of activity throughout the night-time periods also highlights that in several static locations, early and late records were recorded (between 21-40 minutes after sunset and between 40 minutes and sunrise respectively), as follows:

- Static 1: The earliest LHS pass was recorded at 31 minutes after sunset on 13th September. A further three passes were also recorded within 40 mins of sunset between 14th-15th October. These passes may relate to LHS bats roosting at Lower Waye / Alston Farm, but the possibility of bats crossing over from the south side of the A38 cannot be ruled out.
- Static 2: Three passes were recorded between 35-40 minutes after sunset on separate evenings (9th August, 23rd October and 25th October). In addition, a single late pass was also recorded 10 minutes before sunrise on 16th June. Similarly to the GHS records at this static location, these results would strongly suggest a nearby LHS roost located within Caton to the east.
- Static 4: A single early pass (24 minutes after sunset) was recorded on 14th July and is considered most likely to be a bat(s) that had emerged from a building at Alston Farm.

- Static 5: A total of 9 passes were recorded within 40 minutes of sunset or 40 minutes of sunrise spread over six different recording nights in late September and mid-October. Based on other evidence gathered, these are considered most likely to be bats emerging from / returning to roost at Lower Waye to the west.
- Static 6: A total of 21 passes (equivalent to 1.15 b/hr) were recorded within 40 minutes after sunset (all 30 minutes or later). These were mostly individual rather than consecutive passes recorded across a number of different recording nights / months between May – October. Given that this static was located mid-way between Alston Farm and Lower Waye, these could have been bat(s) emerging from either of these two farms.
- Static 8: A single late pass was recorded on 18th May at 29 minutes before sunrise, and was most likely a bat returning to roost at Alston Farm.
- Static 9: The highest levels of early activity were recorded at Static 9 with 62 passes recorded between 21-40 minutes (all 30 minutes or later) after sunset (equivalent to 2.75 b/hr). Although records were from May, July, August, September and October, the vast majority were recorded between 13th-23rd August, when anything between 3 and 7 passes were recorded within this period each night. In addition, six LHS passes were recorded between 40-21 minutes before sunrise between May – September with a very late pass (14 minutes before sunrise) recorded on 28/10/14. Much like the early / late GHS activity recorded at this same location, these LHS records strongly indicate the likely presence of a regularly used roost site to the north-east of the Site.

Table 20: LHS Bat Activity (b/hr) Recorded during Night Time Periods

Static Location	0-20 mins after SS	21-40 mins after SS	41-60 mins after SS	61-80 mins after SS	81-100 mins after SS	101-120 mins after SS	Middle of the Night (121 mins after SS – 121 before SR)	120-101 mins before SR	100-81 mins before SR	80-61 mins before SR	60-41 mins before SR	40-21 mins before SR	0-20 mins before SR
1	0.000	0.227	0.318	0.247	0.284	0.039	0.092	0.000	0.000	0.000	0.000	0.000	0.000
2	0.000	0.147	0.165	0.214	0.227	0.422	0.124	0.092	0.000	0.061	0.207	0.000	0.054
3	0.000	0.000	0.332	0.107	0.096	0.115	0.048	0.061	0.222	0.107	0.054	0.000	0.000
4	0.000	0.061	0.093	0.039	0.161	0.000	0.086	0.115	0.268	0.061	0.000	0.000	0.000
5	0.000	0.179	0.857	0.668	0.167	0.143	0.252	0.071	0.071	0.156	0.345	0.119	0.000
6	0.000	1.152	0.956	0.192	0.109	0.000	0.316	0.287	0.180	0.036	0.337	0.000	0.000
7	0.000	0.000	0.260	0.156	0.146	0.000	0.133	0.054	0.039	0.000	0.000	0.000	0.000
8	0.000	0.000	0.346	0.470	0.424	0.131	0.184	0.107	0.482	0.250	0.109	0.048	0.000
9	0.000	2.762	7.462	2.349	1.509	2.607	0.957	0.645	1.004	3.541	2.999	0.315	0.061
10	0.000	0.000	0.048	0.000	0.000	0.071	0.023	0.000	0.043	0.000	0.000	0.000	0.000
Mean (all locations)	0.000	0.453	1.084	0.444	0.312	0.353	0.222	0.143	0.231	0.421	0.405	0.048	0.011

4.0 VALUATION

An evaluation of the importance of the Site to the various bat species recorded using the Site is provided in Table 21 below. It should be noted that for some species, notably LHS and GHS, some parts of the Site are of greater value than others as described in the detailed results. The evaluation uses the CIEEM geographic frames of reference as set out in Section 2.4 for each species and is based on the data gathered during all of the surveys, with consideration given to their UK status and population estimates, as well as the local status for each (taking into account the bat records obtained during the desk study, as summarised in section 1.3.1). Similarly, valuation has also taken into account the availability of alternative foraging and roosting habitat in the surrounding areas.

Table 21: Evaluation of the Site for Individual Bat Species

Species / Group	UK Status[6]	Estimated UK Population[7]	Relative Frequency within the Site (Activity Surveys)	Evidence of Roosting Found within Site	Likely Value of Site to Bat Species
Common Pipistrelle	Common	2,430,000	Very frequent & widespread.	Small roosts for individual / low numbers.	Local
Soprano Pipistrelle	Common	1,300,000	Regular & found across the Site.	None found.	Local
Nathusius' Pipistrelle	Uncommon (may be under recorded)	16,000	Very Infrequent & sparsely distributed.	None found.	Local
Myotis spp	Uncommon to Common (based on likely species present)	148,000 (Natterer's) 560,000 (Daubenton's) 64,000/30,000 (Whiskered /Brandts)	Frequent & widespread.	Small roost for individual / low numbers of Natterer's.	Local
Noctule	Uncommon	50,000	Frequent & widespread.	None found.	Local
Serotine	Uncommon	15,000	Very Infrequent / sparsely distributed.	None found.	Local
Barbastelle	Rare	5,000	Regular & records widely distributed.	None found.	County
Brown long-eared bat	Common	245,000	Infrequent (but probably under-recorded) & widely distributed.	Small maternity roost and roosts for individual / low numbers.	Local

[6] UK Status is based on the National Bat Monitoring Programme (NBMP) Populations Trends 2012 (BCT, August 2014)

[7] Estimated UK Population based on Battersby (2005) or Harris et. al. (1995).

Species / Group	UK Status[6]	Estimated UK Population[7]	Relative Frequency within the Site (Activity Surveys)	Evidence of Roosting Found within Site	Likely Value of Site to Bat Species
Lesser Horseshoe	Rare	18,000	Regular with uneven distribution. Records considered mostly commuting bats with activity concentrated in the north of the Site.	Day and night roosts for low numbers (>5bats)	County
Greater Horseshoe	Very rare	>6,600	Frequent with uneven distribution. Records considered to be predominantly commuting bats with activity concentrated in the north of the Site.	Day and night roosts for low numbers (>5bats)	County

5.0 CONCLUSIONS

The findings of the suite of bat surveys undertaken at the Site have identified roosts for five different species of bat (including a small maternity roost of Brown Long-eared bat as well as roosts for small numbers of Common Pipistrelle, Natterer's, GHS and LHS bats). Surveys also found that the Site supports an assemblage of at least 10 species of bat with regards foraging / commuting activity, with records dominated by Common Pipistrelle bats. Other bat species considered rare / very rare in the UK were also encountered frequently (GHS) or regularly (LHS and Barbastelle) within the Site but in lower numbers and with a more restricted distribution.

Key habitats used by bats were confirmed to be hedges / woodland edges along the north-west and north-east boundaries of the Site, along green lanes running west-east, hedges surrounding cattle-grazed pasture to the east / south-east of Alston Farm and the existing farm access track.

Overall, the bat assemblage present on the Site is considered to be of up to **County** value.

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