Frodsham Solar

Environmental Statement: Volume 2
Appendix 7-3: Bat Activity Survey Report

May 2025

Cubico
SUSTAINABLE INVESTMENTS

PINS Ref: EN010153
Document Ref: EN010153/DR/6.2
Planning Act 2008; and Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations Regulation 5(2)(a)

Revision P01

Frodsham Solar

on behalf of Axis PED.

Technical Appendix 7.3: Bat Activity Survey Report

avian ecology

Report Verification

Document Control	
Project Name:	Frodsham Solar
Project Number:	AxisL-043-3114
Report Title:	Technical Appendix 7.3: Bat Activity Survey Report

Issue	**Date**	**Notes**	**Prepared**	**Reviewed**
V1	01/09/2024	Draft (for client comment)	L. Quarton *MSc, BSc (Hons.)*	*C. Scott MRes ACIEEM*
V2	16/10/2024	Final Issue	C. Scott *MRes ACIEEM*	
V3	06/03/2025	Updated to include Density Maps of Manual Bat Activity Results Updated for submission with ES Chapter	L. Quarton *MSc, BSc (Hons.)* C. Scott *MRes ACIEEM*	J. Stevens *BSc (Hons)*
V4	14/05/2025	Updated for submission with ES Chapter	B. Gray *BSc (Hons) MCIEEM*	J. Stevens *BSc (Hons)*

CONTENTS

TABLES

FIGURES

ANNEXES

1 INTRODUCTION

1.1 Background and Scope

1.1.1 This Technical Appendix has been prepared to accompany **Chapter 7: Terrestrial Ecology [EN010153/DR/6.1]** of the Frodsham Solar Environmental Statement (ES).

1.1.2 This report provides detailed methodologies and results of desk study and field surveys completed to establish baseline conditions with regards to bat species.

1.1.3 This report has been informed by a desk-based review of relevant ecological information, a habitat suitability assessment, and manual and automatic bat activity surveys. Reference is made to relevant legislation, planning policy and guidance, as appropriate.

1.1.4 Only common names of bat species are used within this report; with scientific names provided in **Annex 1**.

7.1.1 For the avoidance of doubt, the following areas associated with this Appendix are defined below and as shown in **ES Volume 3 Figure 1-2 [EN010153/DR/6.3]**:

i) the 'Solar Array Development Area (SADA)' comprising the area that would include solar photovoltaic (PV) modules and support frames, internal access tracks, cabling, inverters, transformers, the solar array substation (known as the 'Frodsham Solar Substation) and the BESS;

ii) the 'Non-Breeding Bird Mitigation Area (NBBMA)' comprising land primarily within Cell 3, which currently forms part of the Frodsham Wind Farm mitigation. This area of land would be used as a mitigation area for the anticipated displacement of wetland birds associated with the Mersey Estuary;

i) the 'SPEN/National Grid Substation and Access' comprising the existing SPEN/National Grid Substation and access road to the substation compound;

ii) the 'Skylark Mitigation Area' comprising land where neutral grassland would be created during the operational lifetime of the Proposed Development for the benefit of skylarks;

iii) the 'Main Site Access with Private Wire Connection' comprising the access road with Protos private wire connection to the west of the SADA; and,

iv) the 'Main Site Access without Private Wire Connection' comprising the access road without private wire connection to the west of the SADA.

2 LEGISLATION

2.1.1 All species of British bat are listed under Schedule 5 of the Wildlife and Countryside Act 1981 (as amended). Bats are further protected under the Conservation of Habitats and Species Regulations 2017 (as amended) and the Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019. The Act and Regulations make it an offence to:

- Kill, injure, or take any wild bat;
- Damage, destroy or obstruct access to any place that a wild bat uses for shelter or protection; and,
- Intentionally or recklessly disturb any wild bat while it is occupying a structure or place that it uses for shelter or protection.

2.1.2 Seven bat species in the UK are also listed as Species of Principal Importance under Section 41 of the Natural Environment and Rural Communities Act (NERC) Act 2006[1], whilst ten species are listed as priority species under the Cheshire Region Biodiversity Action Plan and are therefore a material consideration within the planning process.

[1] The Natural Environment and Rural Communities Act 2006. Available at: https://www.legislation.gov.uk/ukpga/2006/16/contents

3 METHODOLOGY

3.1.1 The approach to baseline information gathering with regards to bats has been undertaken with reference to Bat Conservation Trust (BCT) Survey Guidelines (Collins, 2016[2]) applicable at the time of survey design, in addition to the Bat Workers Manual (Mitchell-Jones, A. J. & McLeish, A. P, 2004[3]).

3.1.2 Additional pieces of guidance and peer reviewed literature have also been consulted and are referenced where relevant.

3.2 Desk Study

3.2.1 A desk study was undertaken to identify the proximity of the Main Development Area to any statutory or non-statutory designated sites for nature conservation with bat qualifying interest, and to obtain any existing records of bats within the Main Development Area and the surrounding area.

3.2.2 Key desk study sources, search areas and information obtained are summarised in **Table 2-1**.

Table 2-1: Desk study sources

Key Source	Date of Consultation	Information Sought	Study Area
The Multi Agency Geographic Information for the Countryside (MAGIC) website[4], Natural England's Site Search[5] and Joint Nature Conservation Committee (JNCC)[6]	April 2025	Proximity to statutory designated sites, with bat interests.	Within 2 km of the Main Development Area (extending to 30 km for internationally protected sites).
MAGIC	May 2025	Existing records of granted European Protected Species Mitigation Licence ('EPSML') for bats.	Within 2 km of the Main Development Area.
RECORD (Local Environmental Records Centre for Cheshire, Halton, Warrington and Wirral)	September 2024	Existing records of bat species[7]. Non-statutory designated sites, with bat interests.	Within 2 km of the Main Development Area.

[2] Collins, J. (ed.) (2016). Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd edn). The Bat Conservation Trust, London.
[3] Mitchell-Jones, A. J. & McLeish, A. P. (2004). *Bat Workers Manual*. 3rd Edition. Joint Nature Conservation Committee, Peterborough.
[4] Available at: https://magic.defra.gov.uk/MagicMap.aspx [Accessed 30/04/2025]
[5] Available at https://designatedsites.naturalengland.org.uk/ [Accessed 30/04/2025]
[6] http://jncc.defra.gov.uk/ [Accessed 30/04/2025]
[7]Only records dated within the last 10 years (dated from 2014 or later) were used, unless pre-2014 records were considered pertinent to the Proposed Development.

Key Source	Date of Consultation	Information Sought	Study Area
Cheshire West and Chester Public Interactive Map[8]	April 2025	Non-statutory designated sites, with bat interests.	Within 2 km of the Main Development Area.
Frodsham Renewable Energy Development: • Preliminary Ecological Appraisal (PEA) Report (RSK Biocensus, 2023)[9]; and, • Bat Activity Survey Report (RSK Biocensus, 2023)[10].	August 2024	PEA: to provide context as to habitats present within the Preliminary Site Boundary. Bat Activity Survey Report: Existing bat records from baseline field surveys.	PEA: the Preliminary Site Boundary. Bat Activity Survey Report: species-specific search areas used for baseline surveys.

3.2.3 The desk study also included a review of the Site's location in relation to the known ranges of bat species in England, with reference to:

- the most recent UK Habitats Directive[11] Article 17 Report; and,
- A Review of the Population and Conservation Status of British Mammals: Technical Summary (Mathews *et al.*, 2018)[12].

3.3 Field Surveys

3.3.1 The purpose of the baseline field surveys for bats has been to establish the bat species assemblage using the Main Development Area, the spatial and temporal distribution of bat activity within the Main Development Area, the location and extent of commuting and foraging habitat used by bats and, the locations of any bat roosts that could potentially be affected by the Proposed Development.

3.3.2 The following surveys relating to baseline bat activity have been completed:

- Habitat Suitability Assessment;

[8] Available at: Public Map Viewer (cheshirewestandchester.gov.uk) [Accessed 30/04/2025]
[9] RSK Biocensus (2023). Frodsham Renewable Energy Development Preliminary Ecological Appraisal Report. RSK Biocensus.
[10] RSK Biocensus (2023). Frodsham Renewable Energy Development Bat Activity Survey Report. RSK Biocensus.
[11] https://jncc.gov.uk/our-work/article-17-habitats-directive-report-2019-species/
[12] Mathews, F., Kubasiewicz, L.M., Gurnell, J., Harrower, C.A., McDonald, R.A. and Shore, R.F. (2018). *A Review of the Population and Conservation Status of British Mammals: Technical Summary*. The Mammal Society, Peterborough. https://www.mammal.org.uk/wp-content/uploads/2021/06/MAMMALS-Technical-Summary-FINALNE-Verision-FM3290621.pdf

- Manual Bat Activity Surveys; and,
- Automated Bat Activity Surveys.

3.3.3 Bat activity survey effort was determined in reference to BCT guidance (Collins, 2016) applicable at the time of surveys, following an assessment of **Moderate** habitat suitability overall (see section 4.2 Habitat Suitability Assessment).

3.3.4 Consequently, walked transects (i.e., manual bat activity surveys) were undertaken on a monthly basis from July – October (with the exception of Transect 2 being undertaken on 1st November 2023, access constraints due to poor ground conditions from adverse weather resulted in, limitations are discussed in Section 3.4) 2023, from the time of instruction.

3.3.5 Static surveys (i.e., automated bat activity surveys) were also undertaken on a monthly basis throughout the bat activity period, ranging from July until October.

3.3.6 Methodologies relating to each specific bat activity survey are described below.

Habitat Suitability Assessment

3.3.7 A habitat suitability assessment (HSA) of the Main Development Area was undertaken in reference to criteria detailed in **Table 4-1** of BCT guidance (Collins, 2016), which provided an appraisal of the potential value of habitats located within the Main Development Area relative to foraging and commuting potential.

Bat Activity Surveys

Manual Bat Activity Surveys

3.3.8 Manual activity surveys of the Main Development Area, consisting of two walked transects (i.e., Transect 1 and Transect 2) were designed and implemented in accordance with BCT guidance (**Figure 2**).

3.3.9 Transects were programmed to be undertaken on a monthly basis, in line with a **Moderate** habitat suitability assessment of the Main Development Area (Collins, 2016). Each transect was designed to cover the recommended transect length (e.g., 3-5 km) relative to the size of the Main Development Area, so as to be completed within 2-3 hours after sunset/sunrise, as per guidance relevant at the time of survey.

3.3.10 Whilst individual transect routes showed some variation relative to their location, each aimed to cover a representative range of habitats considered to be ecologically important for bats, and which might be impacted by the Proposed Development.

3.3.11 Manual activity surveys were undertaken by a team of ecologists and assistant ecologists, each suitably experienced in relation to bat activity surveys; specifically, each transect was surveyed via a pair of surveyors on a monthly basis between July-October (with the exception of Transect 2 being undertaken on 1st November 2023, due to access constraints due to poor ground conditions from adverse weather. , limitations are discussed in Section 3.4) 2023, in accordance with both good practice guidance and health and safety protocol.

3.3.12 Transects were walked at a constant pace by survey teams utilising either a Wildlife Acoustics Touch 2 Pro or Wildlife Acoustics EM3 bat detector. Transects followed pre-defined routes (tested during prior daytime walkovers) and consisted of 10 – 11 Listening Points (LPs) connected by walked segments (Ws), as presented in **Figure 2**.

3.3.13 Bat passes at each listening point were recorded for approximately 5 minutes before continuing along the walked segment towards the subsequent listening point. Additional metrics recorded included the maximum number of bats observed, the species identified, and any other contextual data such as flight direction, social calling or feeding buzzes relative to a specific area of the transect route.

3.3.14 Manual activity surveys comprised both dusk and dawn transects; dusk transects commenced at sunset and ended approximately two to three hours after sunset, whilst dawn transects commenced two hours prior to sunrise, ending approximately 30 minutes after sunrise. Transects were undertaken in weather conditions conducive for bat activity, when possible (i.e., mild and dry, with relatively low wind speeds).

3.3.15 A summary of survey effort relative to manual activity surveys is presented in **Table 3-1** below.

Table 3-1: A Summary of Manual Activity Survey Effort

Transect ID	Survey Date	Sunset/ Sunrise Time	Start Time	End Time	Survey Conditions
1	11/07/23	21:36	21:33	23:42	Temp: 15°; Rain: Dry; Wind*: Light Breeze; Cloud: 3/8
	29/08/23	20:08	20:08	22:30	Temp: 15 °C; Rain: Dry; Wind*: Light Breeze; Cloud: 2/8
	29/09/23	05:10	07:09	07:30	Temp: 12 °C; Rain: Dry; Wind*: Light Air; Cloud: 1/8
	16/10/23	18:15	18:15	20:37	Temp: 11 °C; Rain: Dry; Wind*: Light Air; Cloud: 2/8
	17/10/23	07:41	05:41	07:41	Temp: 5 °C; Rain: Dry; Wind*: Light Breeze; Cloud: 3/8
2	13/07/23	21:33	21:33	23:33	Temp: 17 °C; Rain: Dry; Wind*: Light Breeze; Cloud: 5/8
	30/08/23	20:05	20:05	22:53	Temp: 15 °C; Rain: Dry; Wind*: Light Air; Cloud: 2/8
	29/09/23	05:10	07:09	07:30	Temp: 12 °C; Rain: Dry; Wind*: Light Air; Cloud: 1/8
	01/11/23	16:39	16:39	20:05	Temp: 11 °C; Rain: Dry; Wind*: Light Breeze; Cloud: 6/8
	02/11/23	N/A	N/A	N/A	N/A

***Beaufort Wind Scale**

3.3.16 At the request of the Cheshire West and Chester Council's Natural Environment Officer, the results of the Manual Activity Surveys have been collated and additional figures (**Figures 5 to 8**) produced in the

style of the figures produced by RSK (heat maps) (see **Annex 3; Figures 4 - 5**). **Figures 5 to 8** illustrate the density of bat activity in the form of heat maps of the total number of bat passes (i.e. for all species combined) recorded per minute along the transect routes, per survey visit. **Figures 5 to 8** illustrate density using a scale of bat passes recorded per minute, ranging from 1 pass to <10 passes (the maximum number of passes at any given point being 11). Due to the geo-referencing recording methods of the bat detector models used during the 2023 surveys, co-ordinates for each bat pass are rounded to the nearest minute, rather than being recorded for each individual pass.

Automatic Bat Activity Surveys

3.3.17 Three automated monitoring stations (MSs) were deployed within the Main Development Area boundary. MS locations were chosen to sample activity from a representative range of habitats considered to be ecologically important for bats, or potentially subject to development impact, present within the Main Development Area.

3.3.18 A summary of MS deployment locations is detailed in **Table 3-2** below, whilst MS locations relative to the Main Development Area are presented in **Figure 2**.

Table 3-2: A summary of Static Monitoring Station (MS) Deployment

Monitoring Station	Grid Reference	Habitat
MS1	SJ 50866 78689	Edge habitat; placed along a mature other native hedgerow within other neutral grassland pasture featuring scattered rushes, east adjacent to an additional other native hedgerow and wet ditch.
MS2	SJ 50946 78188	Placed within a mosaic area of other neutral grassland and tall forbs, featuring addition scattered scrub, trees and rushed.
MS3	SJ 51865 79047	Placed along a mature other native hedgerow and associated wet ditch, located centrally within an area of arable land (i.e., cereal crop).

3.3.19 MS detector types deployed during each automatic activity survey varied, consisting of either a full spectrum SM Mini or SM4 detector attached to a 1 m high stake or suitable existing feature. Monitoring was undertaken approximately thirty minutes before sunset to thirty minutes after sunrise, with detectors set to record simultaneously.

3.3.20 Where possible, bat activity was sampled for a minimum of five consecutive nights of suitable weather, following a monthly survey effort (i.e., July-October). Five nights consecutive nights of data is the minimum recommended survey effort per recording period undertaken, as prescribed for sites with **Moderate** habitat suitability (Collins, 2016).

3.3.21 Key metrics for each MS deployed throughout automatic activity surveys are detailed in **Table 3-3.**

Table 3-3: A Summary of Automated Activity Survey Effort

Monitoring Station	Survey Season	Recording Period Start Date	Recording Period End Date	No. Nights Surveyed	Recording Hours
MS1	July	19/07/2023	25/07/2023	6	46.75
	August	25/08/2023	01/09/2023	7	70.25

Monitoring Station	Survey Season	Recording Period Start Date	Recording Period End Date	No. Nights Surveyed	Recording Hours
	September	25/09/2023	02/10/2023	7	85.25
	October	21/10/2023	29/10/2023	8	112
MS2	July*	19/07/2023	22/07/2023	3	23.25
	August	25/08/2023	01/09/2023	7	70.25
	September	25/09/2023	02/10/2023	7	85.25
	October	21/10/2023	29/10/2023	8	112
MS3	July*	19/07/2023	21/07/2023	2	15.5
	August	25/08/2023	01/09/2023	7	70.25
	September	25/09/2023	02/10/2023	7	85.25
	October	21/10/2023	29/10/2023	8	112

**** Technical failure of MS means the recommended sampling effort was not achieved during the July.***

3.3.22 Weather conditions, taken from World Weather Online website[13] are presented in **Annex 2.**

Data Analysis and Assumptions of Bat Activity

3.3.23 Data analysis and interpretation of results followed the principles presented in the BCT guidance (Collins, 2023[14]). Bat sound analysis has been undertaken by suitably experienced ecologists.

3.3.24 Bat detectors recorded data onto digital media for subsequent analysis using Kaleidoscope Pro (Wildlife Acoustics) software. All data was processed through Kaleidoscope Pro in order to separate associated noise files. The remaining sonograms were then automatically identified by the software. A selection of sonograms from each species or species group was manually checked with particular attention given to non-pipistrelle species.

3.3.25 Bat species were identified using characteristic features associated with species echolocation calls. Diagnostic features used in this analysis include characteristic frequency, slope, call duration, time between calls, minimum length of the body of the call and smoothness.

3.3.26 Bat detectors record the passage of echolocating bats during surveys, enabling an estimation of relative bat activity levels for assessment. It is recognised, however, that there are limitations to the use of this method for determining bat activity levels.

3.3.27 An individual bat can pass a particular feature on several occasions while foraging and therefore it was not possible to estimate the number of individual bats or to allow a fair comparison where survey time differs. As such, bat activity is recorded as an index. The Bat Activity Index (BAI), based on BCT guidance (Collins, 2023), is defined as follows:

[13] https://www.worldweatheronline.com [Accessed 09/09/2024]

[14] Collins, J. (ed.) (2023) Bat Surveys for Professional Ecologists. Good Practice Guidelines (4th edition). The Bat Conservation Trust, London. ISBN-978-1-7395126-0-6.

BAI (per hour) = Total number of bat 'registered calls' / number of hours of recording

3.3.28 For analysis purposes, bat activity was recorded as the number of 'bat registered calls' (a sequence of echolocation calls consisting of two or more call notes (pulse of frequency) from one bat, not separated by more than one second (White and Gehrt, 2001[15] & Gannon *et al*., 2003[16]) with a minimum call note length of >= two milliseconds (Weller *et al*., 2009[17]) from which the activity index is calculated.

3.4 Limitations

Survey design

3.4.1 At the time of the survey design, the Bat Conservation Trust (BCT) Survey Guidelines (Collins, 2016[2]) were the most up to date and industry best practice guidelines for bat surveys. During the scheduled survey effort BCT Survey Guidelines (Collins, 2023) was published. Due to the fact that the bat survey effort had begun using the BCT 2016 guidelines it was assessed as not proportionate to re-design surveys to comply with the 2023 guidance. This is not deemed to be a significant constraint as principles for survey design and survey effort have been undertaken with reference to BCT guidance.

3.4.2 No data has been collected during the Spring period. This was due to the timing of instruction to undertake bat surveys. Although data from Spring period is absent, data has been collated during Summer and Autumn periods, following the principles set out in BCT guidance. This limitation does not prevent an informed view of the likely significant environmental effects in bats of the Proposed Development from being provided in the Environmental Statement. Habitat enhancement provisions would provide new and enhanced features that can be used for foraging by bats.

Bat Activity Surveys

<u>Automatic Activity Surveys</u>

3.4.3 Due to a technical failure, both MS2 and MS3 did not managed to record five consecutive nights of bat activity during the July recording period, as recommended by BCT guidance. Whilst sampling effort is noted to be below the standard number of nights, the use of BAI as a measure of activity does account for variation in recording hours, meaning activity sampled does still provide insight into representative activity at both locations, during the July recording period.

3.4.4 The Bat Conservation Trust (BCT) Survey Guidelines (Collins, 2016[2]) state that, one static detector should be placed per transect on low suitability habitats for bats, and two statics should be placed per transect on moderate suitability habitats. Habitats within the Main Development Area have predominantly been assigned low suitability habitats (e.g. the fields), whereas the remainder of the habitats have been assigned moderate suitability (e.g. hedgerows, tree lines, field margins, ditches and watercourses). As such, this is not deemed to be a significant constraint as three static detectors are considered appropriate considering the presence of both low and moderate suitability habitats.

[15] White, E. & Gehrt, S. (2001). *Effects of recording media on echolocation data from broadband bat detectors*. Wildlife Society Bulletin 29: 974-978

[16] Gannon, W., Sherwin, R. & Haymond, S. (2003). *On the importance of articulating assumptions when conducting acoustic studies of habitat use by bats*. Wildlife Society Bulletin 31: 45-61

[17] Weller, T., Cryan, P. & O'Shea, T. (2009). *Broadening the focus of bat conservation and research in the USA for the 21st century. Endangered Species Research*. 8: 129-145

Additionally, impacts (i.e. direct loss) is primarily located within habitats assessed as low suitability for foraging/commuting bats with habitats of moderate suitability being largely retained.

Manual Activity Surveys

3.4.5 Due to changes to the Proposed Development's Site Boundary which were introduced post-completion of manual activity surveys, three LPs (i.e., LP4 -LP6) previously included as part of Transect 1 now fall outside of the Site boundary, and therefore also the Main Development Area boundary. These LPS have consequently been omitted from analysis as they include habitats found outside of the Site (and Main Development Area), with data relating to bat activity within this area no longer being pertinent to the Proposed Development.

3.4.6 Additionally, during the July manual activity survey of Transect 2, access constraints resulted in several LPs (i.e., LP8 – LP11) going un-surveyed, and which also resulted in specific transect sections being subsequently re-traced, so as to adhere to the recommended survey effort (i.e., time and length). Consequently, several LPs are not directly comparable between survey periods, although a broad interpretation of summer activity trends within the Main Development Area is still possible from data recorded during the August manual activity survey. Likewise, access constraints also resulted in a deviation from the pre-defined transect route (i.e., W7a), which was subsequently retained as activity recorded was considered pertinent to the overall Main Development Area.

3.4.7 Unsuitable weather conditions during the October period also resulted in the final manual activity surveys at Transect 2 being delayed until the 1st of November, falling just outside the arbitrary October recording period, as defined by guidance. Additionally, access constraints due to poor ground conditions from adverse weather resulted in difficulty navigating the transect. As such, the scheduled back-to-back dawn survey programmed was cancelled due to safety concerns.

3.4.8 At the request of the Cheshire West and Chester Council's Natural Environment Officer, the results of the Manual Activity Surveys have been collated and additional figures (**Figures 5 to 8**) produced in the style of the figures produced by RSK (heat maps) (see Annex 3; **Figures 4 - 5**). **Figures 5 to 8** illustrate density using a scale of bat passes recorded per minute, ranging from 1 bass to <10 passes (the maximum number of passes at any given point being 11). Due to the geo-referencing recording methods of the bat detector models used during the 2023 surveys, co-ordinates for each bat pass are rounded to the nearest minute, rather than being recorded for each individual pass. Although some reduction in accuracy is evident, the walked distance per minute is relatively minimal, with available co-ordinates still presenting useful information relative to broader transect areas, or linear features found in close association. It is unknown if the co-ordinates of the bat passes illustrated in the density maps produced by RSK (see **Annex 3; Figures 4 – 5**) are rounded to the to the nearest minute or not. Furthermore, the scale of bat activity density in the maps produced by RSK (see **Annex 3; Figures 4 – 5**) range from 'sparce' to 'dense'; there is no indication of what the definition, or number of bat passes, of spare/dense is. As such, due to the variation in recording equipment, known density scale and additional variables (e.g., survey methodology, weather conditions etc.), a direct comparison between **Figures 5 to 8** and the density maps produced by RSK (**Annex 3; Figures 4 – 5**) is not possible.

Weather Conditions

3.4.9 BCT guidance (Collins, 2016) recommends activity surveys be carried out in the following conditions: temperature above 10 °C at sunset, and no rain or strong wind. For the purpose of this assessment,

strong wind is considered to be anything above 5 m/s. Suitable weather conditions were experienced for the majority of manual activity surveys conducted, with a single exception.

3.4.10 During the October manual activity survey at Transect 1, temperature at the commencement of the survey was noted to be below the recommended parameters; and due to poor weather conditions prevailing throughout the month of October optimal conditions not possible to achieve. However, the difficulty in undertaking baseline surveys within optimal conditions is both commonly experienced and acknowledged in BCT guidance for recording periods which form the start and end of the bat activity seasons (i.e., April and October). As such, it is sometimes necessary to undertake activity surveys during sub-optimal conditions (particularly in relation to early spring and late autumn periods, during which suboptimal conditions are not untypical). Consequently, whilst acknowledged, conditions have been considered during analysis and end conclusions, but are not considered to represent a significant constraint in relation to baseline activity recorded.

3.4.11 Additionally, during automatic activity surveys, weather conditions were deemed unsuitable on 5 out of a total of 28 nights. However, these conditions are not considered to be significantly impactful to bat activity, with activity being recorded consistently on each night sampled and included within analysis. A such, nights during which bats were recorded have been retained within analysis.

Sonogram Analysis

3.4.12 Analysing bat sonograms using Kaleidoscope can often clearly identify certain species. However, some genus groups (such as *Myotis spp. and Nyctalus spp.*) can be difficult to determine the specific species due to their similar styles of calls. In addition, it can be difficult to determine species or even genus in some circumstances, due to partial calls being heard or due to distortion from, for example passing cars, rain or wind. In cases when it is not possible to identify a bat call to genus, it is labelled as an unknown bat. If the genus can be identified but not the species, the call is labelled by the genus group only.

3.4.13 The detectability of some bat species, such as brown long-eared bat, is lower than that of, for example, noctule and pipistrelle species. The echolocation calls of brown long-eared bats are comparatively more difficult to detect with bat detectors, and their particular hunting strategies take them into less open habitats, where survey transect routes may not venture. Careful interpretation has been applied when comparing survey results across species.

3.4.14 It should also be noted that physical and environmental factors as well as a bat's age, sex or behaviour can all influence the echolocation calls (e.g., a social call of a soprano pipistrelle has been known to display similar characteristics to a low clarity noctule call).

3.4.15 Therefore, professional judgement has been used and in some cases it is not possible to safely assign an individual bat call to a species. In cases when it is not possible to identify a bat call to genus, it is labelled as an unknown bat. If the genus can be identified but not the species, the call is labelled by the genus group only. The identification of those calls assigned to individual species is done so on the basis of judgement and experience.

4 RESULTS

4.1 Desk Study

Designated Sites

4.1.1 No statutory designated sites with qualifying bat interest are located within 2 km of the Main Development Area (extending to 30 km for internationally protected sites).

4.1.2 No non-statutory designated sites with qualifying bat interest are located within 2 km of the Main Development Area.

Species Records

RECORD

4.1.3 A total of three records relating to bats were returned by RECORD from within a 2 km radius of the Main Development Area, comprising noctule bat, common pipistrelle and pipistrelle sp. The closest record was of a single noctule bat casualty dated 2016, located approximately 0.80 km southeast of the Main Development Area. The common pipistrelle recorded was dated 2015, located approximately 1.46 km northeast of the Main Development Area, and related to an acoustic detection. The pipistrelle sp. record was dated 2017, located approximately 1.6 km south of the main Development Area, and related to a roost. No records were returned from directly within the Main Development Area.

MAGIC

4.1.4 A review of MAGIC identified four European Protected Species (EPS) mitigation licence records, granted in relation to bat roosts, from within a 2 km radius of the Main Development Area.

4.1.5 Records account for prior roost sites relating to two species overall, which included common pipistrelle and soprano pipistrelle.

4.1.1 EPS mitigation records identified are as follows:

- 2014-4899-EPS-MIT: damage and destruction of a roost (non-breeding) relating to common pipistrelle (active: 2014 – 2015).
- EPSM2010-2642: destruction of a roost (non-breeding) relating to soprano pipistrelle (active: 2011).
- 2017-30729-EPS-MIT: destruction of a roost (non-breeding) relating to soprano pipistrelle (active: 2017).
- 2017-30729-EPS-MIT-1: destruction of a roost (non-breeding) relating to soprano pipistrelle (active: 2017).

4.1.2 Of these EPS mitigation license records, both 2014-4899-EPS-MIT and EPSM2010-2642 are found adjacent/in close association with the Main Development Area boundary.

RSK Bat Activity Survey Report

4.1.3 Full methodologies and results of the RSK Biocensus bat activity survey undertaken of the Preliminary Site Boundary (see **ES Volume 3 Figure 7-2 Survey Areas**) are included in **Annex 3**. In summary, walked transect surveys sampling bat activity were carried out between May and October 2022, augmented by static bat detector surveys using automated units. At least five different species of bat were recorded during the seasonal transect surveys, in addition to Myotis species and Nyctalus species which were identified to genus only. Recorded calls included the following species; common pipistrelle, soprano pipistrelle, Nathusius' pipistrelle, noctule and serotine. Leisler's bat was also recorded during automated monitoring surveys.

UK Bat Species Range

4.1.4 In review of the UK Habitats Directive Article 17 Report *'Habitats Directive Report 2019: Species Conservation Status Assessments 2019'*, the Main Development Area is located within the known UK distribution range for the following bat species:

- Common pipistrelle;
- Soprano pipistrelle;
- Nathusius's pipistrelle;
- Noctule;
- Brown long-eared;
- Daubenton's bat;
- Brandt's bat;
- Whiskered bat; and,
- Natterer's bat.

4.2 Habitat Suitability Assessment

4.2.1 The Main Development Area is noted to primarily consist of open habitat types of varying quality, in addition to linear features (i.e., hedgerows, tree lines and ditches) which function as both boundary features and edge habitats. Small areas of dense and scattered scrub are also present, in addition to wetland features such as reedbeds and areas of standing open water. As such, habitats present provide a variety of niches suitable for both open and edge space foraging species, although closed habitat is notably sparse.

4.2.2 Specifically, foraging habitat which accommodates local species of varying guild types is distributed across the Main Development Area and is largely continuous. Edge habitat and linear features are both extensive and intact, and provide both foraging opportunities and connectivity to additional resources both within and surrounding the Main Development Area. Open habitat is variable, ranging from neutral to mesotrophic grassland and areas of standing water and associated habitat features (i.e., reedbed), but also includes less-suitable areas of arable land and modified grassland. Whilst linear habitat features and scrub parcels are favorable across the Main Development Area, open habitat appears to be of reduced suitability for foraging bats.

4.2.3 Additionally, the local landscape adjacent to the Main Development Area provides generally favorable habitat opportunities, offering both natural and urban habitats which are likely to support foraging and roosting features, as well as being well connected given the abundance of commuting features present (e.g., blue corridors such as the River Mersey, River Weaver and local canals). However, the presence of the M56 to the south and Elton village and Ellesmere Port to the west, likely pose a barrier for commuting bats to/from the wider landscape.

4.2.4 Due to the large size of the Main Development Area and the variety of habitats present, the Main Development Area has been separated by habitats of 'high', 'moderate', 'low' and 'negligible' suitability for foraging and commuting bats (see **Figure 4**). Linear features within the Main Development Area, such as hedgerows, tree lines, field margins, ditches and watercourses offer the most favourable habitats for foraging/commuting bats; these habitats fit the description most closely for land of 'moderate' interest for foraging and commuting bats in accordance with BCT Guidance (Collins, 2016), with continuous habitat connected to the wider landscape that bats could use for foraging and commuting.

4.2.5 Whereas the fields, comprising mostly arable and grazed pasture, which the Main Development Area is dominated by, offer poor quality habitats for foraging and commuting bats. The western section of the SADA, partially below the Frodsham Wind Farm, is considered to have very low potential to support foraging and commuting bats as it comprises predominantly large, improved fields which are intensively grazed by cattle and sheep. These habitats fit the description most closely for land of 'low' interest for foraging and commuting bats, with habitats that could be used by small numbers of foraging/commuting bats.

4.3 Manual Activity Surveys

4.3.1 A summary of bat activity metrics per transect are presented in **Tables 4-1 – 4-2**, whilst a summary of call registrations per segment for each transect are presented in **Tables 4-3 – 4-4**. Additionally, a summary of recorded species distribution for the combined manual activity survey effort is presented in **Figure 3a** (Transect 1) and **Figure 3b** (Transect 2).

Species Presence & Distribution

4.3.2 A minimum of five species have been recorded within the Main Development Area during manual transects, which included common pipistrelle, soprano pipistrelle, noctule, brown long-eared and Myotis bat species.

4.3.3 Recorded distribution during transects varied; common pipistrelle, soprano pipistrelle and noctule bats were noted to have been consistently detected between T1 and T2. However, recorded Myotis species activity was limited to T2, and brown long-eared bat activity to T1. Likewise, recorded distribution per transect segment showed variation between location and transect month (**Table 4-3 – 4-4; Figure 3a** (Transect 1) and **Figure 3b** (Transect 2)).

4.3.4 Species detected during manual transects showed seasonal variation (**Table 4-1 – 4-2**), with common pipistrelle and soprano pipistrelle being the most consistently recorded species between transects (with the exception of T2 during November). Noctule activity was noted to be limited to August in relation to T1, but was consistently recorded across months relative to T2 (with the exception of November). Notably, brown long-eared activity was detected solely during September (T1), whilst Myotis recordings were limited to July and September (T2).

4.3.5 **Figures 5 to 8** illustrate the density of bat activity in the form of heat maps of the total number of bat passes (i.e. for all species combined) recorded per minute along the transect routes, per survey visit

4.3.6 Whilst some variation is evident, frequency of combined activity for T1 was generally higher between LP7 and W9 in association with scrub/linear habitat and riparian features, apart from the September transect (**Figures 5 to 8**).

4.3.7 Whilst more variable, frequency of combined activity for T2 was broadly higher along linear features which formed western boundary of the transect route (i.e., hedgerows and wet ditches), and along the northern boundary (i.e., riparian adjacent areas) (**Figures 5 to 8**).

Bat Activity Levels

4.3.8 Spatially, activity levels for the overall bat assemblages recorded per transect, over the combined survey period, were noted to be higher at T1 (BAI: 32.82 passes per hour) compared to T2 (BAI: 23.53) (**Table 4-1 – 4-2**)

4.3.9 Additionally, seasonal activity levels per transect for the overall bat assemblage recorded were noted to be relatively higher during the August period, and comparably lowest during September and October in relation to T1, and November relative to T2.

4.3.10 In general, soprano pipistrelle accounted for the highest activity levels over T1 (although absent during the October transect), whilst common pipistrelle was noted to account for the highest activity levels over T2 (**Table 4-1 – 4-2**). Additional species (when recorded) were noted to account for relatively low activity in comparison (**Table 4-1 – 4-2**).

4.3.11 Moreover, in considering individual LPs and walked areas at T1, overall activity appears to be relatively higher in relation to edge habitat associated with linear features, but greatest in association with riparian features (e.g., LP8-W9) (**Table 4-3; Figure 3a**).

4.3.12 Likewise, whilst activity varies between segments, overall bat activity at T2 was broadly higher in relation to areas of mature hedge/ linear features, but also greatest in association with riparian features (e.g., W6-W7) (**Table 4-4; Figure 3b**).

4.3.13 Regarding observed activity, both foraging and commuting activity relating to three species (i.e., common pipistrelle, soprano pipistrelle and noctule) was observed between transects; with observed behaviour primarily associated with linear features (i.e., hedgerows and/or wet ditches) or riparian edge habitats (**Figure 3a** (Transect 1) and **Figure 3b** (Transect 2)).

Table 4-1: Summary of Bat Activity Metrics Per Monthly Transect Relative to Transect 1 (T1)

Transect Period	Species Recorded	T1: Bat Activity Metrics			Recording Hours
		No. Passes	Percentage (%)	BAI	
July	Common pipistrelle	48	49.48	27.43	1.75
	Soprano pipistrelle	49	50.52	28.00	
	Total	97	100%	55.43	
August	Common pipistrelle	59	35.33	33.71	1.75
	Soprano pipistrelle	106	63.47	60.57	
	Noctule	2	1.20	1.14	
	Total	167	100%	95.43	
September	Common pipistrelle	2	33.33	1.14	1.75
	Soprano pipistrelle	3	50.00	1.71	
	Brown long-eared	1	16.67	0.57	
	Total	7	100%	3.43	
October (Dusk)	Common pipistrelle	1	14.29	0.57	1.75
	Soprano pipistrelle	6	85.71	3.43	
	Total	7	100%	4.00	
October (Dawn)	Common pipistrelle	2	100%	1.33	1.5
	Total				
Overall Total		279	100%	32.82	8.5

Table 4-2: Summary of Bat Activity Metrics Per Monthly Transect Relative to Transect 2 (T2)

Transect Period	Species Recorded	T2: Bat Activity Metrics			Recording Hours
		No. Passes	Percentage (%)	BAI	
July	Common pipistrelle	65	71.43	32.50	2
	Soprano pipistrelle	22	24.18	11.00	
	Myotis	3	3.30	1.50	
	Noctule	1	1.10	0.50	
	Total	91	100%	45.50	
August	Common pipistrelle	51	38.35	18.55	2.75
	Soprano pipistrelle	77	57.89	28.00	
	Noctule	5	3.76	1.82	
	Total	133	100%	48.36	
September	Common pipistrelle	16	55.17	5.82	2.75
	Soprano pipistrelle	3	10.34	1.09	
	Myotis	9	31.03	3.27	
	Noctule	1	3.45	0.36	
	Total	29	100%	10.55	
October* (Dusk)	**Total**	0	N/A	0.00	3.25
October (Dawn)	**Total**	N/A	N/A	N/A	N/A
Overall Total		253	100%	23.53	10.75

*Undertaken on 1st November 2023

Table 4-3: A Summary of Bat Passes Recorded Per Listening Point (LP) and Walked Segment (W) Per Monthly Transect for Transect 1 (T1)

Month	Species*	T1: Passes per Transect Segment (LP/W)														Total
		LP1	W1	LP2	W2	LP3	W6	LP7	W7	LP8	W8	LP9	W9	LP10	W10	
July	CPIP	0	0	0	0	0	8	7	5	10	3	2	6	5	2	48
	SPIP	0	0	0	0	0	3	7	5	3	12	16	2	0	1	49
	Total	0	0	0	0	0	11	14	10	13	15	18	8	5	3	97
August	CPIP	4	5	17	6	0	0	0	0	2	9	3	6	7	0	59
	SPIP	0	2	0	0	0	0	0	0	2	32	23	34	2	3	106
	NYNO	1	0	1	0	0	0	0	0	0	0	0	0	0	0	2
	Total	5	7	18	14	0	0	0	0	4	41	26	40	9	3	167
September	CPIP	2	0	0	0	0	0	0	0	0	0	0	0	0	0	2
	SPIP	1	0	0	0	0	0	0	0	0	0	0	1	0	1	3
	BLE	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
	Total	3	0	0	0	0	1	0	0	1	0	0	1	0	1	7
October (Dusk)	CPIP	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
	SPIP	0	0	0	0	0	0	0	6	0	0	0	0	0	0	6
October (Dawn)	CPIP	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
	Total	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
Overall Total		8	7	18	14	8	11	14	17	18	57	44	49	15	7	279

*Key: CPIP: Common pipistrelle, SPIP: Soprano pipistrelle, NYNO: Noctule bat and BLE: Brown long-eared bat

Table 4-4: A Summary of Bat Passes Recorded Per Listening Point (LP) and Walked Segment (W) Per Monthly Transect for Transect 2 (T2)

Month	Species*	T2: Passes per Transect Segment (LP/W)																						Total
		LP1	W1	LP2	W2	LP3	W3	LP4	W4	LP5	W5	LP6	W6	LP7	W7a	W7	LP8	W8	LP9	W9	LP10	W10	LP11	W11	
July	CPIP	0	0	0	5	0	4	2	6	0	10	10	7	6	15	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	65
	SPIP	0	0	0	0	0	1	2	6	0	3	0	5	3	2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	22
	MYO	0	0	0	1	0	2	0	0	0	0	0	0	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	3
	NYNO	0	0	0	0	0	0	0	0	0	1	0	0	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1
	Total	0	0	0	6	0	7	4	12	0	14	10	12	9	17	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	91
August	CPIP	0	4	3	4	3	2	1	0	1	5	2	17	1	N/A	5	3	0	0	0	0	0	0	0	51
	SPIP	1	1	1	0	0	0	1	0	1	7	0	29	14	N/A	21	1	0	0	0	0	0	0	0	77
	NYNO	0	0	0	0	0	0	2	0	0	1	0	0	1	N/A	1	0	0	0	0	0	0	0	0	5
	Total	1	5	4	4	3	2	4	0	2	13	2	46	16	N/A	27	4	0	0	0	0	0	0	0	133
September	CPIP	8	0	2	0	0	4	0	0	0	0	0	0	0	N/A	0	0	1	0	1	0	0	0	0	16
	SPIP	0	0	3	0	0	0	0	0	0	0	0	0	0	N/A	0	0	0	0	0	0	0	0	0	3
	NYNO	0	1	5	0	0	0	0	1	0	0	1	0	0	N/A	0	0	0	1	0	0	0	0	0	9
	MYO	0	0	0	0	0	0	0	1	0	0	0	0	0	N/A	0	0	0	0	0	0	0	0	0	1
	Total	8	1	10	0	0	4	0	2	0	0	1	0	0	N/A	0	0	1	1	1	0	0	0	0	29
October (Dusk)**	Total	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	0	0	0	0	0	0	0	0	0	0
Overall Total		9	6	14	10	3	13	8	14	2	27	13	58	25	17	27	4	1	1	1	0	0	0	0	253

*Key: CPIP: Common pipistrelle, SPIP: Soprano pipistrelle, MYO: Myotis and NYNO: Noctule bat.

**Undertaken on 1st November 2023.

4.4 Automatic Activity Surveys

Species Assemblage Overview

4.4.1 Bats were detected on 28 nights (over a total sample period of 28 nights) between three monitoring stations (i.e., **MS1-3**) deployed monthly July - October recording periods. MS locations are described in **Table 3-2** and presented on **Figure 2.**

4.4.2 Throughout each recording period, bat calls indicative of a minimum of six species/genus were detected, accounting for a total of 6,266 call registrations (i.e., passes). **Table 4-5** summarises the overall number of passes recorded (per species/genus) throughout the combined survey periods, as well as the percentage of overall activity and BAI attributed to each species/genus.

4.4.3 Overall, common pipistrelle accounted for the highest number of passes detected within the Main Development Area throughout the overall survey period (i.e., 3,417 passes), accounting for 54.53% of total bat passes. Likewise, common pipistrelle accounted for the highest activity rates over the combined survey effort relative to other species detected, equating to a BAI of 3.85 passes per hour.

4.4.4 Each additional species detected comprised a relatively smaller proportion of total bat passes, with soprano pipistrelle being the second most frequently recorded species (35.11%), followed by Myotis spp. (7.48%) and noctule (1.99%). Brown long-eared and Nathusius' pipistrelle accounted for the fewest number of passes, each accounting for < 1% of total call registrations.

4.4.5 In considering recorded bat passes relative to survey effort, overall bat activity reflected recorded passes/percentage of call registrations per species; whilst common and soprano pipistrelle accounted for the majority of activity recorded within the Main Development Area, the remaining species each represented relatively low activity, with each species accounting for an overall BAI of < 1 per hour.

4.4.6 Overall, when accounting for the overall assemblage activity recorded across the combined survey effort, collective bat activity across the Main Development Area equated to a BAI of 7.06 passes per hour.

Table 4-5: Bat Activity Metrics for the Overall Survey Effort, Per Species[18]

Species	Total No. Passes	Percentage of Total (%)	Overall BAI
Common pipistrelle	3417	54.53	3.85
Soprano pipistrelle	2200	35.11	2.48
Myotis spp.	469	7.48	0.53
Noctule	125	1.99	0.14
Nathusius' pipistrelle	32	0.51	0.04
Brown long-eared	22	0.35	0.02
Total	**6266**	**100%**	**7.06**

[18] The 'total' percentage may be slightly above 100% due to rounding of the percentages per species.

Monitoring Station Overview

4.4.7 **Table 4-6** summarises the total BAI (per species) recorded at each individual monitoring station (i.e., **MS1-MS3**).

4.4.8 Of the six species/genus recorded during automated activity surveys, each species/genus was detected between MS1-MS3 for a minimum of one recording period, indicating the presence of the recorded species assemblage across within the Main Development Area. However, species presence/absence per location does show variation between recording periods and is not noted to be consistent for the majority of species across the combined survey effort (see **Table 4-8 – 4-13**).

4.4.9 Of the monitoring stations deployed, **MS1** recorded the highest rates of overall bat activity detected within the Main Development Area, accounting for a BAI of 8.04 passes per hour. **MS2** (BAI: 6.61 passes per hour) featured the second highest activity rates, followed by **MS3** (BAI: 6.42 passes per hour), although both monitoring stations were relatively comparable.

4.4.10 In general, overall bat activity rates for each species per detector were relatively consistent and reflected overall metrics (**Table 4-5**), with common pipistrelle and soprano pipistrelle having the highest and second-highest BAI rates between detectors, followed by Myotis species, noctule, Nathusius' pipistrelle and brown long-eared bat, respectively.

4.4.11 However, overall bat activity rates per species at MS3 were noted to show some variation, with noctule activity shown to be higher than that of Myotis species, as was brown long-eared activity relative to Nathusius' pipistrelle (although variation was minimal, with each species accounting for < 0.1 passes per hour).

4.4.12 Overall bat activity per species between monitoring stations was noted to broadly follow similar trends to overall assemblage activity, with activity generally being higher at MS1, followed by MS2 and MS3, in relation to common pipistrelle, noctule and Myotis species. However, outstanding species showed variation in overall BAI between locations (i.e., soprano pipistrelle and brown long-eared).

Table 4-6: A Summary of Overall BAI Per Monitoring Period (Per Species)

Species	Monitoring Stations (BAI)			Total BAI. (Per Species)
	MS1	MS2	MS3	
Common pipistrelle	4.81	3.44	3.19	3.85
Soprano pipistrelle	1.76	2.69	3.05	2.48
Noctule	0.19	0.15	0.08	0.14
Myotis	1.23	0.24	0.06	0.53
Brown long-eared	0.02	0.03	0.03	0.02
Nathusius' pipsitrelle	0.03	0.06	0.02	0.04
Total BAI (Per MS)	**8.04**	**6.61**	**6.42**	7.06

Monthly Overview

4.4.13 **Table 4-7** presents the total BAI (per species) recorded between detectors each monthly recording period ranging from July - October 2023.

4.4.14 Most species were noted to have been detected consistently across the Main Development Area between sampled months, except for brown long-eared bat being absent during the July recording period.

4.4.15 Overall bat activity for the combined assemblage was noted to peak during the August recording period (BAI: 15.16 passes per hour) and was preceded by July (BAI: 12.02 passes per hour). BAI decreased during September (6.98 passes per hour) and was noted to be lowest during October (BAI: 0.77 passes per hour).

4.4.16 However, overall bat activity rates per month, for each individual species, showed variation (**Table 4-7**). In general, bat activity per species tended to peak during August (i.e., common pipistrelle and noctule), during September (i.e., Myotis species and brown long-eared bat), or remain consistent between both (i.e., Nathusius' pipistrelle). The singular exception relative to other species was soprano pipistrelle, which featured relatively higher activity during the July recording period (although this was also comparable with activity levels recorded during August).

4.4.17 Generally, overall bat activity rates for each species per recording month were relatively consistent and also reflected overall metrics (**Table 4-5**), with common pipistrelle and soprano pipistrelle having the highest and second-highest BAI rates between recording periods, followed by Myotis species, noctule, Nathusius' pipistrelle and brown long-eared bat, respectively.

4.4.18 However, bat activity per recording period was noted to show variation between individual species at each monitoring station (see **Tables 4-8 – 4-13**).

4.4.19 Overall bat activity per species, between recording periods, was noted to follow similar trends to assemblage activity in relation to common pipistrelle and noctule bat (with soprano pipistrelle being broadly comparable, with similar activity noted between July and August).

4.4.20 However, outstanding species (i.e., Myotis species, brown long-eared and Nathusius' pipistrelle) showed variation in overall activity between monthly recording periods, relative to overall assemblage activity (**Table 4-5**).

Table 4-7: A Summary of Overall BAI Per Recording Period (Per Species)

Species	Recording Period (BAI)				Total BAI (per Species)
	July	August	September	October	
Common pipistrelle	6.51	9.17	3.31	0.24	3.85
Soprano pipistrelle	4.98	4.89	2.32	0.45	2.48
Noctule	0.32	0.44	0.02	0.01	0.14
Myotis spp.	0.20	0.60	1.25	0.02	0.53
Brown long-eared	0.00	0.01	0.04	0.03	0.02
Nathusius' pipistrelle	0.01	0.05	0.05	0.02	0.04
Total BAI (Per Recording Period)	12.02	15.16	6.98	0.77	7.06

Species Overview

Common pipistrelle

4.4.21 Common pipistrelle was the most frequently recorded species within the Main Development Area, accounting for 54.53% of total call registrations (reflected by an overall BAI of 3.85 passes per hour for the combined survey period). A BAI summary of common pipistrelle calls (i.e., registered passes per hour) for individual monitoring stations across the Main Development Area, and per recording period, is presented in **Table 4-8**.

4.4.22 Common pipistrelle was also noted to have been recorded consistently at each monitoring station during each recording period, with activity reflecting generally assemblage trends relative to both location and recording periods (**Table 4-6 – 4-7**).

4.4.23 Overall common pipistrelle activity was noted to be highest at MS1 (BAI: 4.81 passes per hour), with peak activity being recorded during the August period (BAI: 10.01 passes per hour). Activity was relatively lower at MS2 (BAI: 3.44 passes per hour), and lowest at MS3 (BAI: 3.19 passes per hour), although relatively comparable.

4.4.24 Per month, overall activity was also noted to be highest for common pipistrelle during August (BAI: 9.17 passes per hour). Overall activity was noted to be lowest in October (BAI: 0.24 passes per hour), most notably at MS1 (BAI: 0.07 passes per hour).

4.4.25 Although activity per monitoring station did show some variation between recording periods in comparison to overall trends, it was generally observed to be highest during August and July per monitoring station respectively (following observed overall trends).

Table 4-8: A Summary of Common Pipistrelle BAI (Passes Per Hour) for Each Recording Period, Per MS

Monitoring Station	Recording Period per MS (BAI)				Overall BAI (per MS)
	July	August	September	October	
MS1	5.86	10.01	6.19	0.07	4.81
MS2	7.66	9.37	1.67	0.20	3.44
MS3	6.77	8.14	2.06	0.46	3.19
Overall BAI (per Month)	6.51	9.17	3.31	0.24	3.85

Soprano pipistrelle

4.4.26 Soprano pipistrelle was the second most frequently recorded species within the Main Development Area, accounting for 35.11% of total call registrations (and an overall BAI of 2.48 passes per hour throughout the combined survey period). A BAI summary of soprano pipistrelle calls for individual monitoring stations across Main Development Area, and during individual recording periods, is presented in **Table 4-9.**

4.4.27 Soprano pipistrelle was also noted to have been recorded consistently at each monitoring station during each recording period. However, activity showed variation in comparison to general assemblage trends relative to both location and recording periods (**Table 4-6 – 4-7**).

4.4.28 Overall soprano pipistrelle activity between detectors was noted to be highest at MS3 (BAI: 3.05 passes per hour), although peak activity was noted to have been recorded at MS2 during the July recording period (BAI: 9.03 passes per hour). MS2 featured the second highest activity levels (BAI: 2.69 passes per hour), followed by MS1 (BAI: 1.76 passes per hour).

4.4.29 Overall monthly activity was comparable between July and August recording periods, each accounting for just < 4 passes per hour; however, activity was noted to be relatively higher during July (BAI: 4.98 passes per hour). Comparably, overall soprano activity decreased during September and October recording periods (BAI: 2.32 and 0.45 passes per hour, respectively).

4.4.30 However, at individual locations per recording period, variation in activity was evident, with no single location maintaining consistent peak trends per recording period (**Table 4-9**).

Table 4-9: A Summary of Soprano Pipistrelle BAI (Passes Per Hour) for Each Recording Period, Per MS

Monitoring Station	Recording Period per MS (BAI)				Overall BAI (per MS)
	July	August	September	October	
MS1	1.82	2.36	3.33	0.17	1.76
MS2	9.03	4.46	2.90	0.11	2.69
MS3	8.45	7.84	0.73	1.07	3.05
Overall BAI (per Month)	4.98	4.89	2.32	0.45	2.48

Noctule

4.4.31 Noctule was the fourth most frequently recorded species within the Main Development Area, accounting for 1.99% of total call registrations (and an overall BAI of 0.14. passes per hour throughout the combined survey period). A BAI summary of noctule calls for individual monitoring stations across Main Development Area, and during individual recording periods, is presented in **Table 4-10**.

4.4.32 Noctule presence was recorded within the Main Development Area across each recording period; however, presence/absences were noted to vary at individual monitoring stations, e.g., going unrecorded at MS3 during July, at MS2 during September, and MS1 and MS3 during October recording periods. However, overall activity was noted to reflect general assemblage trends relative to both location and recording periods (**Table 4-6 – 4-7**).

4.4.33 Overall noctule activity between monitoring locations was noted to be highest at MS1 (BAI: 0.19 passes per hour). However, whilst reduced, MS2 and MS3 recorded relatively similar activity levels (BAI: 0.15 and 0.08 passes per hour, respectively), each accounting for < 1 pass per hour.

4.4.34 Per month, overall activity was noted to be highest during the August recording period (BAI: 0.44 passes per hour), with peak activity recorded at MS1 (BAI: 0.56 passes per hour). Additional recording periods reflected overall Main Development Area trends, with activity noted to be second highest during July, and decreasing consecutively during September and October. However, overall activity was noted to be relatively similar between the monthly recording periods, each accounting for <1 pass per hour.

4.4.35 Noctule activity showed variation at individual locations per recording period, activity was noted to show variation relative to location across recording periods (e.g., activity at MS1 being comparably lower than MS2 during July and October), although monthly activity generally reflected Main Development Area trends being consistently highest during August etc.

Table 4-10: A Summary of Combined Noctule Species BAI (Calls Per Hour) for Each Recording Period, Per MS

Monitoring Station	Recording Period per MS (BAI)				Overall BAI (per MS)
	July	August	September	October	
MS1	0.36	0.56	0.05	0.00	0.19
MS2	0.43	0.46	0.00	0.02	0.15
MS3	0.00	0.30	0.01	0.00	0.08
Overall BAI (per Month)	0.32	0.44	0.02	0.01	0.14

Myotis species

4.4.36 Myotis species were the third most frequently recorded species detected within the Main Development Area, accounting for 7.48% of total call registrations (and an overall BAI of 0.53 passes per hour throughout the combined survey period). A BAI summary of Myotis species call registration for both individual monitoring stations, and during individual recording periods, is presented in **Table 4-11.**

4.4.37 Myotis species were recorded within the Main Development Area during each recording period across most locations, although undetected at MS3 during the September recording period. Additionally, Myotis species showed variation in overall activity trends relative to recording periods, but not relative to location (**Table 4-6 – 4-7**).

4.4.38 Overall Myotis activity per location was highest at MS1, (BAI: 1.23 passes per hour), and was notably highest during the September recording period (BAI: 3.30 passes per hour). Activity was relatively reduced at MS2 and MS3 (BAI: 0.24 and 0.06 passes per hour, respectively), although both locations were somewhat comparable, accounting for < 1 pass per hour.

4.4.39 Per month, overall activity was noted to be highest during the September recording period (BAI: 1.25 passes per hour). During the remaining recording periods, overall activity was relatively higher during August and July, and lowest during October (although each period was broadly comparable, accounting for < 1 pass per hour).

4.4.40 Myotis activity also showed variation at individual locations per recording period (**Table 4-11**), with no individual location maintaining consistent peak trends between recording periods, and no single recording month showing consistent peak activity between monitoring stations.

Table 4-11: A Summary of Myotis Species BAI (Calls Per Hour) for Each Recording Period, Per MS

Monitoring Station	Recording Period per MS (BAI)				Overall BAI (per MS)
	July	August	September	October	
MS1	0.04	1.45	3.30	0.01	1.23
MS2	0.39	0.31	0.45	0.01	0.24
MS3	0.52	0.06	0.00	0.04	0.06
Overall BAI (per Month)	0.20	0.60	1.25	0.02	0.53

Brown long-eared bat

4.4.41 Brown long-eared bat was the least recorded species within the Main Development Area, accounting for 0.35% of total call registrations (and an overall BAI of 0.02 passes per hour throughout the combined survey period). A BAI summary of brown long-eared bat calls for individual monitoring stations, and during individual recording periods, is presented in **Table 4-12**.

4.4.42 Brown long-eared bat was not recorded consistently within the Main Development Area during survey efforts, being notably absent during July. However, activity was recorded within the Main Development Area during each additional recording period per monitoring location (with the exception of MS3 during the September). However, brown long-eared also showed variation in activity trends in comparison to overall assemblage activity relative to both recording period and location (**Table 4-6 – 4-7**).

4.4.43 Overall brown long-eared bat activity per location was noted to be relatively comparable between locations, with each accounting for a BAI of < 1 pass per hour. However, activity was noted to slightly higher at MS2 and MS3 (BAI: 0.03 passes per hour, respectively), most notably at MS2 during the September recording period (BAI: 0.08 passes per hour).

4.4.44 Per month, activity was also noted to be relatively comparable between recording periods; whilst unrecorded during July, overall BAI accounted for < 1 pass per hour between August - October. However, activity was noted to be slightly higher during September (BAI: 0.04 passes per hour).

4.4.45 Brown long-eared bat activity showed variation at individual locations per recording period, with no individual location maintaining consistent peak trends between recording periods, and no single recording month showing consistent peak activity across detectors. However, activity was noted to be relatively comparable across detectors per recording period, each accounting for < 1 pass per hour.

Table 4-12: A Summary of Brown Long-Eared Bat BAI (Calls Per Hour) for Each Recording Period, Per MS

Monitoring Station	Recording Period per MS (BAI)				Overall BAI (per MS)
	July	August	September	October	
MS1	0.00	0.01	0.02	0.02	0.02
MS2	0.00	0.01	0.08	0.01	0.03
MS3	0.00	0.01	0.00	0.06	0.03
Overall BAI (per Month)	0.00	0.01	0.04	0.03	0.02

Nathusius' pipistrelle

4.4.46 Nathusius' pipistrelle was the fifth most frequently recorded species within the Main Development Area, accounting for 0.51% of total call registrations (and an overall BAI of 0.04 passes per hour throughout the combined survey period). A BAI summary of bat calls for individual monitoring stations, and during individual recording periods, is presented in **Table 4-13**.

4.4.47 Nathusius' pipistrelle presence was detected within the Main Development Area across each recording period; however, presence/absences was noted to vary at individual monitoring stations between months, being absent from MS1 and MS2 during July, and MS1 and MS3 during October. Nathusius' pipistrelle also showed variation in in comparison to overall assemblage activity relative to both recording period and location (**Table 4-6 – 4-7)**.

4.4.48 Overall Nathusius' pipistrelle activity was comparable between monitoring stations, each of which accounted for < 1 pass per hour. However, whilst overall activity was noted to be relatively higher at MS2 (BAI: 0.06 passes per hour), peak activity was similar between detectors (i.e., BAI: 0.07 passes per hour), although variable by month (i.e., peak activity was recorded during August at MS3, but during September at MS1 and MS2 . Relatively, activity was lowest at MS3 (BAI: 0.02 passes per hour).

4.4.49 Per month, overall activity was also noted to be comparable between recording periods, with BAI accounting for < 1 pass per hour. However, overall activity was noted to be slightly higher during August and September recording periods (BAI: 0.05 passes per hour, respectively). Likewise, activity was noted to be comparably reduced between July and October recording periods (BAI: ≤ 0.02 passes per hour), with both periods noted for absences at individual monitoring stations.

4.4.50 Additionally, Nathusius' pipistrelle activity showed variation at individual locations per recording period, with no individual location maintaining consistent peak trends between recording periods, and no single recording month showing consistent peak activity across monitoring stations (**Table 4-13**). However, activity was noted to be relatively comparable across detectors per recording period, each accounting for < 1 pass per hour.

Table 4-13: A Summary of Nathusius' Pipistrelle BAI (Calls Per Hour) for Each Recording Period, per MS

Monitoring Station	Recording Period per MS(BAI)				Overall BAI (per MS)
	July	August	September	October	
MS1	0.00	0.04	0.07	0.00	0.03
MS2	0.00	0.04	0.07	0.06	0.06
MS3	0.06	0.07	0.01	0.00	0.02
Overall BAI (per Month)	0.01	0.05	0.05	0.02	0.04

5 SUMMARY

5.1 Manual Activity Transects

5.1.1 Bat activity was recorded within the Main Development Area during manual activity transects conducted between July and October (with the exception of the October survey of Transect 2 being delayed to 1st November 2023). Activity varied between months, and was notably lower during autumn surveys.

5.1.2 Transect 2 was undertaken on the 1st November 2023, due to access constraints due to poor ground conditions from adverse weather . Whilst a limitation in being in slight excess of the monthly timeframe for an October transect (as per BCT guidelines) the transect is comparable to typical bat activity levels in late October, at the closing stages of the commonly accepted bat activity season. As such, little to no bat activity is likely a consequence of coinciding with the hibernation period.

5.1.3 A minimum of five bat species were recorded during manual activity transects, which included common pipistrelle, soprano pipistrelle, noctule, Myotis species and brown long-eared bat. However, observed activity was limited to common and soprano pipistrelle, and noctule bat.

5.1.4 Common pipistrelle, soprano pipistrelle and noctule activity was recorded consistently between both transects. Conversely, brown long-eared and Myotis activity was limited to Transect 1 and Transect 2, respectively.

5.1.5 Generally, soprano pipistrelle was noted to be the most frequently recorded species in relation to surveys undertaken at Transect 1 (with some minor exceptions), whilst common pipistrelle was generally more frequently recorded relative to Transect 2.

5.1.6 Additionally, overall recorded passes were noted to higher in relation to Transect 1 (279 passes), as was bat activity relative to survey effort was (BAI: 32.82 passes per hour).

5.1.7 From the data collected activity across transects was noted to peak consistently during August, followed by activity during July. Activity was then noted to decrease relative to the summer period, but varied between transects during September and October/November.

5.1.8 Bat passes and observed activity were noted to have been most frequently recorded in association with linear features and edge habitats between transects, with areas in association with riparian habitat being indicative of the highest bat activity levels.

5.2 Automatic Activity Surveys

5.2.1 Bat activity was recorded within the Main Development Area during each recording period surveyed to date (i.e., July – October) at each MS deployed (i.e., MS1-MS3). Overall, a minimum of six species have been detected within the Main Development Area during automated activity surveys, which include: common pipistrelle, soprano pipistrelle, noctule, Myotis species, brown long-eared and Nathusius' pipistrelle.

5.2.2 Presence and distribution of species recorded within the Main Development Area were generally consistent across locations, with the majority of species being detected at each monitoring station

over the combined survey effort; however, brown long-eared bat was notably undetected across monitoring stations during the July recording period.

5.2.3 Additionally, whilst common and soprano pipistrelle were consistently recorded at each monitoring station during individual recording periods (i.e., July-October), additional species were noted to be absent during from some monitoring stations during specific recording periods.

5.2.4 Spatially, bat activity was notably higher at MS1, and relatively comparable between MS2 and MS3. MS1 was notably for being located within other neutral grassland pasture featuring scattered rushes, and in association with mature native hedge lines, and in relative proximity to standing open water (i.e., wet ditch). Comparably, MS2 occupied a mosaic area of neutral grassland and forbs, with scattered scrub, trees and rushes, and in relative proximity to local linear features associated with MS1 (i.e., hedgerows and standing open water). Conversely, whilst placed along a native hedgerow and associated ditch, MS3 was also placed within an area of cereal crop, and differed in its open habitat quality relative to MS1 and MS2.

5.2.5 Per month, overall activity was noted to peak during the August recording period, followed by activity in July, with activity noted to decrease consecutively between September and October.

5.2.6 Overall, combined bat assemblage activity within the Main Development Area for the overall survey effort equated to a BAI of 7.06 passes per hour, with common pipistrelle accounting for the highest level of individual species activity, equating to a BAI of 3.85 passes per hour.

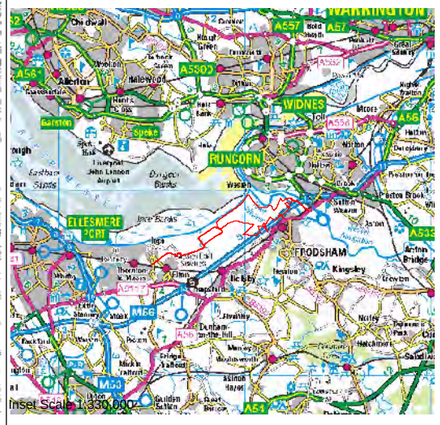
Order Limits

Preliminary Site Boundary

Main Development Area

Bat Activity Survey (RSK Biocensus 2022)

Bat Activity Survey (Avian Ecology 2023)



Cubico
SUSTAINABLE INVESTMENTS

0344 8700 007

axis.co.uk

axis

Project

FRODSHAM SOLAR ENVIRONMENTAL STATEMENT

Figure Number

1

Figure Title

Survey Areas (Bat Activity Surveys)

Scale

1:26000@A3

Date

May 2025

N

0 2

kilometers

Order Limits

Main Development Area

Bat Activity Survey

Static Detector (MS*)

Transect Route

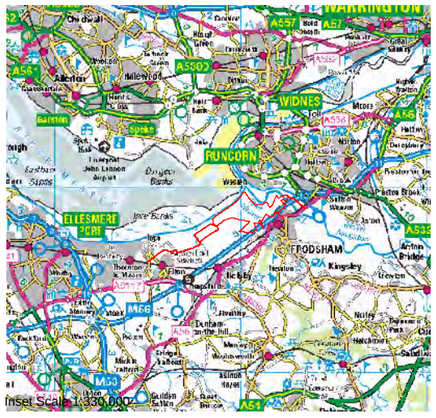
Transect 1

Transect 2

Listening Point

Transect 1

Transect 2



Cubico SUSTAINABLE INVESTMENTS

0344 8700 007

axis.co.uk

axis

Project

FRODSHAM SOLAR ENVIRONMENTAL STATEMENT

Figure Number

2

Figure Title

Bat Activity Plan

Scale

1:7000@A3

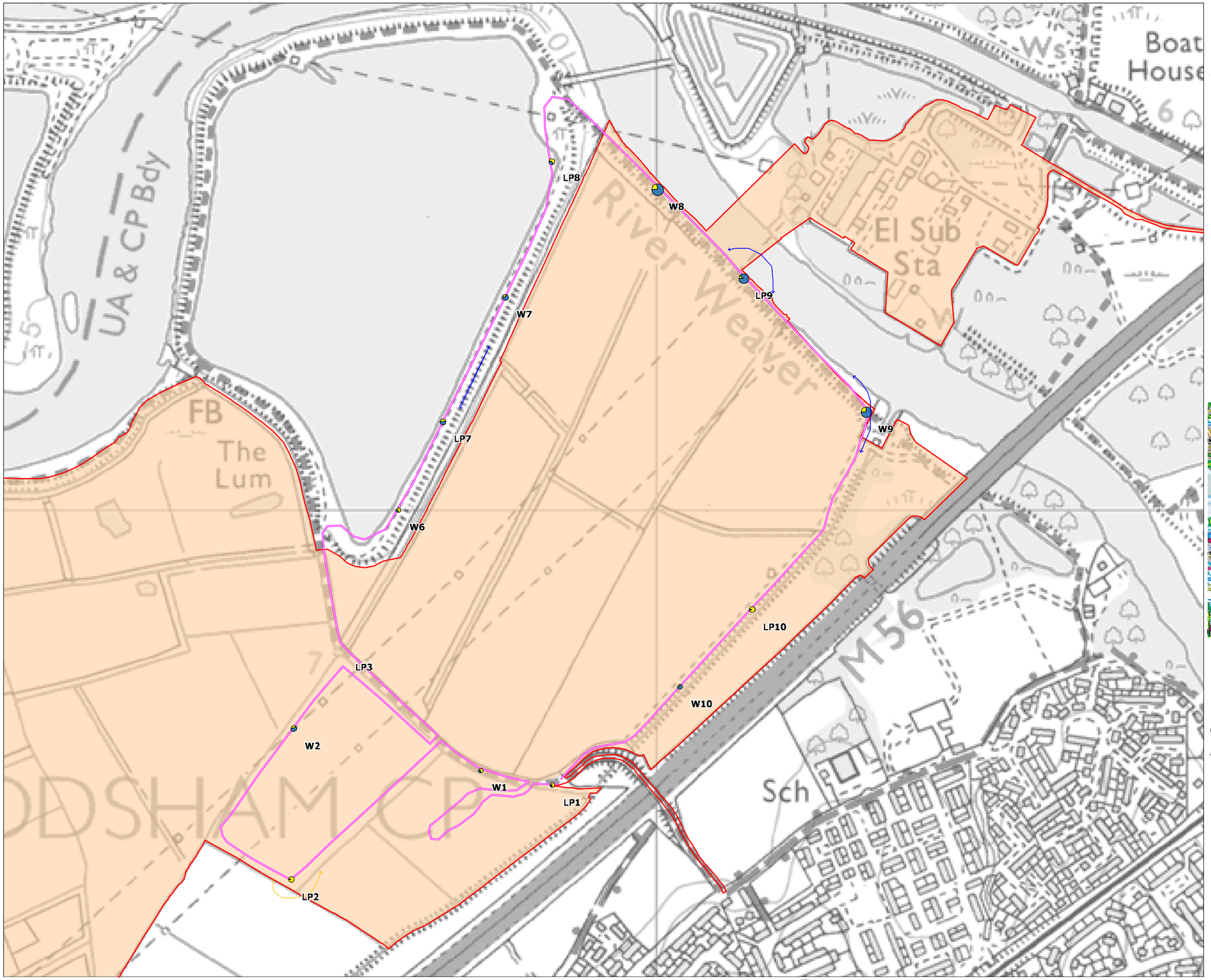
Date

May 2025

N

0 500

meters



Order Limits

Main Development Area

Transect Route

Transect 1

Bat Call Activity

57
28.5
5.7

Common pipistrelle

Soprano pipistrelle

Myotis sp.

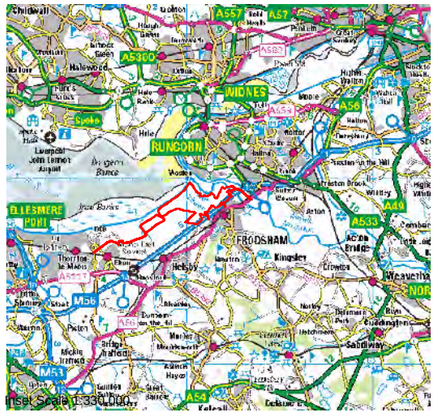
Noctule

Brown long-eared

Bat Flight Activity

Common pipistrelle

Soprano pipistrelle



Inset Scale 1:330,000

Cubico SUSTAINABLE INVESTMENTS

0344 8700 007

axis.co.uk

axis

Project

FRODSHAM SOLAR ENVIRONMENTAL STATEMENT

Figure Number

3a

Figure Title

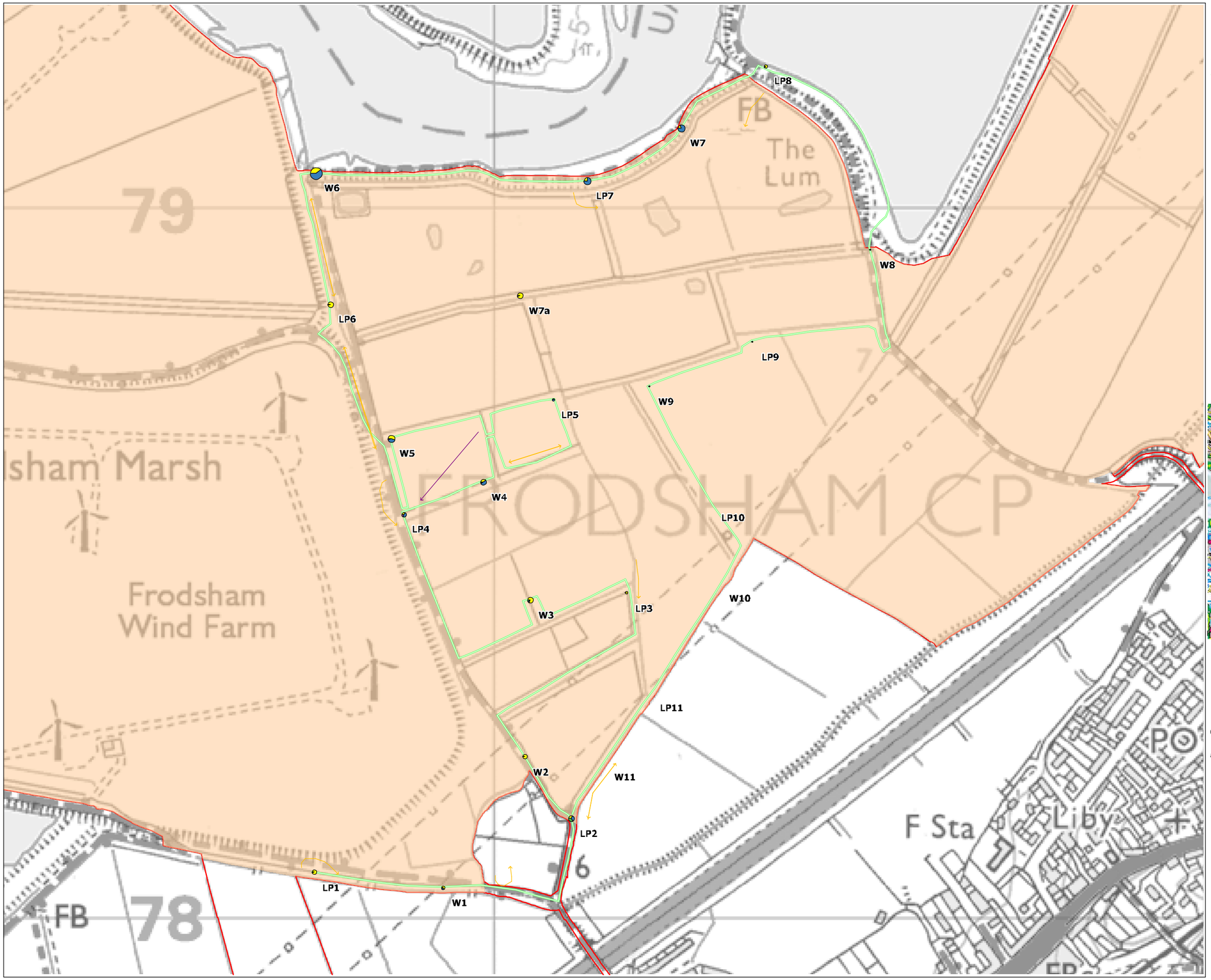
Manual Bat Activity Results (Transect 1)

Scale

1:5000@A3

Date

May 2025



Order Limits

Main Development Area

Transect Route

Transect 2

Bat Call Activity

58
29
5.8

Common pipistrelle

Soprano pipistrelle

Myotis sp.

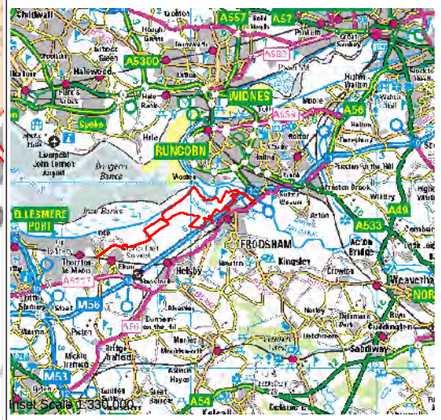
Noctule

Brown long-eared

Bat Flight Activity

Common pipistrelle

Noctule



Cubico SUSTAINABLE INVESTMENTS

0344 8700 007

axis.co.uk

axis

Project

FRODSHAM SOLAR ENVIRONMENTAL STATEMENT

Figure Number

3b

Figure Title

Manual Bat Activity Results (Transect 2)

Scale

1:5000@A3

Date

May 2025

N

0 400

meters

Order Limits

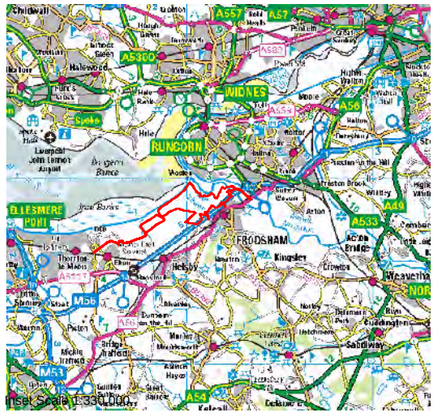
Main Development Area

Bat Habitat Sitability

Negligible

Low

Moderate



Not to Scale 1:330,000

Cubico
SUSTAINABLE INVESTMENTS

0344 8700 007

axis.co.uk

axis

Project

FRODSHAM SOLAR ENVIRONMENTAL STATEMENT

Figure Number

4

Figure Title

Bat Habitat Suitability

Scale

1:26000@A3

Date

May 2025

0 1 kilometers

0 2 kilometers

S:\Axis\Data\Project Folders\Axis\Frodsham Solar DCO\GIS\Bat Survey\Bat Activity Maps 03 2025\Bat heatmaps.qgz

Order Limits

Bat Activity

Total Passes

11

1

Transect Route

Transect 1

Transect 2

Inset Scale 1:150,000

N

0 260 520 780 1,000 1,300 m

Cubico SUSTAINABLE INVESTMENTS

0344 8700 007
axis.co.uk

axis

Project

FRODSHAM SOLAR ENVIRONMENTAL STATEMENT

Figure Number

5

Figure Title

Manual Bat Activity Results - Density Map July

Scale

1:13000@A3

Date

May 2025

S:\Axis Data\Project Folders\Axis\Frodsham Solar DCO\GIS\Bat Survey\Bat Activity Maps 03 2025\Bat heatmaps.qgz

Order Limits

Bat Activity

Total Passes

11

1

Transect Route

Transect 1

Transect 2

Inset Scale 1:150,000

N

0 260 520 780 1,000 1,300 m

Cubico SUSTAINABLE INVESTMENTS

0344 8700 007
axis.co.uk

axis

Project

FRODSHAM SOLAR ENVIRONMENTAL STATEMENT

Figure Number

6

Figure Title

Manual Bat Activity Results - Density Map August

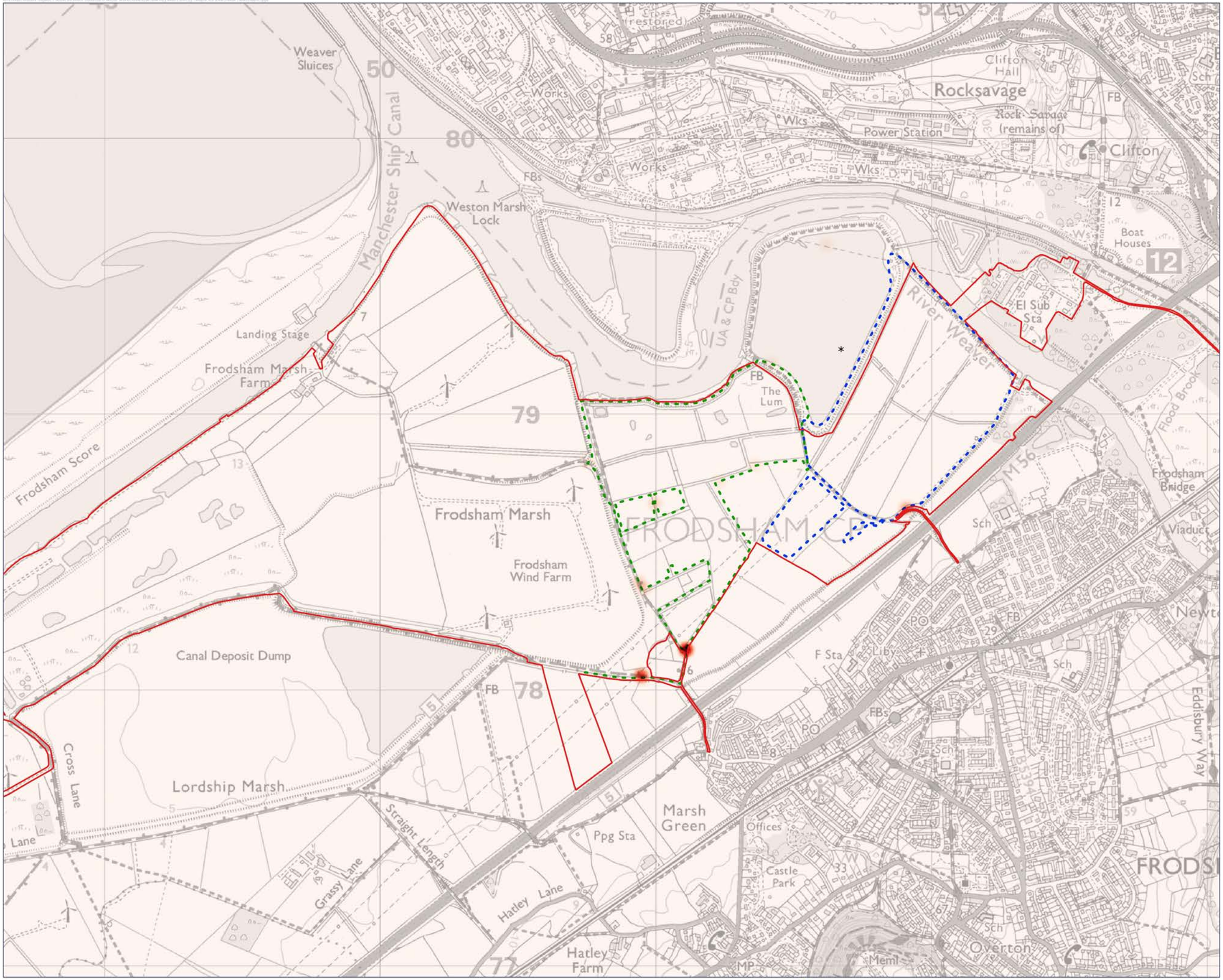
Scale

1:13000@A3

Date

May 2025

S:\Axis Data\Project Folders\Axis\Frodsham Solar DCO\GIS\Bat Survey\Bat Activity Maps 03 2025\Bat heatmaps.qgz



Order Limits

Bat Activity

Total Passes

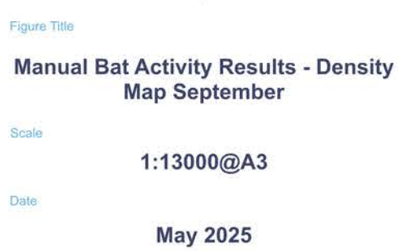
11

1

Transect Route

Transect 1

Transect 2



N

0 260 520 780 1,000 1,300 m

Cubico SUSTAINABLE INVESTMENTS

0344 8700 007
axis.co.uk

axis

Project

FRODSHAM SOLAR ENVIRONMENTAL STATEMENT

Figure Number

7

Figure Title

Manual Bat Activity Results - Density Map September

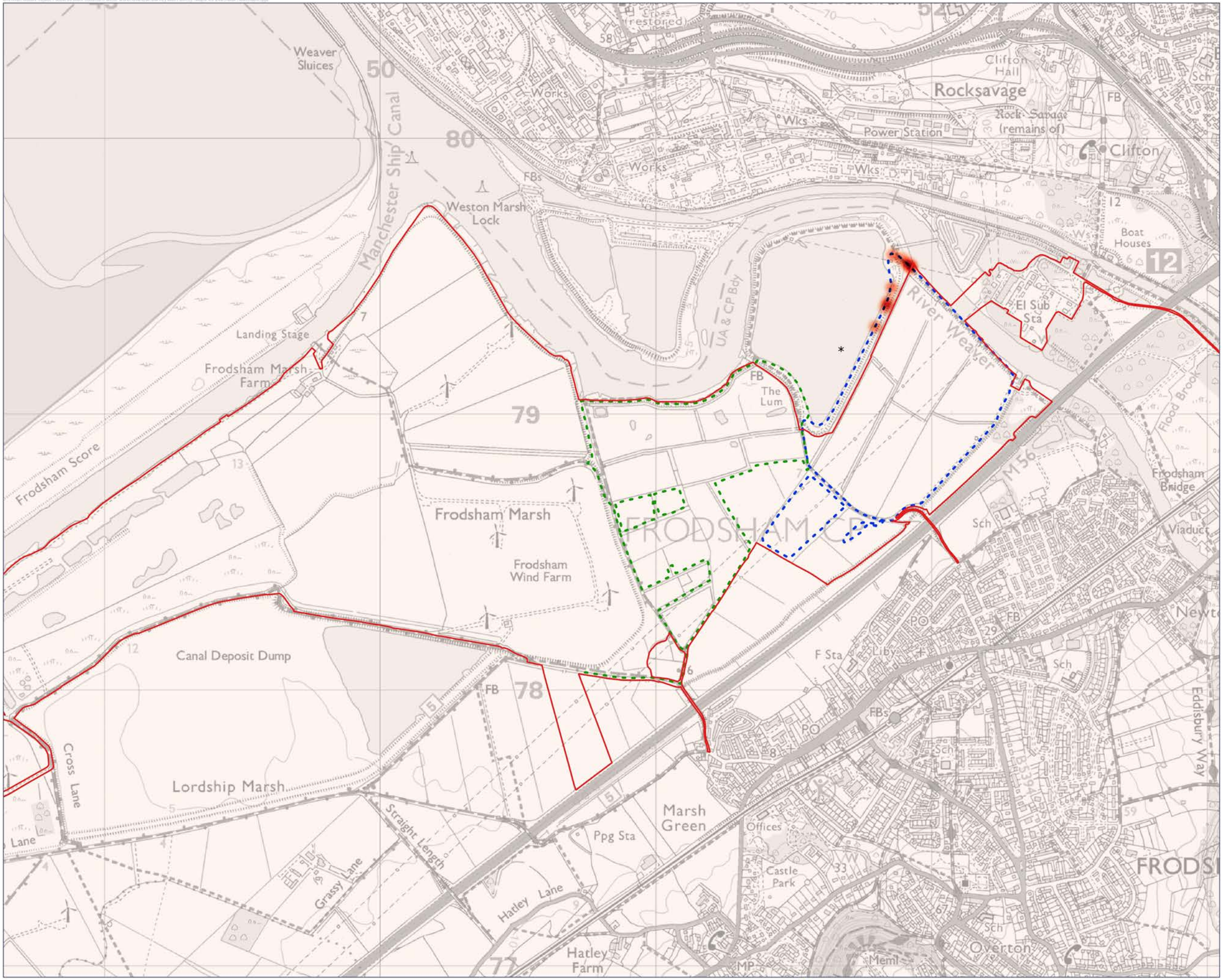
Scale

1:13000@A3

Date

May 2025

S:\Axis Data\Project Folders\Axis\Frodsham Solar DCO\GIS\Bat Survey\Bat Activity Maps 03 2025\Bat heatmaps.qgz



Order Limits

Bat Activity

Total Passes

11

1

Transect Route

Transect 1

Transect 2

N

0 260 520 780 1,000 1,300 m

Cubico SUSTAINABLE INVESTMENTS

0344 8700 007
axis.co.uk

axis

Project

FRODSHAM SOLAR ENVIRONMENTAL STATEMENT

Figure Number

8

Figure Title

Manual Bat Activity Results - Density Map October

Scale

1:13000@A3

Date

May 2025

Annex 1
Scientific Names

Table A1-1 provides scientific names of bat species mentioned within the report.

Table A1-1: *Bat species by common and scientific names.*

Common Name	Scientific Name
Common pipistrelle	*Pipistrellus pipistrellus*
Soprano pipistrelle	*Pipistrellus pygmaeus*
Nathusius' pipistrelle	*Pipistrellus nathusii*
Noctule	*Nyctalus noctula*
Brown long-eared bat	*Plecotus auritus*
Whiskered bat	*Myotis mystacinus*
Natterer's bat	*Myotis nattererii*
Brandt's bat	*Myotis brandtii*
Daubenton's bat	*Myotis daubentonii*

Annex 2

WEATHER DATA FOR STATIC MONITORING SURVEY EFFORT

Table A2-1 below provides weather conditions for bat activity survey periods during automatic activity surveys. Text in highlighted in **red** indicates sub-optimal weather conditions.

Table A2-1: *A summary of weather conditions applicable during automatic activity surveys.*

Date	Temp at Dusk (°C)	Rainfall (mm)	Maximum Wind Speed (m/s)[19]
19/07/2023	14	0.0	2.50
20/07/2023	13	0.0	3.06
21/07/2023	14	0.1	1.94
22/07/2023	16	0.5	2.50
23/07/2023	14	2.4	3.33
24/07/2023	15	2.9	**5.28**
25/08/2023	12	0.4	3.06
26/08/2023	13	0.1	3.06
27/08/2023	14	0.6	**5.56**
28/08/2023	13	0.0	2.22
29/08/2023	13	0.1	2.78
30/08/2023	13	0.0	2.22
31/08/2023	12	0.4	3.33
25/09/2023	13	0.0	3.89
26/09/2023	12	0.0	3.89
27/09/2023	16	0.0	**9.17**
28/09/2023	14	0.0	5.28
29/09/2023	12	0.0	2.22
30/09/2023	15	0.0	4.72
01/10/2023	13	9.0	2.50
21/10/2023	10	0.0	4.44
22/10/2023	10	0.0	1.94
23/10/2023	12	0.2	4.44
24/10/2023	10	0.0	1.94
25/10/2023	10	0.0	3.06
26/10/2023	10	0.0	2.22
27/10/2023	10	0.0	3.06
28/10/2023	10	0.0	**5.28**
29/10/2023	10	0.0	4.44

[19] Converted from km/h

Annex 3

Frodsham Renewable Energy Development Bat Activity Survey Report (RSK Biocensus, 2023)

Peel Cubico Renewables Limited

Frodsham Renewable Energy Development

Bat Activity Survey Report

2483418

MARCH 2023

RSK biocensus
EXPERTS IN ECOLOGY

RSK GENERAL NOTES

Project No.: 2483418

Title: Frodsham Renewable Energy Development – Bat Activity Survey Report

Client: Peel Cubico Renewables Limited

Date: March 2023

Office: Helsby

Status: Rev02

Author and project manager	Emily Clark	**Technical & quality reviewer**	Will Holden
Signature	[redacted]	Signature	[redacted]
Date:	14 March 2023	Date:	14 March 2023

Switchboard: +44 (0)330 223 1074 Company contact: Enquiries@biocensus.co.uk

EXECUTIVE SUMMARY

This report presents the findings of bat activity surveys undertaken for Peel Cubico Renewables Limited on behalf of any future project specific Special Purpose Vehicle (SPV) company in connection to the proposed Frodsham renewable energy development site in Frodsham, Cheshire (OS grid reference: SJ 510 786). The survey area included the land within the red-line boundary (called 'the site' from this point forward – as shown in *Figure 1*).

Walked transect surveys sampling bat activity across the site were carried out between May – October 2022, augmented by static bat detector surveys using automated units.

At least five different species of bat were recorded during the seasonal transect surveys, in addition to Myotis species and Nyctalus species which have been taken to genus only. Recorded calls include the following species; common pipistrelle (*Pipistrellus pipistrellus)*, soprano pipistrelle (*Pipistrellus pygmaeus)*, Nathusius' pipistrelle (*Pipistrellus nathusii*), noctule (*Nyctalus noctule)* and serotine (*Eptesicus serotinus)*.

This has been confirmed via automated monitoring using SM4 detectors where the same five species were recorded across the site. Nyctalus species were identified to species level for some calls within the automated monitoring data, with Leisler's bat (*Nyctalus leisleri*) also identified. A very low number of brown long-eared calls were also recorded during the static detector monitoring. As such, a total of at least eight species have been recorded on the site across all surveys.

Common pipistrelle activity accounted for a significant proportion of bat activity on the site, 42.7% for transect surveys, and 55.7 % for the static detector data. The next most frequently recorded species were soprano pipistrelle and noctule accounting for 28.6% and 25.9% respectively of all activity on the transect surveys and 34.7% and 7.4% respectively of the static monitoring. Other species accounted for a less significant proportion of the bat activity on site, but Nathusius pipistrelle attributed just over 1%, while all other species attributed to less than 1% of the total bat activity recorded.

The habitats of most value to bats on the site were the naturally sheltered and linear features often used by bats on any site; ditches with marginal vegetation, lines of scrub, River Weaver and Manchester Ship Canal and area of plantation woodland edge. Bat activity was most concentrated along the Manchester Ship Canal and River Weaver and associated scrub and swamp habitats to the north and north-east of the site. Activity was also concentrated near the small portion of plantation woodland within the central-western section of site.

CONTENTS

TABLES

FIGURES

1.0 INTRODUCTION

1.1 Purpose of this Report

1.1.1 This report presents the findings of bat activity surveys carried out for Peel Cubico Renewables Limited on behalf of any future project specific Special Purpose Vehicle (SPV) company at the Frodsham renewable energy development site in Frodsham, Cheshire (OS grid reference: SJ 510 786). The surveys were undertaken between May and October 2022. The survey area included the land within the red-line boundary, called 'the site' from this point forward – as shown in *Figure 1*.

1.1.2 During the preliminary ecological appraisal (PEA) of the site, undertaken by RSK Biocensus in March 2022, suitable bat foraging and commuting habitat was identified, including the areas of neutral semi-improved grassland, marshy grassland, swamp, emergent vegetation, scrub, ponds and ditches. Furthermore, the linear features such as areas of scrub, emergent vegetation and ditches along the field boundaries provide suitable habitat for commuting bats and connect the site to suitable habitat in the wider landscape. However, a large proportion of the site contains areas of low-quality habitat for foraging and commuting bats, with large areas of improved grassland, species poor marshy grassland, arable fields and bare ground, which provide limited opportunities for foraging and commuting bats. Therefore, overall site was assessed as having low suitability for foraging and commuting bats.

1.1.3 Surveys were commissioned to identify the species assemblage present on the site, to determine the level of bat activity at the site and identify any impacts the proposed development could have on bats.

1.2 Ecological Context

1.2.1 The site is *c*.285 ha and contains predominantly marshy grassland (grazed by sheep and cattle), agricultural grassland fields and arable land with a grid of interconnected ditches forming the field boundaries. A large portion of the western section of the site is also utilized as a wind farm. The development area is to the north-west of the M56 motorway and 200m north-west of the town of Frodsham. The site is bordered by the Manchester Ship Canal and River Weaver to the north and east, and the M56 motorway and Frodsham to the south.

2.0 METHODS

2.1 General

2.1.1 The surveys were carried out in accordance with the Bat Conservation Trust (BCT) good practice guidelines (Collins, 2016), and aimed to identify the species assemblage using the site, how bats are utilizing the site and identify any habitats on site which are important for commuting and/or foraging bats.

2.1.2 Surveys were led by Emily Clark with assistance from Tom West, Shona Redman, Will Holden, Claire Hesketh and Molly Meadows. All surveyors have experience in undertaking surveys of this type, are suitably qualified and are members of the Chartered Institute of Ecology and Environmental Management (CIEEM). Emily is licensed by Natural England to disturb, take and handle all species of bats under licence number 2019-39350-CLS-CLS (level 2). Emily is also a registered consultant under Natural England's earned recognition scheme.

2.2 Activity Surveys

2.2.1 The site was assessed for its suitability for foraging and commuting bats during the PEA (RSK, 2022), and it was determined that the eastern section of the site has low suitability for both foraging and commuting bats. The western section of the site, below the current windfarm was considered to have very low potential to support foraging and commuting bats as it is predominantly large, improved fields which are intensively grazed by cattle and sheep. As such, the transects were designed to cover the eastern section of the site and the most suitable foraging and commuting habitat. Due to the size and complexity of the site, the site was split into two transects which were surveyed at the same time and covered all suitable habitats within the site for foraging and/or commuting bats, with a focus on boundary features but also included open areas of the site.

2.2.2 As the site was assessed as 'low', as per Collins (2016) guidance, one survey visit is required per season (spring – April/May, summer – June/July/August, autumn (September/October) in suitable weather conditions to sufficiently characterize the bat activity within the site. Surveys were completed between May and September 2022.

2.2.3 All surveys were undertaken at dusk and each dusk transect survey commenced at sunset and lasted two hours Transects included walked sections, continuously recording any signs of bat activity.

2.2.4 A transect map is provided in Figure 2. On each visit, the set transect routes were walked in suitable weather (above 10°C with little or no rain and no strong winds), using a BatLogger M2 handheld bat detectors. Recordings of bat calls were made automatically by these detectors during the survey in full spectrum format, with coordinates assigned to each recording by a GPS unit within the detector. The direction

of each transect was altered each season to sample different parts of the transect at different times after sunset.

2.2.5 Levels of bat activity were quantified by the number of bat passes recorded. A single pass by a bat was defined by a gap of one second or more between the end and beginning of the next bat call. Species were identified through analysis of recordings.

2.2.6 *Table* 1 details the dates and survey times for the activity surveys. Weather conditions at the beginning and end are provided in *Table 2*.

Table 1. Survey dates and timings for each activity survey

Date	Survey Type	Sunset / Sunrise Time	Start Time	End Time
25.05.2022	Dusk	21:18	21:15	23:15
05.07.2022	Dusk	21:40	21:40	23:40
13.09.2022	Dusk	19:30	19:30	21:30

Table 2. Weather conditions recorded at beginning and end of each activity survey

Date	Start / End Temp (°C)	Start / End Wind (Beaufort)	Rainfall	Start / End Cloud Cover (Octas)
25.05.2022	15 / 13	2 / 2	None	4 / 4
05.07.2022	15 / 14	1 / 1	None	8 / 8
13.09.2022	16 / 10	1 / 1	None	4 / 2

2.3 Static monitoring survey

2.3.1 Two Wildlife Acoustics Song Meter 4 Bat+ (SM4) and one Wildlife Acoustics Song Meter 2 Bat (SM2) bat detector were installed at three locations within the boundary of the site in May, July and September 2022 as shown in Figure 3 and Table 3. The detectors were placed alongside features typically used by foraging or commuting bats, such as hedgerows or lines of trees. One static was deployed per transect as recommended within Collins (2016).

2.3.2 One additional static was deployed within the western section of the site which was not covered by the transect survey. The western section of the site is predominantly an intensively grazed improved field with a windfarm, which contains limited suitable habitat for foraging and commuting bats and has been subject to bat monitoring

surveys as part of the windfarm. However, there is a small area of suitable habitat present, with an area of marshy grassland, which was partially covered during the transects, but a static detector was deployed to gather extra data for this section of the site.

2.3.3 As per the Collins (2016) survey guidelines, static monitoring was undertaken for a period of at least five consecutive nights every survey. The static detectors were set up to continuously record from 30 minutes before sunset until 30 minutes after sunrise. Survey dates were selected when the weather forecast indicated suitable weather conditions for foraging and commuting bats (i.e. air temperature above 8°C, the absence of strong winds and minimal precipitation). Typically, the static detectors were left to run longer than the required five-night period to compensate for any nights when conditions were unsuitable or sub-optimal for bats.

Table 3. Survey dates for static detector deployment

Month	Location 1 Dates	Location 2 Dates	Location 3 Dates
May 2022	25.05.2022 – 30.05.2022		
July 2022	05.07.2022 -10.07.2022		
September 2022	13.09.2022 -18.09.2022		22.09.2022 – 27.09.2022

2.4 Analysis of Transect Sound Recordings

2.4.1 All recordings were stored onto memory cards and analysed using Bat Explorer© software. All files including all 'noise' files were double-checked by an experienced ecologist and identified to species level where possible. All recordings were analysed using a number of processes:

- Initially all recordings were subject to batch-scrubbing to eliminate noise files, with all identified noise files retained for later scrutiny for any bat calls that may have been missed by the software.
- All calls not scrubbed as noise were subject to auto-identification (auto-ID) by the software, which was set with a 70% confidence level for identifications (i.e. where the confidence level was lower than this, no species were assigned). Where identified, the species name was automatically appended to the sound file.
- 20% of the sound files where common or soprano pipistrelle bats had been identified were subject to individual scrutiny to confirm that the identification had been made correctly, to give a high level of confidence that these calls had been correctly classified.
- All other calls were subject to an individual assessment, irrespective of the call classification assigned by the software.

- Call parameters such as call shape, inter-pulse interval, call length, frequency of maximum energy (peak frequency), and start and end frequency of the calls, were inspected against the identification assigned by bat explorer, and an identification made/confirmed where possible.
- Echolocation calls were identified down to species or genus level depending on the type of bats encountered (i.e. it is often not possible to reliably identify species belonging to the genus *Myotis, Plecotus* and *Nyctalus* species), and the quality of the recording.

2.5 Analysis of Static Sound Recordings

2.5.1 All recordings were stored onto memory cards and analysed using Kaleidoscope Pro software. All calls not scrubbed as noise were subject to auto-identification (auto-ID) by the software. Identifications returned were given a set confidence level by the analysis program. Any call identifications for common and soprano pipistrelle bats below 70% confidence level were checked by an experienced ecologist using Kaleidoscope©. All other species irrespective of species identified were subject of a manual check using Kaleidoscope© especially Myotis and Nyctalus/Eptesicus calls where all calls could be viewed visually using the in-built viewer.

2.5.2 The analysis software produced a single file for each pass made by an echolocating bat. The level of bat activity was quantified by the number of files (passes) for each recorded species for each night and monitoring period.

2.5.3 This process of analysis also enabled the identification of any other species that use high frequency calls including birds, crickets, and some small mammals.

2.6 Validity of Data

2.6.1 Data collected is usually valid up to two years following the field survey, to provide evidence that is material to the planning determination. Should consent not be awarded within two years of the completed surveys, then it may be necessary to confirm that there have not been material changes to the site and the levels of bat activity within it before planning is determined.

2.7 Survey Constraints and Limitations

2.7.1 During transect surveys, bats and their direction of flight were easiest to observe during the period just after sunset when light levels were still high. As the light faded, visual observation often became impossible and 'heard not seen' records were made. When this occurred, only the location of the bat pass could be recorded and not the direction of flight.

2.7.2 Static detectors cannot distinguish between large numbers of bats, and small numbers of bats making repeated passes. High levels of bat activity can be generated by a small

number of foraging bats and individual bats close to a detector. This was considered during the interpretation of the survey results.

2.7.3 While presence/absence of different species in the genera Myotis, Plecotus, and Nyctalus is now becoming easier to ascertain where high-quality calls have been collected, there are always calls where certainty is not possible, and therefore levels of bat activity by species (rather than genus) must be interpreted with a degree of caution.

2.7.4 Static 3 failed to record for more than one night in May deployment despite being deployed for five consecutive nights (25/05/2022-30/05/2022). This failure of the detector is not considered to be a significant constraint, as one nights' worth of data was nonetheless analysed, and the detector was deployed for five nights in July and September.

2.7.5 Static 3 failed to record during initial deployment in September (13/09/2022-17/09/2022). However, Static 3 was redeployed in September for a further week to gather data (22/09/2022 – 27/09/2022). Sufficient information was gathered throughout the year to inform the potential impacts on bats. Therefore, this is not considered to be a significant constraint.

3.0 RESULTS

3.1 Background data search

3.1.1 43 records for bats were returned in a background data search undertaken as part of the PEA in 2022 (RSK, 2022) within a 2 km radius of the site, including:

- Brown long-eared (*Plecotus auritus*) bat - Four field records were returned, the closest of which is c. 840m north-east of the site.
- Common pipistrelle (*Pipistrellus pipistrellus*) - 16 records were returned, one of which is a roost c. 1.9km south-west of the site. The closest field record is c. 350m south of the site.
- Daubenton's bat (*Myotis daubentonii*) - Two field records were returned, the closest of which is c. 1.3km east of the site.
- Noctule (*Nyctalus noctula*) - Five field records were returned, the closest of which is c. 465m north of the site.
- Pipistrelle species (*Pipistrellus sp.)* - 10 records were returned, one of which was for a roost c. 1.5km south of the site. The closest field record is c. 405m south of the site.
- Soprano pipistrelle (*Pipistrellus pygmaeus*) - Five field records were returned, two of which are in the western section of the site, west of the wind turbines.
- Whiskered bat (*Myotis mystacinus*) - One field record was returned, c. 2km east of the site

3.2 Activity Surveys – Transect Results

3.2.1 Table 4 details the total number of bat passes recorded during the transect surveys. The location and type of bat recorded is shown on Figure 3 - Figure 5.

3.2.2 At least five different species of bat (as determined by sound analysis), in addition to Myotis species and Nyctalus species, which have been taken to genus only, were recorded over the course of the transect surveys. Common pipistrelle were attributed to 42.7% of all activity recorded (foraging and commuting) during these surveys (as shown in Table 4 and Chart 1), followed by soprano pipistrelle (28.6%) and noctule (25.9%). The remaining bat species (Nathusius pipistrelle (*Pipistrellus nathusii)*, Nyctalus species, Myotis species and serotine (*Eptesicus serotinus)*) attributed to less than 2% of the total activity recorded.

3.2.3 The majority of bats were recorded between 45 minutes – 1 hour after sunset, indicating that there are not any significant roosts close to the site. Bat activity was concentrated around the boundaries and linear features on the site such as small areas of plantation woodland, ditches, edges of scrub and Manchester Ship Canal and River Weaver.

Specifically, for most surveys, activity was concentrated along the Manchester Ship Canal and River Weaver and associated scrub and swamp habitats to the north and north-east of the site. However, the activity in May was relatively similar across the site, but activity decreased during the July and September to be concentrated along the boundaries and watercourses.

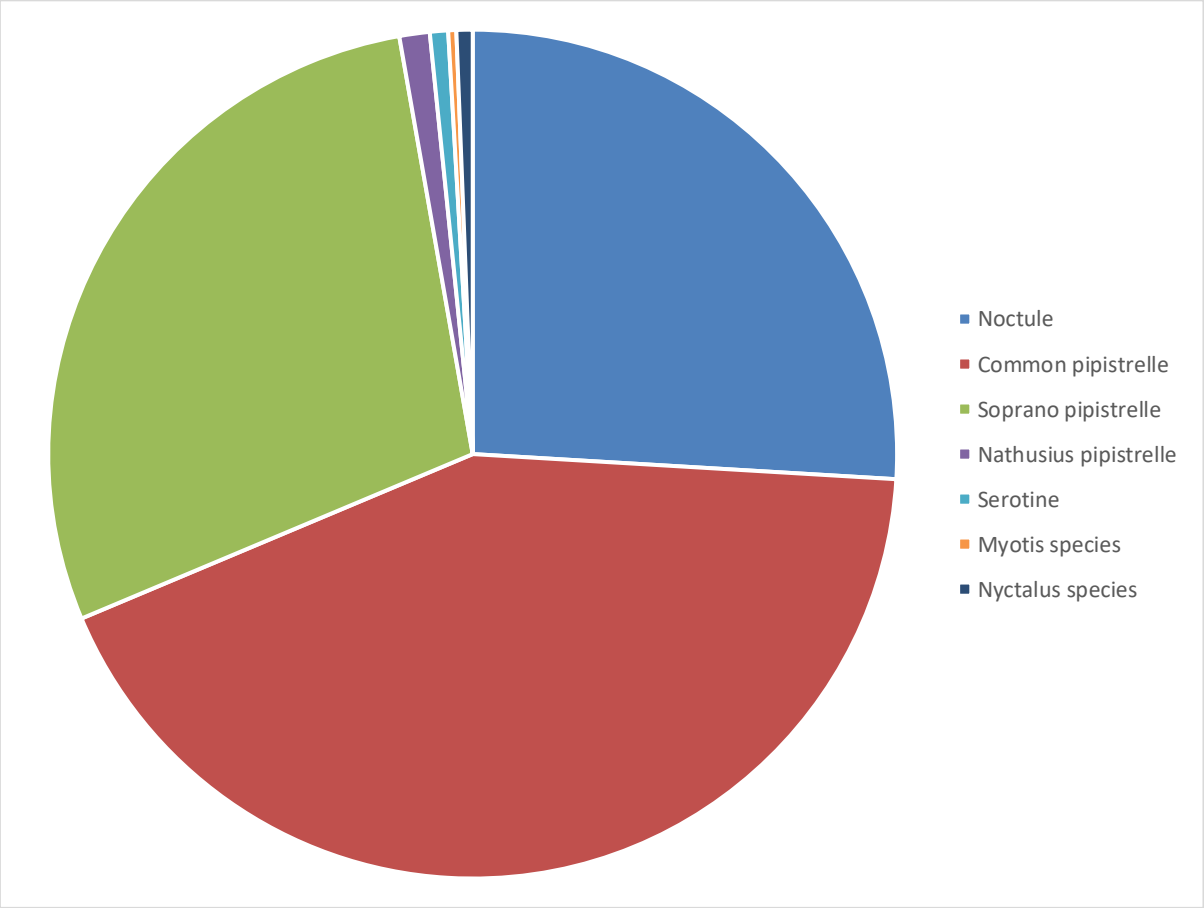
3.2.4 The dusk activity survey on 25 May 2022 had the highest levels of total bat activity recorded, with a total of 607 passes. The lowest level of bat activity was recorded during the July 2022 transect, which had 321 passes.

3.2.5 Species diversity was highest during May with 5 confirmed species recorded and two additional genera recorded (Myotis and Nycatlus). Common pipistrelle, soprano pipistrelle and noctule were recorded during all survey visits, but noctule activity decreased significantly across the surveys from 229 passes in May to 100 passes in July and 8 passes in September. Nathusius' pipistrelle were also recorded at very low frequency during all surveys, while Myotis was only recorded in May and September. Serotine and Nyctalus species were only recorded in May.

Table 4. Total number of bat passes recorded during transect surveys (with approximate % of total also shown).

Species	25.05.2022 - Dusk	05.07.2022 - Dusk	13.09.2022 - Dusk	Total
Common pipistrelle	240	140	175	555 (42.7%)
Myotis	3	0	1	4 (0.3%)
Nathusius' pipistrelle	7	2	6	15 (1.2%)
Noctule	229	100	8	337 (25.9%)
Nyctalus species	8	0	0	8 (0.6%)
Serotine	9	0	0	9 (0.7%)
Soprano pipistrelle	111	79	181	371 (28.6%)
Total	607	321	371	1299

Chart 1.Bat activity recorded on the site for each species across all transect surveys, as an overall % of activity recorded.



3.3 Activity Surveys – Static Results

3.3.1 The positioning of the static detectors is show in Figure 3. Across all of these monitoring points, at least eight species of bat were recorded on the site. A summary of the results is presented in Table 5. Full data tables are provided in Appendix A.

3.3.2 The number of bat 'passes' shown in the following tables equates to the number of files recorded by detector, with intervals of at least one second between recordings, attributed to a species or genus of bat.

3.3.3 Bat activity is measured in the number of bat passes; therefore, this value does not directly equate to the number of bats present.

3.3.4 The results show that 22, 712 bat 'passes' were recorded on the site across all automated surveys. In general, across the whole site the season in which peak bat activity occurred was May, where 13,059 bat 'passes' were recorded compared to 4719 in July and 4934 in September across all automated detectors.

3.3.5 The results show a significant difference between the number of recordings collected in north-eastern corner of the site (Statics 1) and the other sections of the site with Static 1 recording 8355 bat passes in May compared to Static 2 recording 4687.

3.3.6 Furthermore, Static 1 recorded a total of 13287 bat 'passes' compared to 8488 recorded by Static 2 and 937 recorded by Static 3. However, Static 3 only recorded for one night in May due to a failure and also failed during September so was redeployed a week later, which has attributed to the lower number of calls recorded. However, Static 3 still recorded significantly less calls in July (720) compared to Static 1 (2705) and Static 2 (1294), indicating that bats are using the south-western corner of the site less than the north-eastern section and central section.

3.3.7 Seven bat species were recorded during the static detector surveys in addition to Myotis species, which have been taken to genus only. Nyctalus species were identified to species level for some calls within the automated monitoring data, with Leisler's bat (*Nyctalus leisleri*) also identified. The static detector monitoring also identified brown long-eared bat, which was not identified during the transect surveys. Brown long-eared bat was very rarely recorded on the site, with no passes recorded in May, two passes recorded in July and six in September. However, as-well as indicating low numbers of brown long-eared bats utilizing the site, it is also likely to be partly attributed to the quietness of brown long-eared bat calls.

3.3.8 The species most frequently recorded was common pipistrelle, which contributed 55.7% of all bat 'passes' recorded by the static detectors (12,650 total bat 'passes' across all three statics). This was followed by soprano pipistrelle, which contributed 34.7% of all recorded bat 'passes' (7,872 total bat 'passes' across the three statics) and noctule, which contributed 7.4% of all recorded bat 'passes' (1691). Significantly fewer bat 'passes' were recorded for the other species on the site, Nathusius' pipistrelle attributed 1.2% of the total recorded bat 'passes', while all other species attributed to less than 1% of the total recorded bat 'passes'.

Table 5. Summary of automated detector results (with approximate % of total shown)

Month	May					July					September					All months	
Date	25 - 30 /05/22		25/05/22	Total	%	05 - 10/7/2022			Total	%	12 - 17/09/2022		22 - 27/09/2022	Total	%	Grand total	%
Species	Static 1	Static 2	Static 3			Static 1	Static 2	Static 3			Static 1	Static 2	Static 3				
Brown long-eared	0	0	0	0	0.0%	0	0	2	2	0%	1	1	4	6	0.1%	8	0%
Common pipistrelle	4513	3138	0	7651	58.6%	1335	668	388	2391	50.7%	695	1838	75	2608	52.9%	12650	55.7%
Leislers	11	2	0	13	0.1%	2	2	0	4	0.1%	0	0	0	0	0.0%	17	0.1%
Myotis species	62	44	8	114	0.9%	10	3	13	26	0.6%	12	14	16	42	0.9%	182	0.8%
Nathusius' pipistrelle	46	97	0	143	1.1%	11	12	2	25	0.5%	31	72	6	109	2.2%	277	1.2%
Noctule	379	242	9	630	4.8%	704	306	8	1018	21.6%	34	7	2	43	0.9%	1691	7.4%
Serotine	1	2	0	3	0.0%	0	4	8	12	0.3%	0	0	0	0	0.0%	15	0.1%
Soprano pipistrelle	3343	1162	0	4505	34.5%	643	299	299	1241	26.3%	1454	575	97	2126	43.1%	7872	34.7%
Total	**8355**	**4687**	**17**	**13059**	**100%**	**2705**	**1294**	**720**	**4719**	**100%**	**2227**	**2507**	**200**	**4934**	**100%**	**22712**	**100%**

4.0 EVALUATION AND CONCLUSIONS

4.1 Bat diversity and levels of activity

4.1.1 At least five different species of bat were recorded during the seasonal transect surveys, in addition to Myotis species and Nyctalus species which have been taken to genus only. Recorded calls include the following species; common pipistrelle, soprano pipistrelle, Nathusius' pipistrelle, noctule and serotine.

4.1.2 This has been confirmed via automated monitoring using SM4 detectors where the same five species were recorded across the site. Nyctalus species were identified to species level for some calls within the automated monitoring data, with Leisler's bat also identified. A very low number of brown long-eared bat calls were also recorded during the static detector monitoring. As such, a total of at least eight species have been recorded on the site across all surveys.

4.1.3 Common pipistrelle activity accounted for a significant proportion of bat activity on the site, 42.7% for transect surveys, and 55.7 % for the static detector data. The next most frequently recorded species were soprano pipistrelle and noctule accounting for 28.6% and 25.9% respectively of all activity on the transect surveys and 34.7% and 7.4% respectively of the static monitoring.

4.1.4 Across both transect and static surveys, peak bat activity on the site was recorded in May. The lowest amount of activity during the transect survey was recorded in July 2022 while the lowest amount of activity for the static monitoring surveys September 2022 recorded the least activity.

4.2 Habitats and areas of activity

4.2.1 Spatially, the highest levels of bat activity on the walked transects were recorded along linear features such as Manchester Ship Canal, River Weaver, ditches with marginal vegetation and lines of scrub, which provide a sheltered buffer for foraging, as demonstrated by Figures 3 to 5. It should be noted that there is an inherent (but acceptable) bias with walked transects, as they primarily focus on surveying such features (rather than exposed, open areas) since they are typically most used by commuting and foraging bats. However, the open areas between linear features were also sampled.

4.2.2 Furthermore, the static detector monitoring results show a significant difference between the number of recordings collected in north-eastern corner of the site (Statics 1) and the other sections of the site, with Static 1 recording 8,355 bat passes in May compared to Static 2 recording 4,687.

4.2.3 Therefore, bat activity was most concentrated along the Manchester Ship Canal and River Weaver and associated scrub and swamp habitats to the north and north-east of

the site. Activity was also concentrated near the small portion of plantation woodland within the central-western section of site. Therefore, it is a reasonable assumption that these areas are of most value to bats using the site.

5.0 REFERENCES

Arlettaz, R., Godat, S., and Meyer, H (2000) Competition for food by expanding pipistrelle bat populations (Pipistrellus pipistrellus) might contribute to the decline of lesser horseshoe bats (Rhinolophus hipposideros). Biological Conservation 93 (2000) 55-60.

Bat Conservation Trust (BCT) (2014) Artificial lighting and wildlife. Interim Guidance: Recommendations to help minimise the impact [of] artificial lighting. Bat Conservation Trust, London.

Bat Conservation Trust and Institute of Lighting Professionals (2018) Bats and artificial lighting in the UK –Bats and the built environment series. Bat Conservation Trust, London.

Bruce-White, C. & Shardlow, M. (2011) A review of the impact of artificial light on invertebrates. Buglife, Peterborough, UK.

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

Downs, N.C., Beaton, V., Guest, J., Polanski, J., Robinson, S.L. & Racey, P.A. (2003) The effects of illuminating the roost entrance on the emergence behaviour of Pipistrellus pygmaeus. Biological Conservation, 111, 247-252.

Eisenbeis, G. (2006) Artificial night lighting and insects: attraction of insects to streetlamps in a rural setting in Germany. In Ecological consequences of artificial night lighting (eds Rich, C. & Longcore, T.), pp. 281-304. Island Press, Washington.

Frank, K.D. (2006) Effects of artificial night lighting on moths. In Ecological consequences of artificial night lighting (eds Rich, C. & Longcore, T.), pp. 305-344. Island Press, Washington.

Furlonger, C.L., Dewar, H.J. & Fenton, M.B. (1987) Habitat use by foraging insectivorous bats. Canadian Journal of Zoology, 65, 284-288.

Jones, G. & Rydell, J. (1994) Foraging strategy and predation risk as factors influencing emergence time in echolocating bats. Philosophical Transactions: Biological Sciences, 346, 445-455.

Lacoeuilhe, A., Machon, N., Julien J-F., Le Bocq A. and Kerbiriou C. (2014) The Influence of Low Intensities of Light Pollution on Bat Communities in a Semi-Natural Context. PLoS ONE 9(10): e103042. doi:10.1371/journal.pone.0103042.

Packman, C.E., Zeale, M., Harris, S. and Jones, G. (2015) English Heritage Research

Project EH6199. Management of Bats in Churches – a pilot. Final Report (available from the Historic England (previously English Heritage) website).

Rydell, J., 1992. Exploitation of insects around streetlamps by bats in Sweden. Functional Ecology 6, 744-750.

Stone, E.L. (2013) Bats and lighting: Overview of current evidence and mitigation guidance. University of Bristol.

Stone, E.L., Jones, G. & Harris, S. (2012) Conserving energy at a cost to biodiversity? Impacts of LED lighting on bats. Global Change Biology.

6.0 FIGURES

Figure 1 – Site Location Plan

Figure 2 – Transect Route Map and Static Detector Locations

Figure 3 – 25 May 2022 Bat Activity Survey Results

Figure 4 – 5 July 2022 Bat Activity Survey Results

Figure 5– 13 September 2022 Bat Activity Survey Results

Figure 1 – Site Location Plan

Legend:

Site Boundary

Rev	Date	Description	Drn	Chk	App
00	17/01/2023	2483418	TG	RH	ES

Frodsham Renewable Energy Development

RSK biocensus
EXPERTS IN ECOLOGY

TITLE: Figure 1:

Site Location Plan

0 125 250 375
Metres
SCALE: 1:10,000 @ A3

N
W E
S

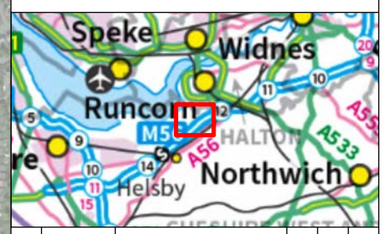
REV 00

Document Path: C:\OneDrive\RSK Group\RSK Biocensus - 06 GIS - 2483418 - Solis Ortis\2483418 - Solis Ortis - Figure 1 - Site Location Plan.aprx

Figure 2 – Transect Route and Static Location Plan

Legend:

- Site Boundary
- Transect 1
- Transect 2
- Static Detector



Rev	Date	Description	Drn	Chk	App
00	17/01/2023	2483418	TG	RH	ES

Frodsham Renewable Energy Development

RSK biocensus
EXPERTS IN ECOLOGY

TITLE: Figure 2:
Transect Route and Static Detector Locations

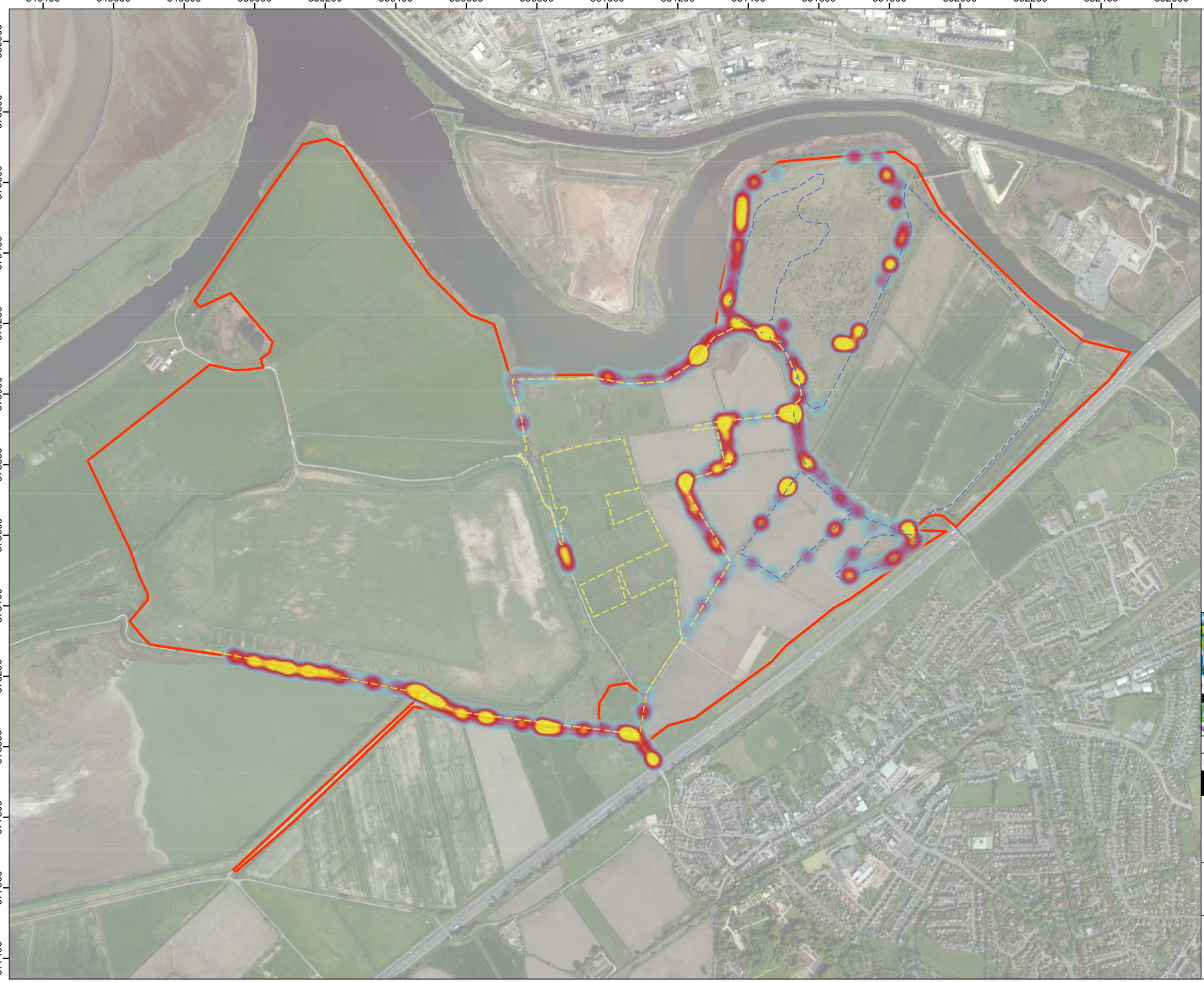
0 125 250 375
Metres
SCALE: 1:10,000 @ A3

N
W E
S

REV 00

Document Path: C:\OneDrive\RSK Group\RSK Biocensus - 06 GIS - 2483418 - Solis Ortis\2483418 - Solis Ortis - Figure 2 - Transect Route Map and Static Detector Locations.aprx

Figure 3. 25 May 2022 Bat Activity Survey Results

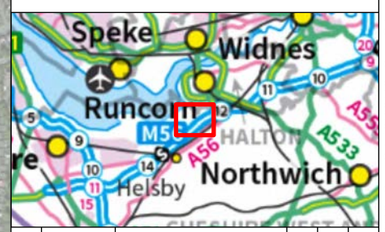


Legend:

- Site Boundary
- Transect 1
- Transect 2

Bat Activity

- Sparse
- Dense



Rev	Date	Description	Drn	Chk	App
00	17/01/2023	2483418	TG	RH	ES

Frodsham Renewable Energy Development

RSK biocensus
EXPERTS IN ECOLOGY

TITLE: Figure 3:
25-May-2022
Bat Activity Survey Results

0 125 250 375
Metres
SCALE: 1:10,000 @ A3

N
W E
S

REV 00

Document Path: C:\OneDrive\RSK Group\RSK Biocensus - 06 GIS - 2483418 - Solis Ortis\2483418 - Solis Ortis - Figure 3 - 25-May-2022 Bat Activity Survey Results.aprx

Figure 4. 5 July 2022 Bat Activity Survey Results

349400 349600 349800 350000 350200 350400 350600 350800 351000 351200 351400 351600 351800 352000 352200 352400 352600

380000 379800 379600 379400 379200 379000 378800 378600 378400 378200 378000 377800 377600 377400

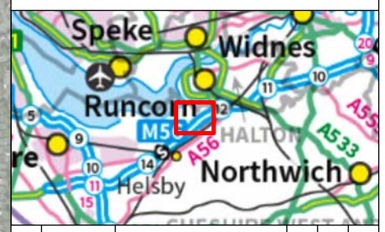
Legend:

- Site Boundary
- Transect 1
- Transect 2

Bat Activity

Sparse

Dense



Rev	Date	Description	Drn	Chk	App
00	17/01/2023	2483418	TG	RH	ES

Frodsham Renewable Energy Development

RSK biocensus EXPERTS IN ECOLOGY

TITLE: Figure 4:
05-July-2022
Bat Activity Survey Results

0 125 250 375
Metres
SCALE: 1:10,000 @ A3

N W E S

REV 00

Document Path: C:\OneDrive\RSK Group\RSK Biocensus - 06 GIS - 2483418 - Solis Ortis\2483418 - Solis Ortis - Figure 4 - 05-July-2022 Bat Activity Survey Results.aprx

Figure 5. 13 September 2022 Bat Activity Survey Results

349400 349600 349800 350000 350200 350400 350600 350800 351000 351200 351400 351600 351800 352000 352200 352400 352600

380000 379800 379600 379400 379200 379000 378800 378600 378400 378200 378000 377800 377600 377400

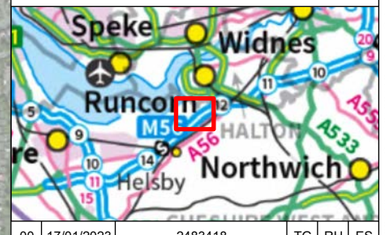
Legend:

- Site Boundary
- Transect 1
- Transect 2

Bat Activity

Sparse

Dense



Rev	Date	Description	Drn	Chk	App
00	17/01/2023	2483418	TG	RH	ES

Frodsham Renewable Energy Development

RSK biocensus EXPERTS IN ECOLOGY

TITLE: Figure 5:
13-September-2022
Bat Activity Survey Results

0 125 250 375
Metres
SCALE: 1:10,000 @ A3

N W E S

REV 00

Document Path: C:\OneDrive\RSK Group\RSK Biocensus - 06 GIS - 2483418 - Solis Ortis\2483418 - Solis Ortis - Figure 5 -13-September-2022 Bat Activity Survey Results aprx

Figure 1 – Site Location Plan

Legend:

Site Boundary

Rev	Date	Description	Drn	Chk	App
00	17/01/2023	2483418	TG	RH	ES

Frodsham Renewable Energy Development

RSK biocensus
EXPERTS IN ECOLOGY

TITLE: Figure 1:

Site Location Plan

0 125 250 375
Metres
SCALE: 1:10,000 @ A3

N
W E
S

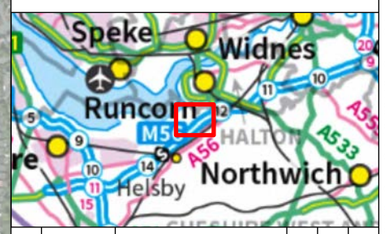
REV 00

Document Path: C:\OneDrive\RSK Group\RSK Biocensus - 06 GIS - 2483418 - Solis Ortis\2483418 - Solis Ortis - Figure 1 - Site Location Plan.aprx

Figure 2 – Transect Route and Static Location Plan

Legend:

- Site Boundary
- Transect 1
- Transect 2
- Static Detector



Rev	Date	Description	Drn	Chk	App
00	17/01/2023	2483418	TG	RH	ES

Frodsham Renewable Energy Development

RSK biocensus
EXPERTS IN ECOLOGY

TITLE: Figure 2:
Transect Route and Static Detector Locations

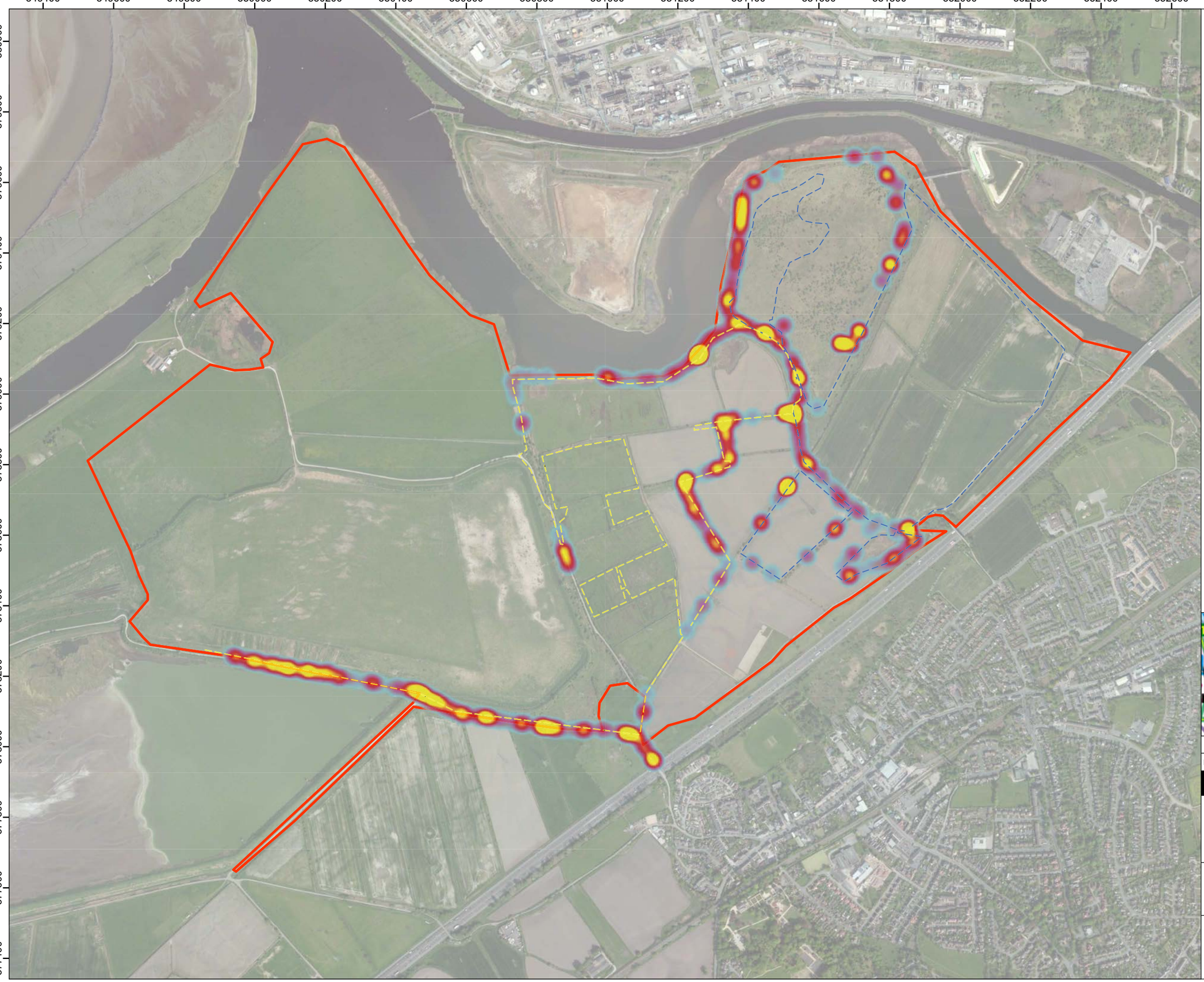
0 125 250 375
Metres
SCALE: 1:10,000 @ A3

N
W E
S

REV 00

Document Path: C:\OneDrive\RSK Group\RSK Biocensus - 06 GIS - 2483418 - Solis Ortis\2483418 - Solis Ortis - Figure 2 - Transect Route Map and Static Detector Locations.aprx

Figure 3. 25 May 2022 Bat Activity Survey Results

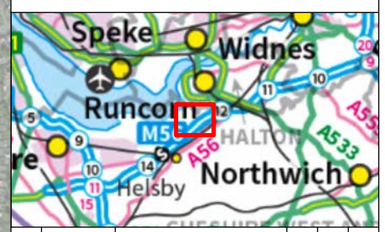


Legend:

- Site Boundary
- Transect 1
- Transect 2

Bat Activity

- Sparse
- Dense



Rev	Date	Description	Drn	Chk	App
00	17/01/2023	2483418	TG	RH	ES

Frodsham Renewable Energy Development

RSK biocensus
EXPERTS IN ECOLOGY

TITLE: Figure 3:
25-May-2022
Bat Activity Survey Results

0 125 250 375
Metres
SCALE: 1:10,000 @ A3

N
W E
S

REV 00

Document Path: C:\OneDrive\RSK Group\RSK Biocensus - 06 GIS - 2483418 - Solis Ortis\2483418 - Solis Ortis - Figure 3 - 25-May-2022 Bat Activity Survey Results.aprx

Figure 4. 5 July 2022 Bat Activity Survey Results

349400 349600 349800 350000 350200 350400 350600 350800 351000 351200 351400 351600 351800 352000 352200 352400 352600

380000 379800 379600 379400 379200 379000 378800 378600 378400 378200 378000 377800 377600 377400

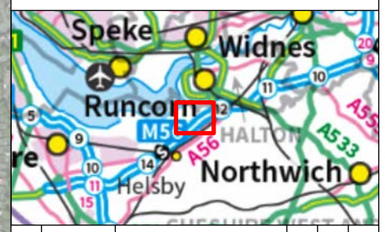
Legend:

- Site Boundary
- Transect 1
- Transect 2

Bat Activity

Sparse

Dense



Rev	Date	Description	Drn	Chk	App
00	17/01/2023	2483418	TG	RH	ES

Frodsham Renewable Energy Development

RSK biocensus EXPERTS IN ECOLOGY

TITLE: Figure 4:
05-July-2022
Bat Activity Survey Results

0 125 250 375
Metres
SCALE: 1:10,000 @ A3

N W E S

REV 00

Document Path: C:\OneDrive\RSK Group\RSK Biocensus - 06 GIS - 2483418 - Solis Ortis\2483418 - Solis Ortis - Figure 4 - 05-July-2022 Bat Activity Survey Results.aprx

Figure 5. 13 September 2022 Bat Activity Survey Results

349400 349600 349800 350000 350200 350400 350600 350800 351000 351200 351400 351600 351800 352000 352200 352400 352600

380000 379800 379600 379400 379200 379000 378800 378600 378400 378200 378000 377800 377600 377400

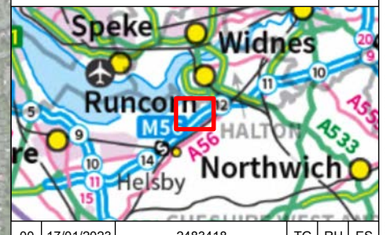
Legend:

- Site Boundary
- Transect 1
- Transect 2

Bat Activity

Sparse

Dense



Rev	Date	Description	Drn	Chk	App
00	17/01/2023	2483418	TG	RH	ES

Frodsham Renewable Energy Development

RSK biocensus EXPERTS IN ECOLOGY

TITLE: Figure 5:
13-September-2022
Bat Activity Survey Results

0 125 250 375
Metres
SCALE: 1:10,000 @ A3

N W E S

REV 00

Document Path: C:\OneDrive\RSK Group\RSK Biocensus - 06 GIS - 2483418 - Solis Ortis\2483418 - Solis Ortis - Figure 5 -13-September-2022 Bat Activity Survey Results aprx

APPENDIX A – FULL STATIC MONITORING RESULTS

Table 6. Static monitoring results May 2022

	May 2022						Total	%
	25	26	27	28	29	30		
Static 1	1321	2485	937	1587	1864	161	8355	100.0%
Common pipistrelle	390	1069	600	1009	1314	131	4513	54%
Leislers	4	3	0	4	0	0	11	>1%
Myotis species	2	20	28	3	9	0	62	1%
Nathusius pipistrelle	1	13	4	10	18	0	46	1%
Noctule	145	130	36	32	36	0	379	5%
Serotine	1	0	0	0	0	0	1	>1%
Soprano pipistrelle	778	1250	269	529	487	30	3343	40%
Static 2	286	648	322	1023	2392	16	4687	100%
Common pipistrelle	166	418	193	604	1757	0	3138	67%
Leislers	2	0	0	0	0	0	2	>1%
Myotis species	3	14	0	4	7	16	44	1%
Nathusius pipistrelle	3	15	10	10	59	0	97	2%
Noctule	58	62	39	53	30	0	242	5%
Serotine	1	0	1	0	0	0	2	>1%
Soprano pipistrelle	53	139	79	352	539	0	1162	25%
Static 3	17	0	0	0	0	0	17	100%
Myotis species	8	0	0	0	0	0	8	47%
Noctule	9	0	0	0	0	0	9	53%
Grand total	1624	3133	1259	2610	4256	177	13059	100%

Table 7. Static monitoring results July 2022

	July 2022						Total	%
	5	6	7	8	9	10		
Static 1	362	278	496	599	757	213	2705	100%
Common pipistrelle	203	97	198	302	422	113	1335	49%
Leislers	0	1	1	0	0	0	2	>1%
Myotis species	0	1	4	5	0	0	10	>1%
Nathusius pipistrelle	1	0	2	4	2	2	11	>1%
Noctule	65	132	214	110	167	16	704	26%
Soprano pipistrelle	93	47	77	178	166	82	643	24%
Static 2	171	121	167	259	358	218	1294	100%
Common pipistrelle	80	48	78	139	201	122	668	51%
Leislers	0	1	1	0	0	0	2	>1%
Myotis species	0	1	0	2	0	0	3	>1%
Nathusius pipistrelle	0	1	1	5	3	2	12	1%
Noctule	38	46	60	49	75	38	306	24%
Serotine	0	2	0	0	1	1	4	>1%
Soprano pipistrelle	53	22	27	64	78	55	299	23%
Static 3	115	180	79	103	70	173	720	100%
Brown long-eared	0	1	0	1	0	0	2	>1%
Common pipistrelle	72	125	14	87	32	58	388	54%
Myotis species	4	1	3	3	2	0	13	2%
Nathusius Pipistrelle	2	0	0	0	0	0	2	>1%
Noctule	4	4	0	0	0	0	8	1%
Serotine	0	4	4	0	0	0	8	1%
Soprano pipistrelle	33	45	58	12	36	115	299	41%
Grand total	648	579	742	961	1185	604	4719	100%

Table 8. Static monitoring results September 2022

	September												Total	%
	12	13	14	15	16	17	22	23	24	25	26	27		
Static 1	449	612	321	452	372	21							2227	100.0%
Brown long-eared	158	202	85	128	118	4							1	>1%
Common pipistrelle	1	3	2	0	6	0							695	31%
Myotis species	3	3	7	12	5	1							12	>1%
Nathusius pipistrelle	2	18	10	2	2	0							31	1%
Noctule	285	386	217	310	241	15							34	1%
Soprano pipistrelle	158	202	85	128	118	4							1454	65%
Static 2	144	270	892	949	246	6							2507	100%
Brown long-eared					1								1	>1%
Common pipistrelle	74	125	828	705	104	2							1838	73%
Myotis species		6		3	5								14	>1%
Nathusius pipistrelle	1	2	15	54									72	3%
Noctule	1	2		4									7	>1%
Soprano pipistrelle	68	135	49	183	136	4							575	23%
Static 3							5	55	51	77	9	3	200	100%
Brown long-eared									1	1	1	1	4	2%
Common pipistrelle								21	24	25	4	1	75	37%
Myotis species								2	7	5	1	1	16	8%
Nathusius pipistrelle								2	2	2			6	3%
Noctule							2						2	1%
Soprano pipistrelle							3	30	17	44	3		97	48%
Grand Total	593	882	1213	1401	618	27	5	55	51	77	9	3	4934	100%

APPENDIX B - LEGISLATION

Bats

All species of British bat are protected by The Wildlife and Countryside Act 1981 (as amended) extended by the Countryside and Rights of Way Act 2000. This legislation makes it an offence to:

- intentionally kill, injure or take a bat;
- possess or control a bat;
- intentionally or recklessly damage, destroy or obstruct access to a bat roost; and
- intentionally or recklessly disturb a bat while it occupies a bat roost.

Bats are also European Protected Species, being listed on Schedule 2 of The Conservation of Species and Habitats Regulations 2017 (as amended). This legislation makes it an offence to:

- deliberately capture, injure or kill a bat;
- deliberately disturb bats, including in particular any disturbance which is likely (a) to impair their ability -(i) to survive, to breed or reproduce, or to rear or nurture their young; or (ii) hibernate or migrate, where relevant; or (b) to affect significantly the local distribution or abundance of the species to which they belong;
- damage or destroy a breeding site or resting place of a bat; and
- possess, control, transport, sell, exchange a bat, or offer a bat for sale or exchange.

All bat roosting sites receive legal protection even when bats are not present.