Tween Bridge Solar Farm

Environmental Statement
Appendix 7.13 : Bat Activity Report

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Tween Bridge NSIP Solar Farm

on behalf of Pegasus Planning Ltd.

Appendix 7.13: Bat Activity Report

avianecology

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1 INTRODUCTION

1.1 Background and Scope

1.1.1 Avian Ecology Ltd (AEL) was commissioned by Pegasus Planning Ltd to undertake baseline bat activity surveys.

1.1.2 The survey was undertaken in relation proposed a renewable energy generating project, hereafter referred to as 'the Scheme'. The Scheme consists of ground-mounted solar photovoltaic ('PV') arrays, together with on-site energy storage and associated infrastructure. The Scheme is located on land to the east of the town of Thorne and to the west of the town of Crowle (the 'Order Limits') as illustrated on **Figure 1.**

1.1.3 This report has been prepared to accompany the Ecology and Nature Conservation Chapter 7 of the Environmental Statement (ES) and presents survey methodology and results of surveys undertaken to establish baseline conditions with regards to bat species on-site.

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

2 METHODOLOGY

2.1 Overview

2.1.1 The approach to baseline information gathering with regards to bats has been undertaken with reference to Bat Conservation Trust (BCT) Survey Guidelines (Collins, 2023[1]), in addition to the Bat Mitigation Guidelines (Reason, P.F. & Wray, S, 2023[2]), and Bat Workers Manual (Mitchell-Jones, A. J. & McLeish, A. P, 2004[3]).

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

2.2 Field Surveys

2.2.1 The purpose of the baseline field surveys has been to establish the following:

- bat species assemblage using the Order Limits; and,
- the spatial and seasonal distribution of bat activity.

2.2.2 As such, the following baseline activity surveys have been completed:

- Manual Bat Activity Surveys (i.e. Night-time Bat Walkovers (NBW)); and,

[1] Collins, J. (ed.) (2023). Bat Surveys for Professional Ecologists: Good Practice Guidelines (4th edn). The Bat Conservation Trust, London.

[2] Reason, P.F. and Wray, S. (2023). UK Bat Mitigation Guidelines: a guide to impact assessment, mitigation and compensation for developments affecting bats. Version 1.1. Chartered Institute of Ecology and Environmental Management, Ampfield.

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

- Automated Bat Activity Surveys (i.e. static detector surveys).

2.2.3 Bat activity survey effort and methodology was agreed with both North Lincolnshire and Doncaster Council with reference to BCT guidance (Collins, 2023).

2.2.4 As such, both manual and automated activity surveys were undertaken on a seasonal basis (i.e. spring, summer and autumn).

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

Habitat Suitability Assessment

2.2.6 A Habitat Suitability Assessment of the Order Limits was undertaken by Tyler Grange Ltd. in reference to criteria detailed in **Table 4.1** of BCT guidance (Collins, 2023), which provided an appraisal of the potential value of habitats located within the area relative to foraging and commuting potential, and prescribed survey effort.

Bat Activity Surveys

Night-time Bat Walkover Surveys

2.2.7 The NBW surveys, comprising five transect routes in total, were designed and implemented on a seasonal basis (i.e. spring, summer and autumn), with reference to BCT guidance (Collins, 2023), as presented in **Figure 1.**

2.2.8 NBW transect routes were designed to cover the recommended transect length (i.e. 3-5km) relative to the size of the Order Limits, to be completed within 2-3 hours after sunset. Where possible, transect routes were also designed to cover a representative range of habitats and ecological features present within and bordering the site (as determined by accessibility).

2.2.9 NBW surveys were scheduled on a seasonal basis and conducted during periods of suitable weather conducive for bat activity (i.e. mild and dry, with relatively low wind speeds). Surveys commenced at sunset, and were led by a team of competent ecologists, which included N. Husle, B. Clyne, C. Shepherd and E. Rigate.

2.2.10 Per NBW, surveyors undertook an initial 30-60 minute vantage point relative to potential emergence activity before walking a pre-determined transect route. Surveyors utilised a full spectrum Wildlife Acoustics Echo Meter Touch 2 Pro detector, and in some instances a night-vison aid (NVA); equipment allowed for both acoustic recordings and observations of activity to be recorded, allowing for bat identification and a time-stamped narrative of activity to be spatially logged (**Figures 2-4**).

2.2.11 During each NBW, particular emphasis was placed on recording observed activity (e.g., numbers of bats, behaviour, habitat usage etc.) for the purpose of understanding how bats are using the area, and to help further inform a response to proposed impacts. Whilst the transect routes were pre-determined, flexibility was enabled, permitting some deviation from redefined transect route to allow for a better understanding of bat activity within the Order Limits.

2.2.12 A summary of NBW survey effort is presented in **Table 2.1** below.

Table 2.1: A summary of NBW survey effort, per transect area.

Season	Transect ID	Survey Date	Sunset Time	Start Time	End Time	Survey Conditions
Spring	T1	22/05/2025	21:08	20:55	23:10	16°C, 1/8 wind, 2/8 cloud, 0 rain
	T2	24/05/2025	21:13	21:00	22:49	16°C, 2/8 wind, 4/8 cloud, 0 rain
	T3	21/05/2025	21:09	21:00	23:10	15°C, 2/8 wind, 2/8 cloud, 0 rain
	T4	22/05/2025	21:08	20:55	23:10	16°C, 1/8 wind, 2/8 cloud, 0 rain
	T5	21/05/2025	21:09	21:00	23:10	15°C, 2/8 wind, 2/8 cloud, 0 rain
Summer	T1	18/07/2025	21:22	21:10	23:15	23°C, 2/8 wind, 6/8 cloud, 0 rain
	T2	17/07/2025	21:23	21:15	23:35	19°C, 0/8 wind, 7/8 cloud, 0 rain
	T3	16/07/2025	21:24	21:15	23:20	17°C, 2/8 wind, 4/8 cloud, 0 rain
	T4	17/07/2025	21:23	21:15	23:35	19°C, 0/8 wind, 7/8 cloud, 0 rain
	T5	18/07/2025	21:22	21:10	23:15	23°C, 2/8 wind, 6/8 cloud, 0 rain
Autumn	T1	17/09/2025	19:14	19:05	21:05	20°C, 2/8 wind, 4/8 cloud, 0 rain
	T2	16/09/2025	19:16	19:07	21:07	16°C, 3/8 wind, 2/8 cloud, 0 rain
	T3	18/09/2025	19:12	19:01	21:01	19°C, 3/8 wind, 4/8 cloud, 0 rain
	T4	17/09/2025	19:14	19:05	21:05	20°C, 2/8 wind, 4/8 cloud, 0 rain
	T5	16/09/2025	19:16	19:07	21:07	16°C, 3/8 wind, 2/8 cloud, 0 rain

Automatic Bat Activity Surveys

2.2.13 Ten automated monitoring stations (MSs)[4] were deployed within the Order Limits, and adjacent survey areas during any given survey period.

2.2.14 MS locations were chosen to sample activity from a representative range of habitats relative to the Proposed Development (where accessible), which included features considered to be potentially ecologically important for bats.

2.2.15 A summary of MS locations is detailed in **Table 2.2**, with deployment location presented in **Figure 1.**

Table 2.2: *A summary of static monitoring station (MS) deployment.*

MS ID	Grid Reference	Habitat Description
MS3	SE 72529 11393	Linear feature; hedgerow adjacent arable crop and amenity grassland.
MS4	SE 71783 12146	Linear feature; wet ditch (i.e. South Soak Drain) adjacent arable crop.
MS5	SE 75415 13756	Edge habitat; woodland edge and dry ditch, adjacent arable crop.

[4] Ten static detectors were deployed within the Order Limits during any given recording period; however, disturbance to MS6a meant the MS location was later amended, i.e. MS6b (outlined in **2.4 Limitations**). As such, eleven MS locations are presented throughout this report (**Table 2.3**).

MS ID	Grid Reference	Habitat Description
MS6a	SE 75328 12615	Open habitat; located adjacent arable crop fields.
MS6b	SE 74962 12171	Linear feature; treeline adjacent watercourse (i.e. Stainforth and Keadby Canal).
MS7	SE 77073 10502	Linear feature; hedgerow and wet ditch (i.e. Hatfield Waste Drain) adjacent arable crop.
MS8	SE 76836 10144	Linear feature; hedgerow adjacent arable crop.
MS9	SE 69691 14709	Linear feature; hedgerow and wet ditch (i.e. Leonard's Drain) adjacent arable crop. Connecting to residential area due west.
MS10	SE 70625 12950	Linear feature; hedgerow with trees, adjacent arable crop.
MS11	SE 73548 09384	Linear feature; line of trees and wet ditch, adjacent arable crop.
MS12	SE 71079 09232	Linear feature; hedgerow with tree, adjacent arable crop and close to roads.

2.2.16 Static detectors deployed per MS locations consisted of either a full spectrum Wildlife Acoustics Song Meter (SM) Mini or Song Meter 2 (SM2) detector, attached at a minimum hight of 1m to a suitable feature.

2.2.17 Surveys were undertaken between time periods spanning approximately thirty minutes before sunset to thirty minutes after sunrise, with detectors set to record simultaneously.

2.2.18 A standardised, representative sample of bat activity over seven consecutive nights (per season) was collected and subject to further activity analysis, in line with the minimum recommended survey effort prescribed to sites of **Low** habitat suitability for foraging and commuting bats (Collins, 2023).

2.2.19 Key metrics for each MS deployed throughout automatic activity surveys are detailed in **Table 2.3.**

Table 2.3: *A summary of automated activity survey effort.*

Recording Period	MS ID	Sample Start Date	Sample End Date	No. Nights Surveyed	Recording Hours
Spring	MS3	22/05/2025	28/05/2025	7	60
	MS4	22/05/2025	28/05/2025		
	MS5	22/05/2025	28/05/2025		
	MS6a[5]	22/05/2025	28/05/2025		
	MS7	22/05/2025	28/05/2025		
	MS8[6]	n/a	n/a		
	MS9	22/05/2025	28/05/2025		
	MS10	22/05/2025	28/05/2025		

[5] Subject to disturbance and later redeployed in a separate location with different baseline habitats (i.e. MS6b) following spring automated activity surveys. See **2.4 Limitations**.
[6] Failure to record following technical error. See **2.4 Limitations.**

Recording Period	MS ID	Sample Start Date	Sample End Date	No. Nights Surveyed	Recording Hours
	MS11	22/05/2025	28/05/2025		
	MS12	22/05/2025	28/05/2025		
Summer	MS3	10/06/2025	16/06/2025	7	56
	MS4	10/06/2025	16/06/2025		
	MS5	10/06/2025	16/06/2025		
	MS6b[7]	10/06/2025	16/06/2025		
	MS7	10/06/2025	16/06/2025		
	MS8	10/06/2025	16/06/2025		
	MS9	10/06/2025	16/06/2025		
	MS10	10/06/2025	16/06/2025		
	MS11	10/06/2025	16/06/2025		
	MS12	10/06/2025	16/06/2025		
Autumn	MS3	09/09/2025	15/09/2025	7	84.5
	MS4	09/09/2025	15/09/2025		
	MS5	09/09/2025	15/09/2025		
	MS6b	09/09/2025	15/09/2025		
	MS7	09/09/2025	15/09/2025		
	MS8	09/09/2025	15/09/2025		
	MS9	09/09/2025	15/09/2025		
	MS10	09/09/2025	15/09/2025		
	MS11	09/09/2025	15/09/2025		
	MS12	09/09/2025	15/09/2025		

2.2.20 Weather conditions, taken from World Weather Online[8] are presented in **Annex 2.**

[7] Deployed post-spring automated activity survey following disturbance of original MS6a location.

[8] World Weather Online (2025) Accessible here: https://www.worldweatheronline.com/ [Accessed 03/10/25].

2.3 Data Analysis and Assumptions of Bat Activity

Acoustic Analysis

2.3.1 Data analysis and interpretation of results followed the principles presented in the BCT guidance (Collins, 2023). Data analysis was undertaken by L. Quarton *MSc BSc* (Hons.), an experienced bat ecologist who regularly carries out analysis of bat survey data.

2.3.2 Bat detectors recorded data onto digital media and were analysed using Kaleidoscope Pro (Wildlife Acoustics) software. Kaleidoscope Pro automatically identified sonograms, and a manual check was conducted to confirm species identified. Bat species were identified using diagnostic features (e.g., frequency, slope, duration, time between calls, minimum call length etc.).

2.3.3 For the purpose of sonogram analysis, the number of 'bat registered calls' were defined as a sequence of echolocation calls consisting of two or more call notes (pulse of frequency), not separated by more than one second (White and Gehrt, 2001 and Gannon et al., 2003), with a minimum call note length of two milliseconds (Weller et al., 2009).

Bat Activity Index

2.3.4 An individual bat can pass a particular feature on several occasions while foraging. As such, it is not possible to estimate the number of individual bats or draw a fair comparison where survey times differ.

2.3.5 In response, bat activity as presented within this technical appendix is recorded as an index, accounting for average bat pass rate per hour or a 'Bat Activity Index (BAI)', as outlined in BCT guidance (Collins, 2023), and defined as follows:

BAI (per hour): total number of registered bat calls / total number of recording hours

2.3.6 BAI presented herein is a measure of mean pass rate per hour relative to each MS location and recording period for both the combined bat assemblage and individual species recorded, accounting for both spatial and seasonal activity across the survey effort

2.4 Limitations

Bat Activity Surveys

Order Limits Amendments

2.4.1 Following amendments to the Order Limits, two MS locations (MS1 and MS2), and an additional transect area (T6) no longer fall within the site. As neither fall within the Proposed Development area, both have been omitted from further assessment. However, MS numbering has been retained for consistency (i.e. MS3-MS12).

MS Failure

2.4.2 Due to technical issues, the MS8 failed to record during the spring recording period. As such, it is not possible to make a direct comparison of activity recorded at MS8 during subsequent months, or between MS location. However, habitats of similar character (e.g. MS3) were successful during spring,

and provide insight in lieu of failure. As such, the failure of a single detector during spring is not considered to be a substantial limitation to the baseline data assessment.

MS Deployment Amendment

2.4.3 Following an initial deployment during spring, MS6a was redeployed in a separate location (i.e. MS6b) due to agricultural disturbance. MS6b was deployed in an area including different baseline habitats (i.e. a watercourse and wooded linear features) outside of the Order Limits (**Figure 1**), and has subsequently been analysed separately to MS6a. Additionally, whilst outside the Order Limits the feature (i.e. Stainforth and Keadby Canal) bisects and is adjacent to the site in areas and has consequently been retained within analysis as a proxy of bat activity relative to these areas.

Weather Conditions

2.4.4 BCT guidance (Collins, 2023) recommends activity surveys be carried out in the following conditions: temperature above 10°C at sunset and with no rain or strong wind. For this assessment, strong wind is considered to be anything above 5m/s.

2.4.5 Suitability of weather conditions during automatic activity surveys was variable, with eight nights sampled undertaken when at least one of the parameters would be considered sub-optimal, most of which occurred during spring and autumn recording periods (**Annex 2**). However, bat activity was recorded during each of these nights. As such, each has been retained for activity analysis.

Acoustic Analysis

2.4.6 Kaleidoscope software can identify certain bat species from sonograms, but some species within the *Myotis* and *Nyctalus* genus can be difficult to distinguish. In some cases, calls may be partially heard or distorted by external factors like passing cars, rain or wind, resulting in unknown or genus-only labels. Likewise, species such as brown long-eared bat have lower detectability and may not be detected during activity surveys relative to their hunting strategies in less open habitats. Survey results have been carefully interpreted across species.

3 RESULTS

3.1 Habitat Suitability Assessment

3.1.1 In reference to BCT guidance (Collins, 2023), the Order Limits was assessed as having '**Low'** habitat suitability relative to its overall commuting and foraging value for bat species.

3.1.2 Habitat suitability was prescribed based on dominant habitat type and land-use, with open habitats present on-site being largely comprised of arable farmland considered to be of negligible ecological value as a foraging resource.

3.1.3 However, linear features and edge habitats are distributed across and adjacent to the site area, which include wooded (e.g. hedgerows and tree lines) and wet (e.g. wet ditches and water courses) linear features, in addition to localised woodland edge.

3.1.4 Linear features and sporadic ponds, scrub and woodland are of increased ecological value relative to both foraging and commuting suitability, and provide additionally connectively throughput the local landscape. On this basis, the Order Limits area was prescribed 'Low' habitat suitability when considering the proportionality of viable feature and habitats.

3.2 Night-time Bat Walkovers

3.2.1 Bat species recorded over the total NBW survey effort are presented in **Table 3.1**. Bat activity metrics per species for each NBW transect are further presented in **Table 3.2**.

3.2.2 Recorded activity per transect area, relative to each NBW survey is further present on **Figures 2-4**.

Species Assemblage and Activity

3.2.3 Collectively, NBW surveys recorded a minimum of four species across the Order Limit area: common pipistrelle, soprano pipistrelle, noctule, and *Myotis* bats.

3.2.4 Bat species presence per transect area was noted to be variable; most species were recorded per transect area during a minimum of one NBW survey, except for T4 (where only common and soprano pipistrelle were recorded).

3.2.5 Common pipistrelle accounted for the most frequently and consistently recorded species per transect area, and for the overall NBW survey effort (although some seasonal variation was noted per transect).

3.2.6 Overall, autumn NBW surveys accounted for highest number of passes per species, which was consistently noted per transect area.

3.2.7 Likewise, T5 accounted for the highest number of overall bat passes, which was consistently noted per NBW survey (although some variation was noted per individual species between NBW surveys).

Activity Distribution and Density

Spring NBW

3.2.8 Bat activity was recorded during spring NBW transects was generally limited to linear features and edge habitats (**Figure 2**), with observed activity including both foraging and commuting behaviour relative to *Pipistrellus* species.

3.2.9 Relative to **Figure 2**, recorded activity during spring NBW transects was most densely associated with linear features, including hedge lines (T1), wet ditches (T3; T5), and treelines (T5).

3.2.10 Summer NBW

3.2.11 Bat activity was recorded during summer NBW transects was generally limited to linear features and edge habitats (**Figure 3**), although some activity was recorded relative to open habitat (i.e. T5). Observed activity included both foraging and commuting behaviour relative to *Pipistrellus* species.

3.2.12 Relative to **Figure 3**, recorded activity during spring NBW transects was most densely associated with linear features, including hedge lines (T1), and wet ditches and treelines (T5).

Autumn NBW

3.2.13 Bat activity was recorded during autumn NBW transects was generally limited to linear features and edge habitats (**Figure 4**), with observed activity including both foraging and commuting behaviour relative to noctule and *Pipistrellus* species.

3.2.14 Relative to **Figure 4**, recorded activity during spring NBW transects was most densely associated with linear features, including hedge lines (T1), woodland edge (T4) and wet ditches and treelines (T5), in addition to freestanding trees and scrub (T2; T3).

Table 3.1: Total bat passes, and percentage passes recorded during NBW surveys.

Species/Genus	Total No. Passes	Percentage of Total Passes (%)
Common pipistrelle	450	81.37
Soprano pipistrelle	35	6.33
Noctule	42	7.59
Myotis spp.	26	4.70
NBW Total (Assemblage)	**553**	**100.00**

Table 3.2: Bat activity metrics per species, for each NBW transect.

Season	Species / Genus	Bat Activity Metrics per NBW Transect (%)										Species Total	
		T1		T2		T3		T4		T5			
		No. Passes	%	No. Passes	%	No. Passes	%	No. Passes	%	No. Passes	%	No. Passes	%
Spring	Common pipistrelle	40	99.00	2	100.00	45	83.33	10	83.33	70	95.89	167	91.76
	Soprano pipistrelle	0	0.00	0	0.00	5	9.26	0	0.00	3	4.11	8	4.40
	Noctule	0	0.00	0	0.00	0	0.00	0	0.00	0	9	2	1.10
	Myotis spp.	1	1.00	0	0.00	4	7.41	2	16.67	0	0	5	2.75
Total		41	22.53	2	1.10	54	29.67	12	6.59	73	40.11	182	32.91
Summer	Common pipistrelle	31	93.94	10	99.00	0	0.00	0	0.00	19	38.78	60	61.86
	Soprano pipistrelle	0	0.00	1	1.00	0	0.00	0	0.00	23	46.94	24	24.74
	Noctule	2	6.06	0	0.00	0	0.00	4	100.00	5	10.20	11	11.34
	Myotis spp.	0	0.00	0	0.00	0	0.00	0	0.00	2	4.08	2	2.06
Total		33	34.02	11	11.34	0.00	0	4	4.12	49	50.52	97	17.54
Autumn	Common pipistrelle	66	94.29	9	31.03	57	90.48	22	55.00	69	95.83	223	81.39
	Soprano pipistrelle	1	0.00	2	6.90	0	0.00	0	0.00	0	0.00	3	1.09
	Noctule	3	4.29	1	3.45	6	9.52	18	45.00	1	1.39	29	10.58
	Myotis spp.	0	0.00	17	58.62	0	0.00	0	0.00	2	2.78	19	6.93
Total		70	25.55	29	10.58	63	22.99	40	14.60	72	26.28	274	49.55
Transect Total		144	26.04	42	7.59	117	21.16	56	10.13	194	35.08	553	100.00

3.3 Automatic Activity Survey

Species Assemblage (Site BAI)

3.3.1 Registered calls indicative of a minimum of six species / genus of bats was detected over the combined survey effort, as presented in **Table 3.3.**

3.3.2 **Table 3.3** summarises the total number of passes, percentage of passes, and the total BAI for the overall Order Limit (i.e. bat activity metrics).

3.3.3 Collectively, the combined assemblage accounted for 23211 passes, equating to a site level BAI of 11.42 passes per hour.

3.3.4 Common pipistrelle accounted for the highest bat activity metrics, relative to additional species recorded (**Table 3.3**).

Table 3.3: Total bat passes, percentage passes, and BAI for the overall survey area.

Species/Genus	Total No. Passes	Percentage of Total Passes (%)	Total BAI (per Species)
Common pipistrelle	20306	87.48	9.99
Soprano pipistrelle	1098	4.73	0.52
Noctule	896	3.86	0.50
Myotis spp.	826	3.56	0.37
Brown long-eared	31	0.13	0.02
Nathusius' pipistrelle	23	0.10	0.01
Total BAI (Assemblage)	23211	100.00	11.42

BAI (MS Location, per Recording Period)

Combined Assemblage

3.3.5 BAI metrics for the combined species assemblage are presented in **Table 3.4.**

3.3.6 Bat presence was consistently recorded at each MS location per recording period (discounting incidents of failure and redeployment).

3.3.7 Relative to total BAI, activity was greatest at MS6b (56.23 passes per hour), and comparable between summer and autumn recording period (although relatively higher during autumn at 14.50 passes per hour).

3.3.8 Relative to individual BAI at each MS location per recording period, BAI showed variation (**Table 3.4**)**.** Individual BAI ranged from 0.30 – 64.57 passes per hour, peaking at MS6b during autumn.

Table 3.4: Combined assemblage BAI at each MS location, per recording period.

Recording Period	Monitoring Station ID											Total BAI (Recording Period)
	MS3	MS4	MS5	MS6a	MS6b	MS7	MS8	MS9	MS10	MS11	MS12	
Spring	3.02	6.07	2.27	0.32	n/a	11.76	n/a	9.96	7.54	3.77	6.79	5.72
Summer	7.04	8.82	4.75	n/a	47.89	14.75	2.64	28.80	5.68	7.14	12.88	14.04
Autumn	38.78	3.64	0.38	n/a	64.57	6.32	0.30	21.82	1.52	1.26	6.41	14.50
Total BAI (MS)	16.28	6.18	2.47	0.32	56.23	10.94	1.47	20.20	4.91	4.06	8.69	11.42

Common Pipistrelle

3.3.9 BAI metrics for common pipistrelle are presented in **Table 3.5**.

3.3.10 Common pipistrelle presence was consistently recorded at each MS location per recording period.

3.3.11 Total BAI was greatest at MS6b (53.08 passes per hour), and during the autumn recording period (12.72 passes per hour).

3.3.12 BAI at each MS location per recording period showed variation (**Table 3.5**). Individual BAI ranged from 0.06 – 61.50 passes per hour, peaking at MS6b during autumn.

Table 3.5: Common pipistrelle BAI at each MS location, per recording period.

Recording Period	Monitoring Station ID											Total BAI (Recording Period)
	MS3	MS4	MS5	MS6a	MS6b	MS7	MS8	MS9	MS10	MS11	MS12	
Spring	2.93	5.77	2.03	0.25	n/a	7.14	n/a	9.86	7.46	3.12	6.59	5.02
Summer	6.68	8.21	3.89	n/a	44.66	6.18	2.14	28.59	5.54	5.82	10.61	12.23
Autumn	29.25	3.15	0.11	n/a	61.50	3.74	0.06	21.19	1.47	0.99	5.70	12.72
Total BAI (MS)	12.95	5.71	2.01	0.25	53.08	5.69	1.10	19.88	4.82	3.31	7.63	9.99

Soprano Pipistrelle

3.3.13 BAI metrics for soprano pipistrelle are presented in **Table 3.6**.

3.3.14 Soprano pipistrelle presence was consistently recorded at most MS locations per recording period, but was variably undetected at MS11 (autumn) and MS10 (summer and autumn).

3.3.15 Total BAI was comparably greatest at MS3, MS6b and MS7 (> 1 passes per hour), and comparable between recording period (although relatively higher during autumn at 0.78 passes per hour).

3.3.16 BAI at each MS location per recording period showed variation (**Table 3.6**). Individual BAI ranged from 0.01 – 5.16 passes per hour, peaking at MS3 during autumn.

Table 3.6: Soprano pipistrelle BAI at each MS location, per recording period.

Recording Period	Monitoring Station ID											Total BAI (Recording Period)
	MS3	MS4	MS5	MS6a	MS6b	MS7	MS8	MS9	MS10	MS11	MS12	
Spring	0.03	0.17	0.15	0.03	n/a	2.25	n/a	0.02	0.07	0.00	0.05	0.31
Summer	0.02	0.23	0.48	n/a	1.82	1.73	0.34	0.09	0.00	0.04	0.11	0.49
Autumn	5.16	0.01	0.08	n/a	1.37	1.05	0.02	0.01	0.00	0.01	0.04	0.78
Total BAI (MS)	1.74	0.14	0.24	0.03	1.60	1.68	0.18	0.04	0.02	0.02	0.06	0.52

Noctule

3.3.17 BAI metrics for noctule are presented in **Table 3.7**.

3.3.18 Noctule presence was consistently recorded at most MS locations per recording period, but was undetected at MS5, MS9 and M10 during the spring recording period.

3.3.19 Total BAI was greatest at MS7 (3.26 passes per hour), and comparable between recording period (although relatively higher during summer at 0.98 passes per hour).

3.3.20 BAI at each MS location per recording period showed variation (**Table 3.7**). Individual BAI ranged from 0.02 – 6.46 passes per hour, peaking at MS7 during summer.

Table 3.7: Noctule BAI at each MS location, per recording period.

Recording Period	Monitoring Station ID											Total BAI (Recording Period)
	MS3	MS4	MS5	MS6a	MS6b	MS7	MS8	MS9	MS10	MS11	MS12	
Spring	0.05	0.08	0.00	0.02	n/a	2.16	n/a	0.00	0.00	0.10	0.10	0.28
Summer	0.13	0.29	0.09	n/a	0.84	6.46	0.16	0.02	0.11	1.25	0.43	0.98
Autumn	0.10	0.35	0.02	n/a	0.05	1.15	0.16	0.06	0.02	0.18	0.27	0.24
Total BAI (MS)	0.09	0.24	0.04	0.02	0.44	3.26	0.16	0.03	0.04	0.51	0.27	0.50

Myotis species

3.3.21 BAI metrics for *Myotis* species are presented in **Table 3.8**.

3.3.22 *Myotis* presence was consistently recorded at most MS locations per recording period, but was undetected at MS10 during the autumn recording period.

3.3.23 Total BAI was comparably greatest at MS3 and MS6b (> 1 passes per hour), and comparable between recording period (although relatively higher during autumn at 0.70 passes per hour).

3.3.24 BAI at each MS location per recording period showed variation (**Table 3.8**). Individual BAI ranged from 0.02 – 4.27 passes per hour, peaking at MS3 during autumn.

Table 3.8: Myotis BAI at each MS location, per recording period.

Recording Period	Monitoring Station ID											Total BAI (Recording Period)
	MS3	MS4	MS5	MS6a	MS6b	MS7	MS8	MS9	MS10	MS11	MS12	
Spring	0.02	0.02	0.07	0.02	n/a	0.18	n/a	0.05	0.02	0.55	0.02	0.10
Summer	0.21	0.07	0.18	n/a	0.55	0.27	0.00	0.11	0.02	0.02	1.73	0.32
Autumn	4.27	0.10	0.14	n/a	1.59	0.33	0.04	0.52	0.00	0.03	0.00	0.70
Total BAI (MS)	1.50	0.06	0.13	0.02	1.07	0.26	0.02	0.22	0.01	0.20	0.58	0.37

Brown long-eared

3.3.25 BAI metrics for brown long-eared are presented in **Table 3.9**.

3.3.26 Brown long-eared presence was variably recorded at between MS locations per recording period, only being consistently recorded at MS4 and MS7, and was notably undetected at MS3 and MS12.

3.3.27 Where recorded, total BAI was comparable between MS locations and recording periods (< 1 pass per hour).

3.3.28 BAI at each MS location per recording period was also relatively comparable (**Table 3.9**). Individual BAI ranged from 0.01 – 0.11 passes per hour, peaking at MS7 during summer.

Table 3.9: Brown long-eared BAI at each MS location, per recording period.

Recording Period	Monitoring Station ID											Total BAI (Recording Period)
	MS3	MS4	MS5	MS6a	MS6b	MS7	MS8	MS9	MS10	MS11	MS12	
Spring	0.00	0.03	0.02	0.00	n/a	0.03	n/a	0.03	0.00	0.00	0.00	0.01
Summer	0.00	0.02	0.00	n/a	0.02	0.11	0.00	0.00	0.00	0.02	0.00	0.02
Autumn	0.00	0.01	0.00	n/a	0.06	0.04	0.02	0.02	0.02	0.00	0.00	0.02
Total BAI (MS)	0.00	0.02	0.01	0.00	0.04	0.06	0.01	0.02	0.01	0.01	0.00	0.02

Nathusius' pipistrelle

3.3.1 BAI metrics for Nathusius' pipistrelle are presented in **Table 3.10**.

3.3.2 Nathusius' pipistrelle presence was largely unrecorded across MS locations per recording period, only being consistently recorded at MS5, and variably recorded during autumn at MS4, MS7, MS11 and MS12.

3.3.3 Where recorded, total BAI was comparable between MS locations and recording periods (< 1 pass per hour).

3.3.4 BAI at each MS location per recording period was also relatively comparable (**Table 3.10**). Individual BAI ranged from 0.01 – 0.17 passes per hour, peaking at MS5 during spring.

Table 3.10: Nathusius' pipistrelle BAI at each MS location, per recording period.

Recording Period	Monitoring Station ID											Total BAI (Recording Period)
	MS3	MS4	MS5	MS6a	MS6b	MS7	MS8	MS9	MS10	MS11	MS12	
Spring	0.00	0.00	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02
Summer	0.00	0.00	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
Autumn	0.00	0.02	0.02	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.01	0.01
Total BAI (MS)	0.00	0.01	0.10	0.00	0.00	<0.01	0.00	0.00	0.00	<0.01	<0.01	0.01

4 SUMMARY

4.1 Habitat Suitability Assessment

4.1.1 The Order Limits includes both open and edge habitat niches, but is of variable habitat suitability relative to foraging and commuting value, being predominantly comprised of arable farmland of negligible suitability.

4.1.2 However, the distribution and quality of linear features, localised woodland parcels, and overall connectivity on-site relative to the local landscape provides a habitat resource of increased ecological value to bats.

4.1.3 Consequently, taking a proportional approach to the extent and types of habitats present, the Order Limits area was prescribed '**Low**' habitat suitability, in reference to descriptions outlined on BCT guidance (Collins, 2023).

4.2 Night-time Bat Walkover Surveys

Species Assemblage

4.2.1 Over the combined NBW survey effort, a minimum of four species/genus of bat were recorded across the Order Limits, including common pipistrelle, soprano pipistrelle, noctule, and *Myotis* species.

4.2.2 Per species, common pipistrelle accounted for the highest number of recorded passed (450 passes; 81.37%), with additional species being proportionally comparable (< 10% of total passes per species).

4.2.3 Presence per transect area was noted to be variable; most species were recorded per transect area during a minimum of one NBW survey, except for T4 (where only common and soprano pipistrelle were recorded).

4.2.4 Per transect area, T5 accounted for the highest number of overall bat passes (194 passes; 35.08%).

4.2.5 Per NBW, autumn surveys accounted for highest number of total passes (274 passes; 49.55%), consistently noted per transect area.

Species Distribution and Density

4.2.6 Per transect area, bat activity generally distributed in association with wooded linear features, woodland edge habitats, and wet ditches per NBW, with limited activity recorded in association with open pasture (i.e. Area 5, summer NBW).

4.2.7 Observed activity was limited to *Pipistrellus* and noctule bats, relating to both forging and commuting behaviour in association with linear features.

4.2.8 Density of recorded activity was variable between NBWs but was frequently noted in association with linear features per transect area, which included hedgerows, treelines and woodland edge, and wet ditches and watercourses, being consistently high relative to linear features at T1 and T5 (**Figure 2-4**).

4.3 Automatic Activity Surveys

Species Assemblage

4.3.1 A minimum of six species/genus of bat were recorded on-site, which included common pipistrelle, soprano pipistrelle, noctule, brown long-eared bat, *Myotis* bats and Nathusius' pipistrelle.

4.3.2 Relative to spatial distribution, most species were recorded per MS location for a minimum of one recording period, apart from brown long-eared bat and Nathusius' pipistrelle.

4.3.3 Likewise, each species recorded was detected on-site per recording period, although seasonal presence between MS locations was noted to vary.

4.3.4 However, common pipistrelle was noted to have been consistently recorded at each MS location, per recording period.

Bat Activity Index Results

Overall Site BAI

4.3.5 Over the combined survey effort, a total of 23211 bat passes were recorded across the survey area, accounting for an overall site BAI of 11.42 passes per hour for the combined assemblage.

4.3.6 Overall site BAI per species was variable, with common pipistrelle accounting for the highest activity levels at 9.99 passes per hour; soprano pipistrelle (0.52 passes per hour) noctule (0.50 passes per hour), and *Myotis* bat (0.37 passes per hour) activity was comparably lower, whilst both brown long-eared bat and Nathusius' pipistrelle accounted for < 0.1 pass per hour.

Combined Assemblage BAI

4.3.7 Per MS location, total BAI for the combined assemblage was greatest at MS6b (i.e. located adjacent the Stainforth and Keadby Canal) at 56.23 passes per hour. Comparably, activity between MS9, MS3 and MS7 (i.e. wooded and wet linear features), each accounted for > 10 passes per hour. Activity was relatively lower at additional MS locations (< 10 passes per hour), but lowest at M6a (i.e. open arable habitat) at 0.32 passes per hour.

4.3.8 Per recording period, total BAI for the combined assemblage was relatively higher during autumn (14.50 passes per hour) but comparable during summer (14.04 passes per hour), and lowest during spring (5.72 passes per hour). However, peak BAI per MS location showed some variation between recording periods and was most frequently highest during the summer recording period.

Species BAI per MS Location

4.3.9 Peak total BAI per species MS location was variable between species. Common pipistrelle mimicked site level trends, being greatest at MS6b (53.08 passes per hour), and being relatively higher at MS3 (12.95 passes per hour) and MS9 (19.88 passes per hour). Soprano pipistrelle total BAI was comparably high at MS3, MS6b and MS7 (> 1 pass per hour), noctule bats at MS7 (3.26 passes per hour), and *Myotis* bats at MS3 and MS6b (> 1 pass per hour). Where recorded, total BAI for brown long-eared and Nathusius' pipistrelle was comparable across MS locations (< 1 pass per hour).

4.3.10 Conversely, minimum total BAI for common pipistrelle was notably lower at MS6a, but comparable between additional MS locations for soprano pipistrelle, noctule and *Myotis* bats (< 1 pass per hour), and for brown long-eared and Nathusius' pipistrelle (where recorded).

4.3.11 Peak total BAI between species was most frequently noted with MS3, MS6b, MS7 and MS9 (apart from brown long-eared bat and Nathusius' pipistrelle). Relative to MS6b, MS7, and MS9, these locations are each associated with both wet and wooded linear feature on and adjacent to Order Limits (the latter also being directly connected to an urban settlement, i.e. potential roost sites). Conversely, MS3 is associated with a hedgerow and adjacent urban dwelling, although functionally connected to wet ditches and watercourses (e.g. Bloating Dyke Drain; Stainforth and Keadby Canal).

Species BAI per Recording Period

4.3.12 Peak total BAI per recording period was also variable between species. Total BAI for common pipistrelle was relatively higher during autumn but comparable to summer (> 12 passes per hour), and lowest during spring (5.02 passes per hour).

4.3.13 Total BAI per recording period for between soprano pipistrelle, noctule and *Myotis* bats was relatively comparable between recording periods (< 1 pass per hour), but relatively higher during autumn relative to soprano pipistrelle and *Myotis* species, and summer relative to noctule. However, total BAI for all three species was noted to be relatively lowest during spring.

4.3.14 Total BAI per recording period was comparable for both brown long-eared and Nathusius' pipistrelle at < 0.1 passes per hour per season, but was relatively higher during summer and autumn for brown long-eared bat, and during spring for Nathusius' pipistrelle.

4.3.15 Overall, total BAI per recording period was more frequently higher during autumn, and lowest during spring for most species recorded, and for the overall assemblage.

Annex 1

Scientific Names

Table A1.1 provides common and scientific names of bat species mentioned within this report.

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*
Myotis spp.	*Myotis*

Annex 2

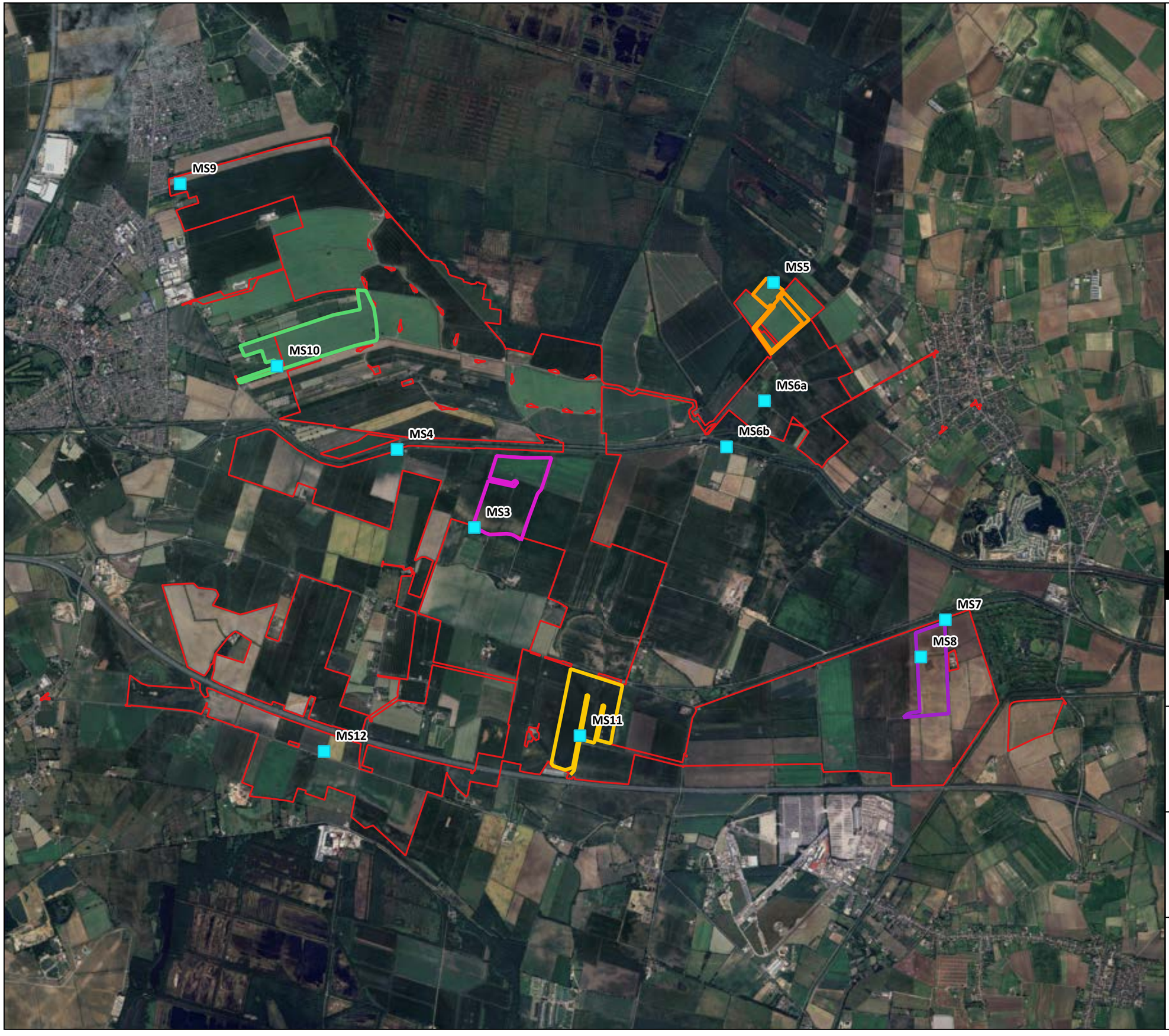
Weather Conditions

Table A2.1 below provides weather conditions during automatic activity surveys. Underlined text in **red** highlights sub-optimal weather conditions for bats, based on guidance outlined in Collins (2023).

Date	Temp at Dusk (°C)	Rainfall (mm)	Maximum Wind Speed (m/s)[9]
22/05/2025	12	0.0	2.78
23/05/2025	12	0.0	2.22
24/05/2025	15	0.3	3.06
25/05/2025	11	0.0	**5.28**
26/05/2025	14	0.0	**6.11**
27/05/2025	10	0.0	**7.22**
28/05/2025	11	0.0	2.22
10/06/2025	11	0.0	0.83
11/06/2025	15	0.0	**5.28**
12/06/2025	18	0.0	4.72
13/06/2025	19	0.2	1.67
14/06/2025	13	0.0	3.33
15/06/2025	13	0.0	3.89
16/06/2025	16	0.0	1.67
09/09/2025	19	0.0	3.61
10/09/2025	17	0.0	**6.39**
11/09/2025	15	0.0	**5.56**
12/09/2025	16	0.0	4.17
13/09/2025	14	0.3	5.00
14/09/2025	14	0.0	**5.83**
15/09/2025	14	0.0	**10.83**

[9] Converted from km/h

FIGURE 1: BAT ACTIVITY SURVEY PLAN



Order Limits

Monitoring Station

NBW Transect Area

Area 1 (NBW)

Area 2 (NBW)

Area 3 (NBW)

Area 4 (NBW)

Area 5 (NBW)

TWEEN BRIDGE

Bat Activity Survey Plan

Version: 01

Date: 07/11/2025

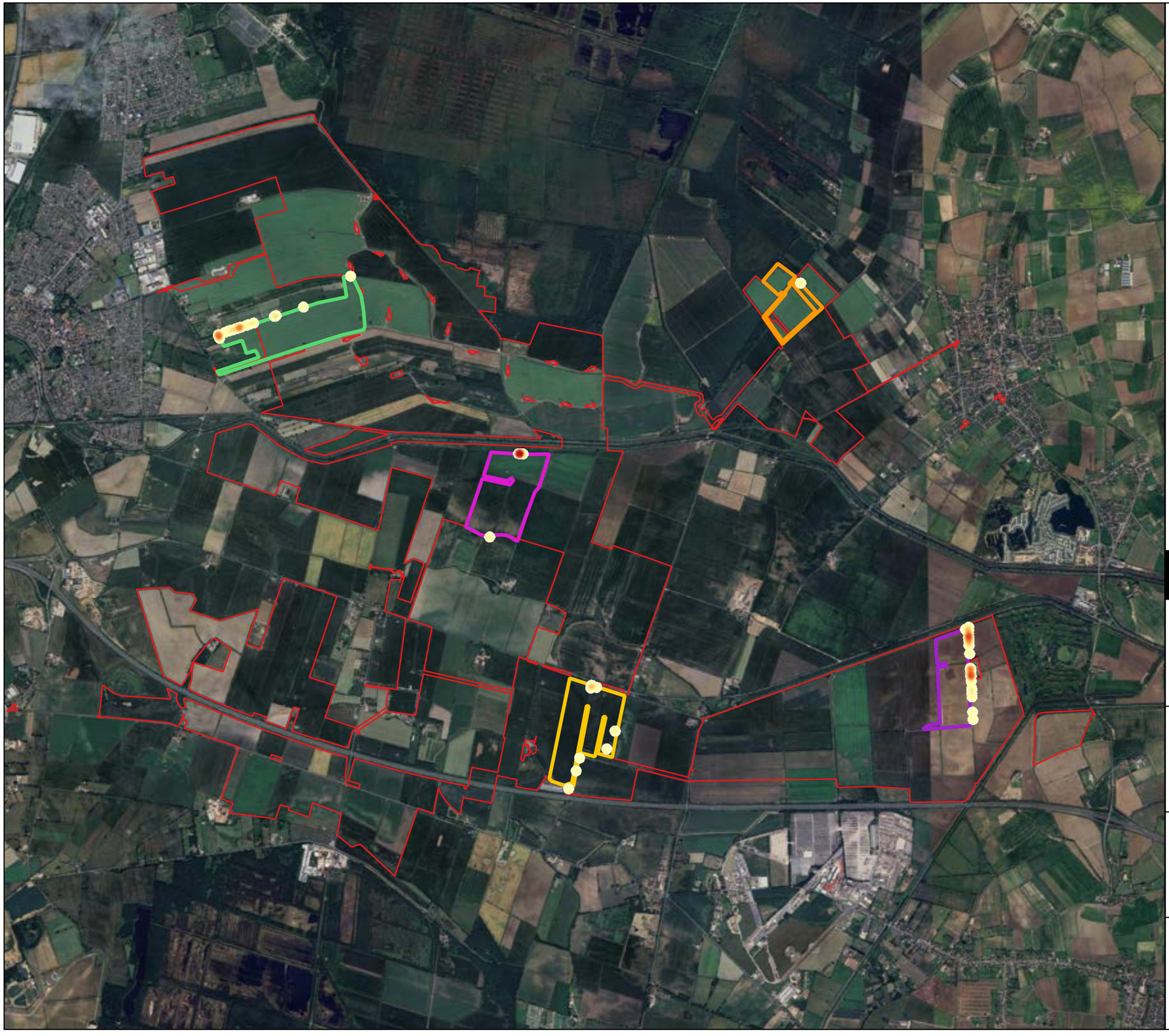
Avian Ecology, Suite 3c Walnut Tree Farm, Northwich Road, Lower Stretton
WA4 4PG
Tel: 0843 506 5116
www.avianecology.co.uk

0 1 2 km

Co-ordinate System : British National Grid
Projection: Traverse Mercator
Datum: OSGB 1936
Units: Metres

This map contains data from the following sources:

FIGURE 2: NBW SURVEY RESULTS (SPRING)



Order Limits

Density of bat activity recorded (within 50m radius)

- 0 - 1
- 1.1 - 3
- 3.1 - 5
- 5.1 - 10
- 10.1 - 20
- 20.1 - 40

NBW Transect Area

- Area 1 (NBW)
- Area 2 (NBW)
- Area 3 (NBW)
- Area 4 (NBW)
- Area 5 (NBW)

TWEEN BRIDGE

NBW Activity Results (Spring)

Version: 01

Date: 07/11/2025

avian ecology

Avian Ecology, Suite 3c Walnut Tree Farm, Northwich Road, Lower Stretton
WA4 4PG
Tel: 0843 506 5116
www.avianecology.co.uk

0 1 2 km

N

Co-ordinate System : British National Grid
Projection: Traverse Mercator
Datum: OSGB 1936
Units: Metres

This map contains data from the following sources:

FIGURE 3: NBW SURVEY RESULTS (SUMMER)

Order Limits

Density of bat activity recorded (within 50m radius)

- 0 - 1
- 1.1 - 3
- 3.1 - 5
- 5.1 - 10
- 10.1 - 20
- 20.1 - 40

NBW Transect Area

- Area 1 (NBW)
- Area 2 (NBW)
- Area 3 (NBW)
- Area 4 (NBW)
- Area 5 (NBW)

TWEEN BRIDGE

NBW Activity Results (Summer)

Version: 01

Date: 07/11/2025

Avian Ecology, Suite 3c Walnut Tree Farm, Northwich Road, Lower Stretton
WA4 4PG
Tel: 0843 506 5116
www.avianecology.co.uk

0 1 2 km

N

Co-ordinate System : British National Grid
Projection: Traverse Mercator
Datum: OSGB 1936
Units: Metres

This map contains data from the following sources:

FIGURE 4: NBW SURVEY RESULTS (AUTUMN)

Order Limits

Density of bat activity recorded (within 50m radius)

- 0 - 1
- 1.1 - 3
- 3.1 - 5
- 5.1 - 10
- 10.1 - 20
- 20.1 - 40

NBW Transect Area

- Area 1 (NBW)
- Area 2 (NBW)
- Area 3 (NBW)
- Area 4 (NBW)
- Area 5 (NBW)

TWEEN BRIDGE

NBW Activity Results (Autumn)

Version: 01

Date: 07/11/2025

Avian Ecology, Suite 3c Walnut Tree Farm, Northwich Road, Lower Stretton
WA4 4PG
Tel: 0843 506 5116
www.avianecology.co.uk

0 1 2 km

N

Co-ordinate System : British National Grid
Projection: Traverse Mercator
Datum: OSGB 1936
Units: Metres

This map contains data from the following sources: