

Tween Bridge Solar Farm

Environmental Statement Appendix 7.4: Nightjar Survey Results

Planning Act 2008
Infrastructure Planning (Applications: Prescribed Forms
and Procedure) Regulations 2009

APFP Regulation 5(2)(a)

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Revision 1



Tween Bridge Solar Farm

A Nationally Significant Infrastructure Project in the Energy Sector

Preliminary Environmental Information Report

Technical Appendix 7.4 – Nightjar Survey Results October 2023



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Humberhead Peatlands National
Nature Reserve – Thorne and
Crowle Moors

Nightjar Survey Report - 2022

September 12, 2022

DOCUMENT CONTROL

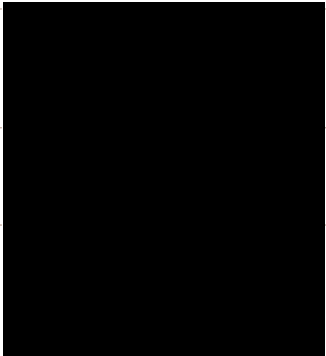
Project:	Humberhead Peatlands National Nature Reserve Nightjar Surveys 2022		
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1. EXECUTIVE SUMMARY

AB Ecology was commissioned by Natural England to undertake nightjar *Caprimulgus europaeus* surveys as part of the long-term monitoring of the nightjar population on Thorne and Crowle Moors (hereafter referred to as the 'site') which forms part of the Humberhead Peatlands National Nature Reserve (NNR).

The surveys were conducted in line with best practice guidelines between 15th June and 13th July 2022. Surveys were undertaken in calm, warm, dry conditions as nightjars churr more frequently on warm nights. This ensured that there was the greatest possibility of encountering birds which were displaying territorial activity.

Surveys in 2022 have recorded the highest number of churring males on Thorne Moors since 2017 and the highest number on Crowle Moors since 2006. Comparing numbers of the totals for both sites shows that the numbers of churring males recorded in 2022 equals the highest number on record from 2017.

On Thorne Moors 41 churring males or territories were recorded, which is 9 more than in 2021 and 8 more than the mean number of territories averaged since the surveys began in 2005 (mean = 33 nightjar per year).

On Crowle Moors 17 churring males were recorded, which is 6 more than in 2021 and 3.12 more than the mean number of birds averaged since the surveys began in 2005 (mean = 13.88 nightjar per year).

Correlations have been made in previous years surveys with favourable weather conditions, which is in line with the results from 2022, where all surveys were undertaken in good or moderate wind conditions (<10 mph) and good temperature conditions (between 16 and 21 °C).

The annual total for the whole of the Humberhead Peatlands NNR in 2022 (Thorne and Crowle, combined with Hatfield) is 110 churring males/territories.

2. INTRODUCTION

AB Ecology was commissioned by Natural England to undertake nightjar *Caprimulgus europaeus* surveys as part of the long-term monitoring of the nightjar population on Thorne and Crowle Moors (hereafter referred to as the 'site') which forms part of the Humberhead Peatlands National Nature Reserve (NRR).

2.1 OBJECTIVE

The objectives of the survey were as follows:

- To determine the number of churring male nightjars on Thorne and Crowle Moors using teams of surveyors to walk pre-determined transect routes; and
- To produce a report which details the findings of the aforementioned surveys and compare numbers of churring males with surveys that have been undertaken over the last 17 years to monitor population trends.

2.2 SITE CONTEXT

The Humberhead Peatlands NNR comprises Thorne Moors, Crowle Moors and Hatfield Moors; the sites make up the two largest lowland raised mires in Great Britain, covering 3,000 hectares in total. The sites are both designated as a Special Area of Conservation (SAC), Site of Special Scientific Interest (SSSI), Special Protection Area (SPA) and a NNR. Both Thorne and Hatfield Moors were designated as SPA in August 2000, under article 4.1 of the Wild Birds Directive (HMSO, 2017) because the sites are used regularly by 1% or more of the population of nightjar in Great Britain (Natural England, 2000).

The central grid reference for Thorne and Crowle Moors is located at Ordnance Survey National Grid Reference SK 806 504 and the location of Thorne, Crowle and Hatfield Moors can be seen on Drawing 1.

Hatfield Moors was also surveyed for nightjar during the same period; the results of which can be found in a separate report (AB Ecology, 2022)

2.3 NIGHTJAR ECOLOGY

Nightjar are crepuscular and nocturnal birds that arrive in the UK between late April and mid-May before returning to Africa in August or September. In Britain, nightjars breed principally on lowland heath and coniferous plantation clear-fell. A clutch of eggs is laid from mid-May to mid-July and young begin flying at 15 days old. Male nightjars have a distinctive call known as churring, this identifies their location along with wing claps and contact calls. Birds churr from mid-May to mid-August, peaking in June (Gilbert *et al*, 1998).

2.4 LEGISLATION AND SPECIES PROTECTION

All birds are protected under the Wildlife and Countryside Act 1981 (as amended) (HMSO, 1981), making it an offence, with certain exceptions (e.g. game birds), to intentionally:

- Kill, injure or take any wild bird;
- Take, damage or destroy the nest of any wild bird while it is in use or being built; and
- Take or destroy the egg of any wild bird.

Nightjar is also listed on Schedule 1 of the Act. Schedule 1 contains a list of birds which are conferred extra protection and for which all offences carry harsher penalties. Under the legislation it is illegal to: intentionally or recklessly disturb a Schedule 1 bird while it is building a nest, or is in or near a nest containing eggs or young; and intentionally or recklessly disturb dependent young of such a bird.

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

The S41 list is used to guide decision-makers such as public bodies, including local and regional authorities, in implementing their duty under Section 40 of the NERC Act 2006, to have regard to the conservation of biodiversity in England, when carrying out their normal functions.

3. METHODOLOGY

3.1 SURVEY PERSONNEL

Surveys were undertaken by experienced lead surveyors George Day and Colin Neale and assisted by Mark Paine and Richard Cooper.

George Day has extensive experience working with nightjars, having spent the previous 4 years studying nightjar behaviour and site use across the UK for his PhD investigating the breeding and population ecology of European nightjar in the U.K. In 2020/2021 he spent 12 months in the field on the Humberhead Peatlands NNR.

Colin Neale has been surveying and studying nightjars as a Natural England volunteer, and latterly employed, for the last 8 years on the Humberhead Peatlands NNR, using a variety of techniques and technologies.

3.2 FIELD SURVEY

The surveys were conducted in line with best practice guidelines (Gilbert *et al.*, 1998, with modifications by Conway *et al.*, 2007) between 15th June and 13th July 2022. The surveys were approached with due attention to parameters which may affect the activity of birds i.e. time of day and weather conditions.

Surveys were only undertaken in calm, warm, dry conditions as nightjars churr more frequently on warm nights. This ensured that there was the greatest possibility of encountering birds which were displaying territorial activity. The weather conditions during each survey visit were assessed for suitability using a scale developed for the monitoring in previous years (Middleton Bell, 2021); this was developed to help determine impacts of any adverse weather conditions on the results of the surveys. The following scales were used:

Wind Scale

- Good (wind 0-5 mph);
- Moderate (wind 6-10 mph);
- Poor (wind 11-16 mph).

Temperature Scale

- Good (15°C and above);
- Moderate (11 °C - 14 °C);
- Poor (5 °C - 10 °C).

Survey methods were kept largely the same as in surveys undertaken in previous years by Middleton Bell (Middleton Bell, 2021) so that comparisons could continue to be made between survey results. The only exception to this was that surveys were commenced at 21:30 instead of 22:00 and ceased at 01:00 instead of 01:30. Lead surveyors (George Day and Colin Neale) have extensive experience in surveying nightjars on the reserves and felt that the recommended start time for surveys in Gilbert *et al.* (1998), and that had been followed by the previous monitoring surveys undertaken by Middleton Bell, was resulting in churring males being under recorded; this was because birds are most active at dusk. The length of the survey periods was the same as had been undertaken in previous years of monitoring (3.5 hours).

Surveyors walked pre-determined transect routes which were provided by Natural England (See Drawing 2) with frequent stops (every 200 m, or whenever a bird was heard) to check and record 'churring' males. Located nightjars were recorded on a map with a coloured dot. All surveyors used OS Global Positioning System (GPS) smart phone applications and a digital mapping tool (google maps) to accurately record bird registrations. The locations of all churring male nightjars were recorded, with special attention given to simultaneously churring males which would indicate two separate males on different territories. Once a bird was located and directionality determined, then a GPS location for the bird was taken using google maps. Wherever possible the location for the same bird was rechecked further along the transect, if the bird continued to churr.

Thorne and Crowle Moors were surveyed on separate nights due to the size of the site; this follows the approach undertaken in previous surveys. On Thorne Moors, two teams of two surveyors surveyed the site simultaneously, with one team surveying the northern section of the transect and another team surveying the southern section. On Crowle Moors only one team of two surveyors was required for the transect.

Lead surveyors undertook the first transect on Crowle Moor together to verify the recording approach, and after this, each subsequent survey had at least one lead surveyor present in each team during every survey to ensure standardisation of the recording methods.

3.3 DETERMINATION OF TERRITORIES

After the surveys were complete the lead surveyors analysed the maps from all survey visits, verified nightjar registrations were collated and individual territories determined. This involved analysing the data recorded from the two surveys and applying the following process to bird registrations to determine the individual number or territories/churring males as defined by Conway *et al.*, (2007)¹:

- Data was filtered by survey number (1 or 2) and simultaneously churring males were marked as separate territories;
- Registrations of birds that were more than 350 m apart were marked as separate territories; and

¹ Conway *et al.* (2007), to try and overcome observer inaccuracy when recording the number of males on a site, due to individual males moving unseen between song posts, created a threshold of 350 m to differentiate between male territories when males were not recorded simultaneously.

- Consolidated maps and individual coordinates from birds from both surveys were then combined on QGIS (a digital geographical information system) and the 350 m threshold distances re-checked and the total number of churring males produced.

3.4 LIMITATIONS

The Humberhead Peatlands nightjar monitoring surveys have been consistently surveyed for numerous years by Middleton Bell Ecology. A change over of the survey team could have led to inconsistencies in the survey and analysis methods for recording the birds, however every measure was taken to ensure that the same methods were used to undertake the surveys in 2022. Despite this, there is always an element of subjectivity in the analysis when evaluating whether birds recorded between surveys 1 and 2 were separate birds.

The results from 2022 are broadly comparable to previous years therefore it is concluded that the change over in the survey team has not affected the comparability of the results.

4. RESULTS

4.1 WEATHER CONDITIONS

Details of survey dates, start and finish times and weather conditions for the nightjar surveys are presented in Table 1. All surveys were conducted in suitable weather conditions.

Table 1: Survey Schedule and Weather Conditions

Site	Visit	Survey Date	Start Time	Finish Time	Wind Dir.	Wind Speed (mph)	Cloud Cover	Average Temp °C	Precipitation
Crowle	1	15 June 2022	21:30	01:00	E	3	35%	16	None
Thorne	1	16 June 2022	21:30	01:00	S	2	40%	21	None
Crowle	2	29 June 2022	21:30	01:00	SW	10	0-5%	18	None
Thorne	2	13 July 2022	21:30	01:00	S	2	50%	21	None

4.2 FIELD SURVEY

A total of 58 churring nightjars or territories were located during the surveys on Thorne and Crowle Moors in 2022. 41 territories were found on Thorne Moors and 17 territories on Crowle Moors. See Drawing 2 for locations of churring males recorded, the drawing shows churring males recorded on Survey 1 (blue points) and Survey 2 (green points), and also shows locations of males recorded in the same locations on both surveys (purple points).

Other notable species recorded were five breeding pairs of long eared owl *Asio otus* (indicated through begging calls from chicks in nests), with four pairs being recorded on Crowle Moors on

Survey 1 and one pair being recorded on Thorne Moors on Survey 1. Woodcock *Scolopax rusticola* were also recorded on Crowle Moors, with two displaying individuals being recorded during each survey.

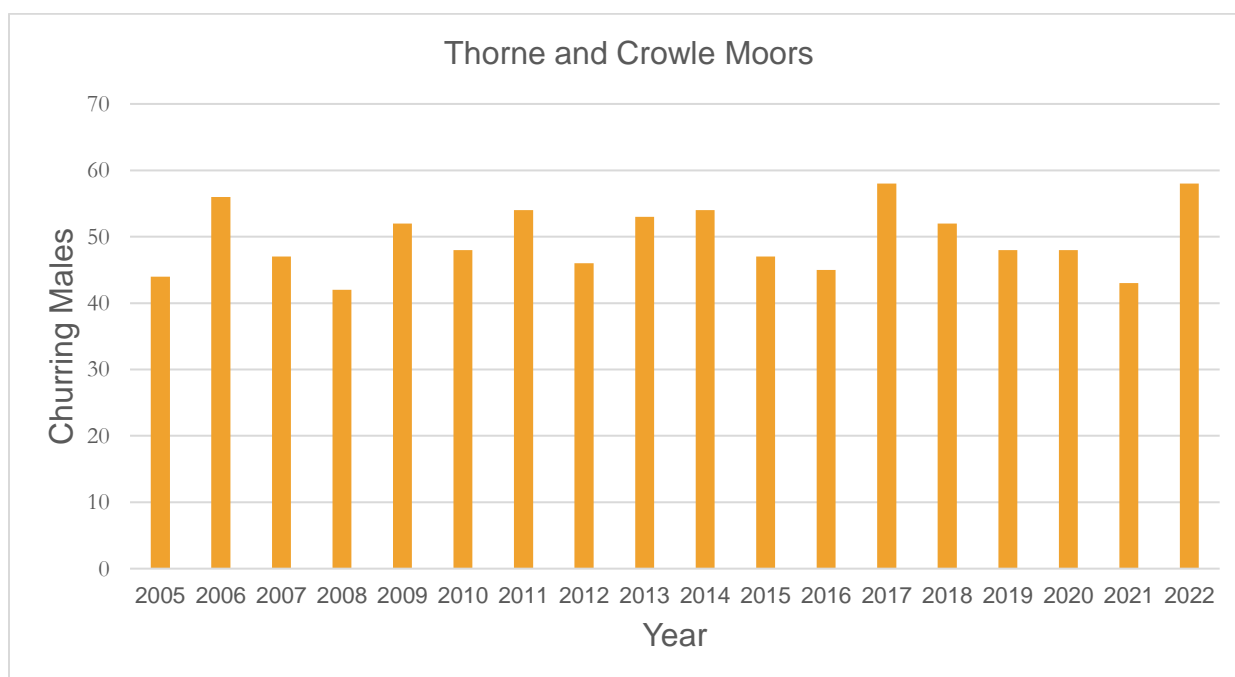
5. DISCUSSION

Table 2 shows the numbers of churring male nightjars recorded each year since 2005 (information adapted from Middleton Bell, 2021) and trends shows that this year has recorded the highest number of churring males on Thorne Moors since 2017 and the highest number on Crowle Moors since 2006. Comparing numbers of the totals for both sites shows that the numbers of churring males recorded in 2022 equals the highest number on record from 2017 – see Figure 1 for populations trends for Thorne and Crowle combined.

Table 2: Annual Total of Churring Males on Thorne and Crowle Moors 2005-2022

Year	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22
Thorne	23	36	34	30	37	32	34	34	40	41	32	34	46	40	34	35	32	41
Crowle	21	20	13	12	15	16	13	12	13	13	15	11	12	12	14	13	11	17
Total	44	56	47	42	52	48	54	46	53	54	47	45	58	52	48	48	43	58

Figure 1: Churring Males (Trends 2005-2022)



On Thorne Moors 41 churring males or territories were recorded, which is 9 more than in 2021 and 8 more than the mean number of territories averaged since the surveys began in 2005 (mean = 33 nightjar per year).

On Crowle Moors 17 churring males were recorded, which is 6 more than in 2021 and 3.12 more than the mean number of birds averaged since the surveys began in 2005 (mean = 13.88 nightjar per year).

The annual total for the whole of the Humberhead Peatlands NNR in 2022 (Thorne and Crowle, combined with Hatfield - AB Ecology, 2022) is 110 churring males or territories.

The four years with the highest number of churring males since the surveys began have been when the weather has been dry and warm (Middleton Bell, 2021), which is in line with the results from 2022 where all surveys were undertaken in favourable weather conditions, with good or moderate wind conditions (<10 mph) and good temperature conditions (between 16 and 21 °C).

Comparisons with nightjar distribution across Thorne and Crowle Moors can be made with the 2021 results, and as a whole distribution is very similar to what was recorded in 2022.

On Crowle Moors, territories tend to be denser in the habitat to the north, rather than in the south, with small clusters of territories in the central northern area. On Thorne Moors, nightjar territories were broadly associated with the same areas as last year, however no territories were found in the north eastern part of the site (Management Compartments 26-28 and 35-36 – see Appendix B); in 2021 two territories were located in this area. One of the areas with the highest density of territories lies to the south (Casson's Marsh and to the north of the Marsh), and is associated with Management Compartments 55, 56, 61 and 65; 7 territories were found in this area which is significantly more than was found in 2021 where 3 territories were found. A further cluster was found on the western tip of Thorne Moors (Snaith and Cowick Moors) with 7 territories being found in Management Compartments 5b, 6b and 30; 3 territories were found in this area in 2021.

The average density for the whole of Thorne and Crowle Moors has previously been assessed annually (Middleton Bell, 2021), and in 2021 the average density for the whole of Thorne and Crowle was deemed to be approximately 3.1 churring males per 1 km², however the report does not state what size area this was measured against. If the figure of 17 km² was used to make this measurement (the approximate area of Thorne and Crowle Moors NNR boundary measured using GIS software) the average density in 2022 would therefore be 3.4 churring males per km² which is above average, however this is not a result that can be compared with previous years monitoring due to area measurements not being given, also not all habitat with the NNR is suitable for nightjar so results should be interpreted with caution.

It is worth noting that whilst churring nightjars appeared to be absent from some areas of suitable habitat, this is not necessarily the case – see Drawing 2. Paired males may only churr for a reduced period of time compared with unpaired individuals (Day, *pers comm.*). It may be the case that nightjars are not always encountered during a two-visit survey. Also, churring males do not always equate to breeding pairs (Jenks *et al.*, 2014), and may better reflect distribution of unpaired birds.

Five pairs of long-eared owl were recorded in 2022, with four pairs being recorded on Crowle Moors and one on Thorne Moors during the first survey visit to these areas. The mean number of pairs for this area that has been established during the nightjar monitoring surveys since 2005 is 2.23 long eared owls per year, therefore the results from 2022 are well above average and the most that has been recorded since the surveys began in 2005 – refer to Table 3. Reasons for this are unknown, the habitat remains in a similar condition as in previous years, therefore this could be due to the favourable weather conditions (warm and calm) for the surveys in 2022 making the behaviour more apparent, or that there has been an increase in the number of pairs.

Table 3: Annual Total of Breeding Pairs of Long-eared Owl 2005-2022

Year	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22
Long-eared owl	4	3	3	2	1	4	3	2	0	5	3	1	2	0	1	0	4	5

6. REFERENCES

AB Ecology (2022) *Humberhead Peatlands National Nature Reserve – Hatfield Moors: Nightjar Survey Report*. Report Reference 2022/016/02.

Conway, G., Wotton, S., Henderson, I., Langston, R., Drewitt, A., Currie, F. (2007) Status and Distribution of European Nightjars *Caprimulgus europaeus* in the UK in 2004. *Bird Study* 54, p98-111

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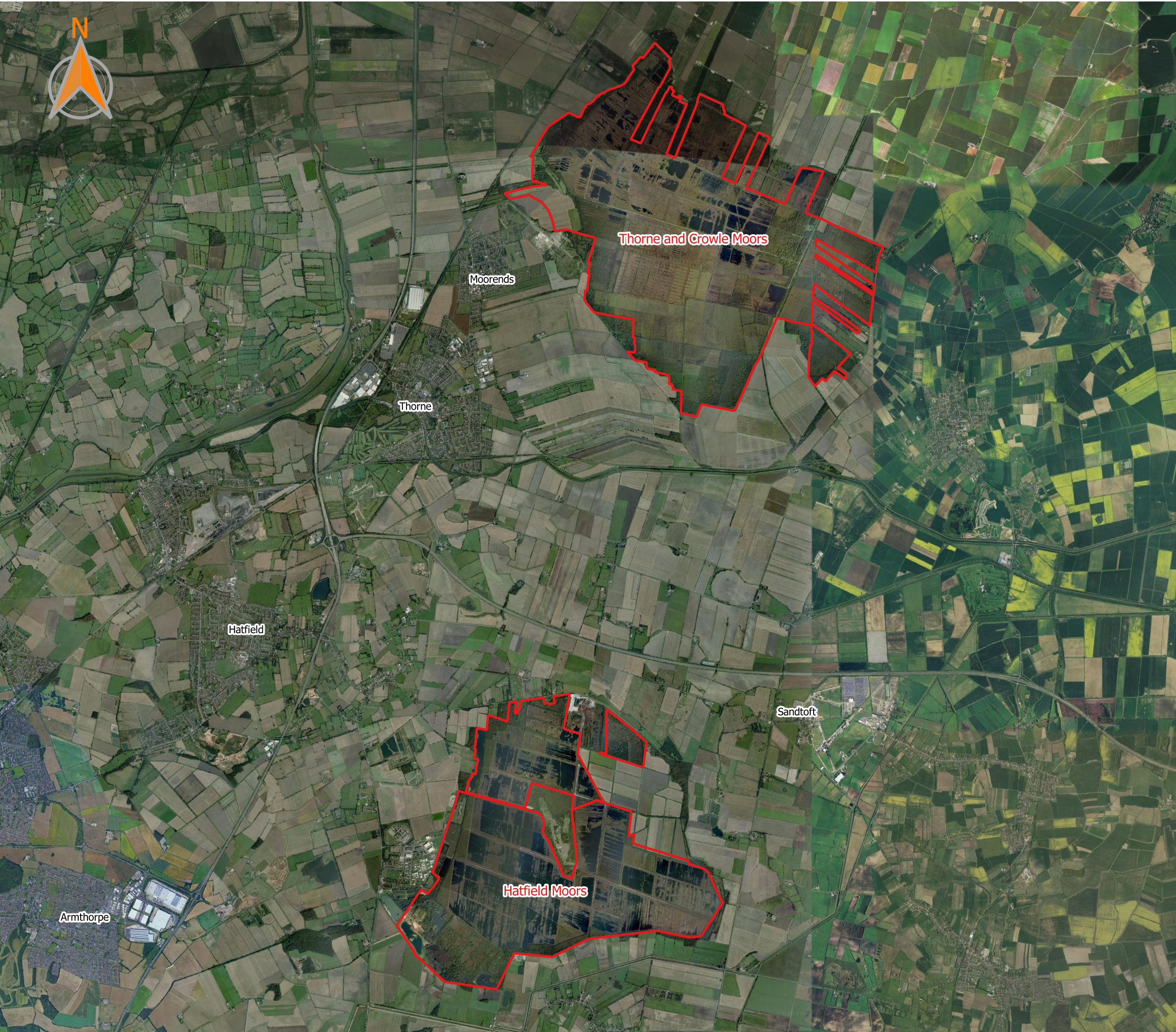
Middleton Bell (2021) *Breeding Nightjar Survey – 2021 – Humberhead Peatlands NNR, SAC, SSSI, SPA (Thorne, Goole and Crowle Moors)*.

Natural England (2000) *Thorne and Hatfield Moors SPA Citation* [online]. Available at: <http://publications.naturalengland.org.uk/publication/6503407711944704> [accessed September 2022].

Drawings

Drawing 1 – Site Location Plan

Drawing 2 - Churring Nightjar Location Map



Legend

Humberhead Peatlands NNR Site Boundary

Base map fromGoogle Satellite
Scale @ A3 1:25000

Client Natural England	
Project Humberhead Peatlands NNR – Thorne and Crowle Moors – Nightjar Survey	
Title Site Location Plan	
Project Number 2022/016	Date 31/08/2022
<div><div>AB</div><div>Ecology</div></div>	Drawing Number 1



Legend

Humberhead Peatlands NNR Site Boundary

Transect Route

Churring Male Nightjar (Visit 1 only)

Churring Male Nightjar (Visit 2 only)

Churring Male Nightjar (Visits 1 & 2)

Base map from Google Satellite
Scale @ A3 1:25000

Client Natural England	
Project Humberhead Peatlands NNR – Thorne and Crowle Moors – Nightjar Survey	
Title Churring Nightjar Location Map	
Project Number 2022/016	Date 31/08/2022
<div><div>AB</div><div>Ecology</div></div>	Drawing Number 2

Appendix A

Churring Male Coordinates

NIGHTJAR SURVEY REPORT – THORNE AND CROWLE MOORS - APPENDIX A –
CHURRING MALE COORDINATES

No	Latitude	Longitude	Survey Recorded	Wind Conditions	Temp Conditions
1	53.628382	-0.86268961	1 and 2	Good/Moderate	Good
2	53.630863	-0.8540086	1 and 2	Good/Moderate	Good
3	53.625444	-0.8547973	1 and 2	Good/Moderate	Good
4	53.630389	-0.8611648	1 and 2	Good/Moderate	Good
5	53.631518	-0.8551872	1 and 2	Good/Moderate	Good
6	53.652126	-0.9260595	1 and 2	Good	Good
7	53.639587	-0.918404	1 and 2	Good	Good
8	53.618656	-0.89920521	1 and 2	Good	Good
9	53.624079	-0.9094915	1 and 2	Good	Good
10	53.633653	-0.90553522	1 and 2	Good	Good
11	53.649493	-0.92921913	1 and 2	Good	Good
12	53.62918	-0.88815451	1 and 2	Good	Good
13	53.620374	-0.89752078	1 and 2	Good	Good
14	53.615308	-0.89738131	1 and 2	Good	Good
15	53.617883	-0.9024178	1 and 2	Good	Good
16	53.623269	-0.90476274	1 and 2	Good	Good
17	53.653692	-0.90832483	1 and 2	Good	Good
18	53.651773	-0.91019147	1 and 2	Good	Good
19	53.6229588	-0.8666353	1	Good	Good

NIGHTJAR SURVEY REPORT – THORNE AND CROWLE MOORS - APPENDIX A –
CHURRING MALE COORDINATES

No	Latitude	Longitude	Survey Recorded	Wind Conditions	Temp Conditions
20	53.6225085	-0.8659381	1	Good	Good
21	53.6178484	-0.86839	1	Good	Good
22	53.6246075	-0.8656481	1	Good	Good
23	53.6288069	-0.8671969	1	Good	Good
24	53.6302614	-0.8535922	1	Good	Good
25	53.6302471	-0.8710956	1	Good	Good
26	53.651551	-0.89979548	1	Good	Good
27	53.653286	-0.88950634	1	Good	Good
28	53.636804	-0.90481896	1	Good	Good
29	53.629187	-0.89127037	1	Good	Good
30	53.621268	-0.89844609	1	Good	Good
31	53.618916	-0.89720128	1	Good	Good
32	53.616502	-0.90095806	1	Good	Good
33	53.623421	-0.90173932	1	Good	Good
34	53.624688	-0.90401173	1	Good	Good
35	53.627796	-0.91910268	1	Good	Good
36	53.635262	-0.91986203	1	Good	Good
37	53.634636	-0.91433823	1	Good	Good
38	53.632534	-0.91458914	1	Good	Good

NIGHTJAR SURVEY REPORT – THORNE AND CROWLE MOORS - APPENDIX A –
CHURRING MALE COORDINATES

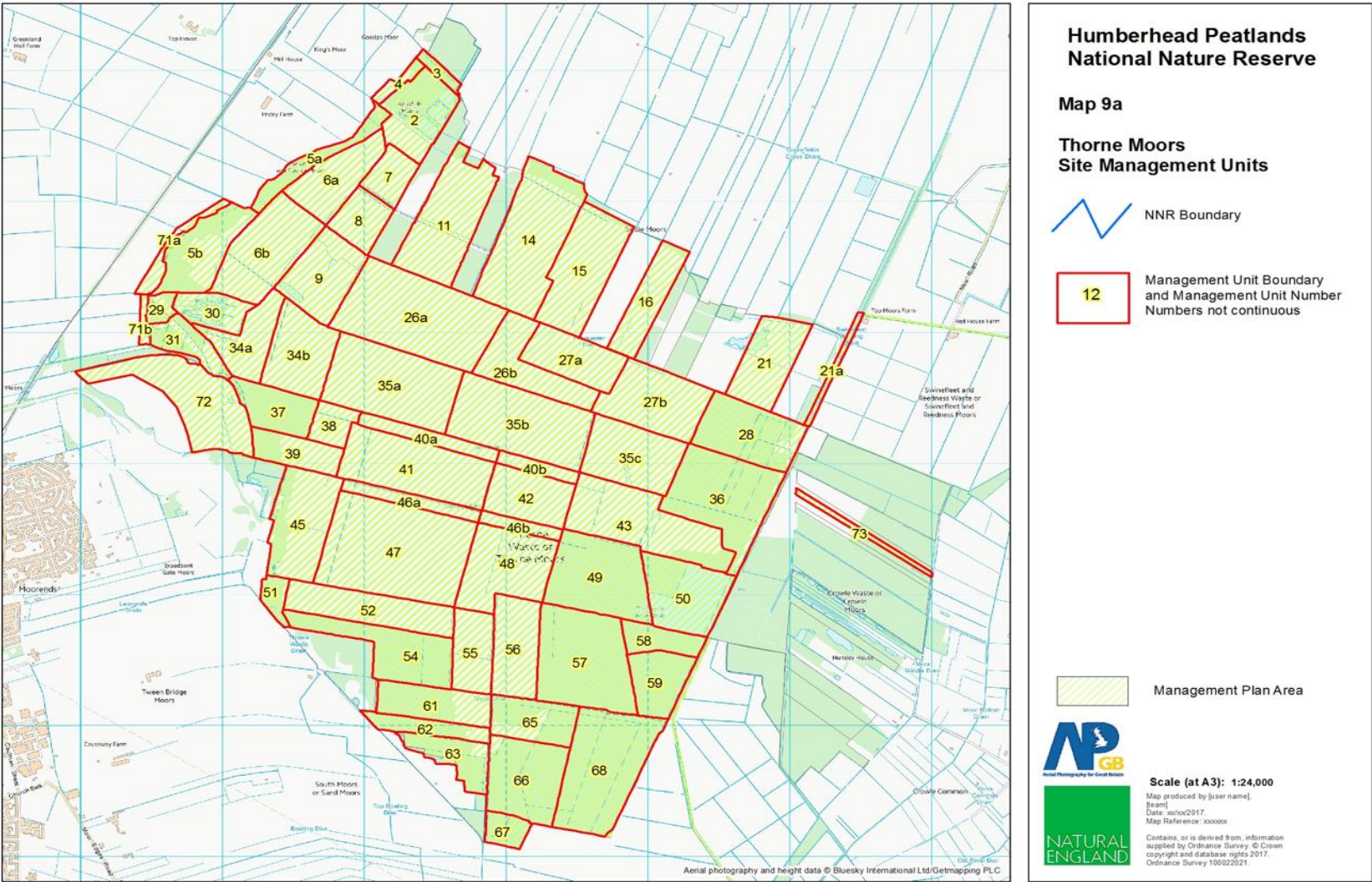
No	Latitude	Longitude	Survey Recorded	Wind Conditions	Temp Conditions
39	53.634358	-0.91033439	1	Good	Good
40	53.619163	-0.88499109	1	Good	Good
41	53.6338851	-0.8634135	2	Moderate	Good
42	53.6344314	-0.858394	2	Moderate	Good
43	53.6240327	-0.8541572	2	Moderate	Good
44	53.6278752	-0.8561567	2	Moderate	Good
45	53.6259698	-0.8594847	2	Moderate	Good
46	53.658458	-0.90684709	2	Good	Good
47	53.647671	-0.93116391	2	Good	Good
48	53.619352	-0.89194243	2	Good	Good
49	53.657328	-0.90381056	2	Good	Good
50	53.62656	-0.91296052	2	Good	Good
51	53.626063	-0.9075737	2	Good	Good
52	53.631712	-0.90117037	2	Good	Good
53	53.630792	-0.90130174	2	Good	Good
54	53.648668	-0.9220743	2	Good	Good
55	53.652269	-0.92782974	2	Good	Good
56	53.657191	-0.9144026	2	Good	Good
57	53.648434	-0.92847926	2	Good	Good

NIGHTJAR SURVEY REPORT – THORNE AND CROWLE MOORS - APPENDIX A –
CHURRING MALE COORDINATES

No	Latitude	Longitude	Survey Recorded	Wind Conditions	Temp Conditions
58	53.650272	-0.93171358	2	Good	Good

Appendix B

Management Compartment Map (Natural England)





Humberhead Peatlands National
Nature Reserve – Hatfield Moors

Nightjar Survey Report - 2022

September 12, 2022

DOCUMENT CONTROL

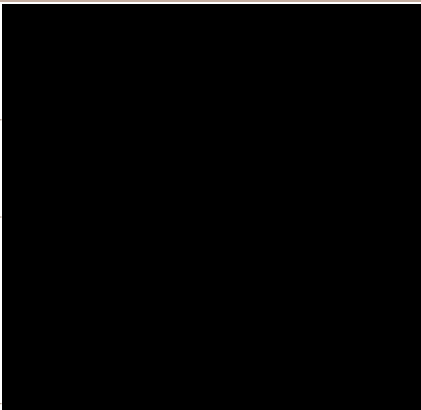
Project:	Humberhead Peatlands National Nature Reserve Nightjar Surveys 2022		
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1. EXECUTIVE SUMMARY

AB Ecology was commissioned by Natural England to undertake nightjar *Caprimulgus europaeus* surveys as part of the long-term monitoring of the nightjar population on Hatfield Moors (hereafter referred to as the 'site') which forms part of the Humberhead Peatlands National Nature Reserve (NRR).

The surveys were conducted in line with best practice guidelines between 16th June and 12th July 2022. Surveys were undertaken in warm, dry conditions as nightjars churr more frequently on warm nights. This ensured that there was the greatest possibility of encountering birds which were displaying territorial activity.

Trends shows that 2022 has recorded the highest number of churring males on Hatfield Moors since the monitoring began in 2005, and follows an upward trend in numbers since 2016, this is despite the large wildfire in 2020, which occurred during the breeding season and which could have had a negative effect on numbers of birds.

During the surveys this year 52 churring males or territories were recorded, which is 9 more than in 2021 and 16 more than the mean number of territories averaged since the surveys began in 2005 (mean = 36 nightjar per year). As in previous years Packard's Heath is the area which has the highest density of nightjars on the site.

The annual total for the whole of the Humberhead Peatlands NNR in 2022 (i.e the combined total on Hatfield Moor and Thorne and Crowle Moors (reported in a separate report; AB Ecology, 2022)) is 110 churring males or territories.

2. INTRODUCTION

AB Ecology was commissioned by Natural England to undertake nightjar *Caprimulgus europaeus* surveys as part of the long-term monitoring of the nightjar population on Hatfield Moors (hereafter referred to as the 'site') which forms part of the Humberhead Peatlands National Nature Reserve (NRR).

2.1 OBJECTIVE

The objectives of the survey were as follows:

- To determine the number of churring male nightjars on Hatfield Moors using teams of surveyors to walk pre-determined transect routes; and
- To produce a report which details the findings of the aforementioned surveys and compare numbers of churring males with surveys that have been undertaken over the last 17 years to monitor population trends.

2.2 SITE CONTEXT

The Humberhead Peatlands NNR comprises Thorne Moors, Crowle Moors and Hatfield Moors; the sites make up the two largest lowland raised mires in Great Britain, covering 3,000 hectares in total. The sites are both designated as a Special Area of Conservation (SAC), Site of Special Scientific Interest (SSSI), Special Protection Area (SPA) and a NNR. Both Thorne and Hatfield Moors were designated as SPA in August 2000, under article 4.1 of the Wild Birds Directive (HMSO, 2017) because the sites are used regularly by 1% or more of the population of nightjar in Great Britain (Natural England, 2000).

The central grid reference for Hatfield Moors is located at Ordnance Survey National Grid Reference SE 711 060 and the location of Thorne, Crowle and Hatfield Moors can be seen on Drawing 1.

Thorne and Crowle Moors was also surveyed for nightjar during the same period; the results of which can be found in a separate report (AB Ecology, 2022)

2.3 NIGHTJAR ECOLOGY

Nightjar are crepuscular and nocturnal birds that arrive in the UK between late April and mid-May before returning to Africa in August or September. In Britain, nightjars breed principally on lowland heath and coniferous plantation clear-fell. A clutch of eggs is laid from mid-May to mid-July and young begin flying at 15 days old. Male nightjars have a distinctive call known as churring, this identifies their location along with wing claps and contact calls. Birds churr from mid-May to mid-August, peaking in June (Gilbert *et al*, 1998).

2.4 LEGISLATION AND SPECIES PROTECTION

All birds are protected under the Wildlife and Countryside Act 1981 (as amended) (HMSO, 1981), making it an offence, with certain exceptions (e.g. game birds), to intentionally:

- Kill, injure or take any wild bird;
- Take, damage or destroy the nest of any wild bird while it is in use or being built; and
- Take or destroy the egg of any wild bird.

Nightjar is also listed on Schedule 1 of the Act. Schedule 1 contains a list of birds which are conferred extra protection and for which all offences carry harsher penalties. Under the legislation it is illegal to: intentionally or recklessly disturb a Schedule 1 bird while it is building a nest, or is in or near a nest containing eggs or young; and intentionally or recklessly disturb dependent young of such a bird.

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

The S41 list is used to guide decision-makers such as public bodies, including local and regional authorities, in implementing their duty under Section 40 of the NERC Act 2006, to have regard to the conservation of biodiversity in England, when carrying out their normal functions.

3. METHODOLOGY

3.1 SURVEY PERSONNEL

Surveys were undertaken by experienced lead surveyors George Day and Colin Neale and assisted by Mark Paine, Richard Cooper and Malcolm Richardson.

George Day has extensive experience working with nightjars, having spent the previous 4 years studying nightjar behaviour and site use across the UK for his PhD investigating the breeding and population ecology of European nightjar in the U.K. In 2020/2021 he spent 12 months in the field on the Humberhead Peatlands NNR.

Colin Neale has been surveying and studying nightjars as a Natural England volunteer, and latterly employed, for the last 8 years on the Humberhead Peatlands NNR, using a variety of techniques and technologies.

3.2 FIELD SURVEY

The surveys were conducted in line with best practice guidelines (Gilbert *et al.*, 1998, with modifications by Conway *et al.*, 2007) on 16th June and 12th July 2022. The surveys were approached with due attention to parameters which may affect the activity of birds i.e. time of day and weather conditions.

Surveys were undertaken, where possible, in calm, warm, dry conditions as nightjars churr more frequently on warm nights. This ensured that there was the greatest possibility of encountering birds which were displaying territorial activity. The weather conditions during each survey visit were assessed for suitability using a scale developed for the monitoring in previous years (Middleton Bell, 2021); this was developed to help determine impacts of any adverse weather conditions on the results of the surveys. The following scales were used:

Wind Scale

- Good (wind 0-5 mph);
- Moderate (wind 6-10 mph);
- Poor (wind 11-16 mph).

Temperature Scale

- Good (15°C and above);
- Moderate (11 °C - 14 °C);
- Poor (5 °C - 10 °C).

Survey methods were kept largely the same as in surveys undertaken in previous years by Middleton Bell (Middleton Bell, 2021) so that comparisons could continue to be made between survey results. The only exception to this was that surveys were commenced at 21:30 instead of 22:00 and ceased at 01:00 instead of 01:30. Lead surveyors (George Day and Colin Neale) have extensive experience in surveying nightjars on the reserves and felt that the recommended start time for surveys in Gilbert *et al.* (1998), and that had been followed by the previous monitoring surveys undertaken by Middleton Bell, was resulting in churring males being under recorded; this was because birds are most active at dusk. The length of the survey periods was the same as had been undertaken in previous years of monitoring (3.5 hours).

Surveyors walked pre-determined transect routes which were provided by Natural England (See Drawing 2) with frequent stops (every 200 m, or whenever a bird was heard) to check and record 'churring' males. Located nightjars were recorded on a map with a coloured dot. All surveyors used OS Global Positioning System (GPS) smart phone applications and a digital mapping tool (google maps) to accurately record bird registrations. The locations of all churring male nightjars were recorded, with special attention given to simultaneously churring males which would indicate two separate males on different territories. Once a bird was located and directionality determined, then a GPS location for the bird was taken using google maps. Wherever possible the location for the same bird was rechecked further along the transect, if the bird continued to churr.

Two teams of two surveyors surveyed the site simultaneously, with one team surveying the northern section of the transect and another team surveying the southern section.

Lead surveyors had previously surveyed transects on Crowle Moors together to verify the recording approach. The surveys on Hatfield Moors had at least one lead surveyor present in each team during every survey to ensure standardisation of the recording methods.

3.3 DETERMINATION OF TERRITORIES

After the surveys were complete the lead surveyors analysed the maps from all survey visits, verified nightjar registrations were collated and individual territories determined. This involved analysing the data recorded from the two surveys and applying the following process to bird registrations to determine the individual number or territories/churring males as defined by Conway *et al.*, (2007)¹:

- Data was filtered by survey number (1 or 2) and simultaneously churring males were marked as separate territories;
- Registrations of birds that were more than 350 m apart were marked as separate territories; and
- Consolidated maps and individual coordinates from birds from both surveys were then combined on QGIS (a digital geographical information system) and the 350 m threshold distances re-checked and the total number of churring males produced.

¹ Conway *et al.* (2007), to try and overcome observer inaccuracy when recording the number of males on a site, due to individual males moving unseen between song posts, created a threshold of 350 m to differentiate between male territories when males were not recorded simultaneously.

3.4 LIMITATIONS

The Humberhead Peatlands nightjar monitoring surveys have been consistently surveyed for numerous years by Middleton Bell Ecology. A change over of the survey team could have led to inconsistencies in the survey and analysis methods for recording the birds, however every measure was taken to ensure that the same methods were used to undertake the surveys in 2022. Despite this, there is always an element of subjectivity in the analysis when evaluating whether birds recorded between surveys 1 and 2 were separate birds.

Although numbers of churring males recorded in 2022 were higher than in previous years, it is felt that this could be as a result of the combination of the warm weather conditions, and the lead surveyor's decision to commence surveys slightly earlier than in previous years, and this has meant that more birds were apparent as more of the survey was undertaken in the peak period of activity. Therefore meaning the results are a truer reflection of numbers than in previous years.

Both surveys were undertaken in poor wind conditions (> 16 mph), however the results show that this does not seem to have affected the results with the highest number of nightjars being recorded on record.

4. RESULTS

4.1 WEATHER CONDITIONS

Details of survey dates, start and finish times and weather conditions for the nightjar surveys are presented in Table 1. All surveys were conducted in suitable weather conditions, although conditions were windier than expected.

Table 1: Survey Schedule and Weather Conditions

Site	Visit	Survey Date	Start Time	Finish Time	Wind Dir.	Wind Speed (mph)	Cloud Cover	Average Temp °C	Precipitation
Hatfield	1	16 June 2022	21:30	01:00	W	16	25%	20	None
Hatfield	2	12 July 2022	21:30	01:00	W	21	30%	18	None

4.2 FIELD SURVEY

A total of 52 churring nightjars or territories were located during the surveys on Hatfield Moors in 2022. See Drawing 2 for the locations of churring males recorded, the drawing shows churring males recorded on Survey 1 (blue points) and Survey 2 (green points), and also shows locations of males recorded in the same locations on both surveys (purple points).

Other notable species recorded were four breeding pairs of long eared owl *Asio otus* (indicated through begging calls from chicks in nests). Woodcock *Scolopax rusticola* were also recorded, with two displaying individuals being recorded during Survey 1 in different areas of the site.

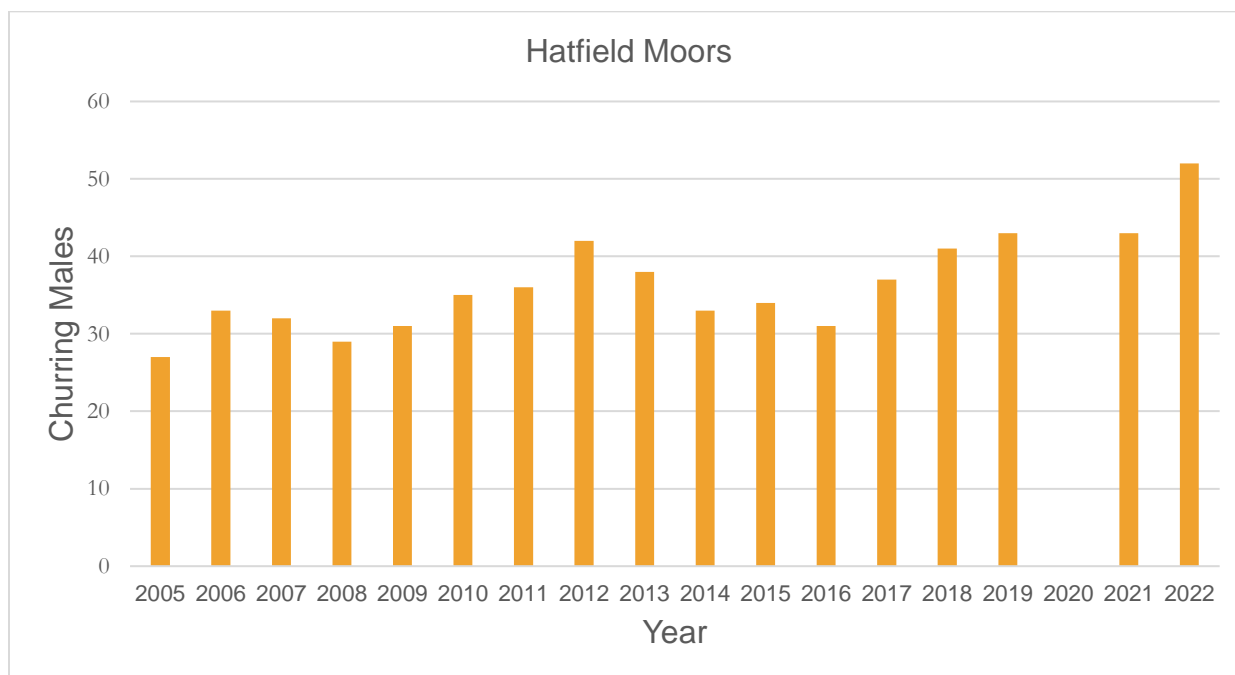
5. DISCUSSION

Table 2 shows the numbers of churring male nightjars recorded each year since 2005 (information adapted from Middleton Bell, 2021). Trends shows that 2022 has recorded the highest number of churring males on Hatfield Moors since the monitoring began in 2005. This follows an upward trend in numbers since 2016 (see Figure 1), despite the large wildfire in 2020 during the breeding season which could have had a negative effect on numbers of birds.

Table 2: Annual Total of Churring Males on Hatfield Moors 2005-2022

Year	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20 ²	21	22
Total	27	33	32	29	31	35	36	42	38	33	34	31	37	41	43	N/a	43	52

Figure 1: Churring Males (Trends 2005-2022)



During the surveys this year 52 churring males or territories were recorded, which is 9 more than in 2021 and 16 more than the mean number of territories averaged since the surveys began in 2005 (mean = 36 nightjar per year).

The annual total for the whole of the Humberhead Peatlands NNR in 2022 (Thorne and Crowle (AB Ecology, 2022) combined with Hatfield) is 110 churring males or territories.

Comparisons with nightjar distribution across Hatfield Moors can be made with the 2021 results, and as a whole distribution is very similar to what was recorded in 2022, with the areas containing

² No survey due to a wildfire burning throughout the survey period

the most churring males being Packard's Heath, where 10 territories were found, compared to 7 found in 2021 (Management Compartment 24 – see Appendix B).

A cluster of territories was also found this year at the eastern end of Packard's South (Management Compartment 21), with 6 territories being found; this is a similar number to what was recorded in 2021 however birds were mostly found around the peripheries of the compartment, territories were distributed more centrally in 2022. Belton Moor (Management Compartment 5) recorded a similar number of territories to what was found in 2021 and a higher density of birds was recorded in the north of the site compared to last year in Stainforth and Kilham North (Management Compartments 2 & 6)

The average density for Hatfield Moors has previously been assessed annually (Middleton Bell, 2021), and in 2021 the average density was deemed to be 6 churring males per 1 km². Using the figure of 12.7 km² (the approximate area of Hatfield Moors NNR boundary measured using GIS software) the average density in 2022 is approximately 4 churring males per km² which is below average, however this is not a result that can be compared with previous years monitoring due to area measurements not being given in previous reports. Also, not all habitats with the NNR boundary are suitable habitat for nightjar, so interpretations should be made with caution.

It is worth noting that whilst churring nightjar appeared to be absent from some areas of suitable habitat, this is not necessarily the case – see Drawing 2. Paired males may only churr for a reduced period of time compared with unpaired individuals (Day, *pers comm.*). It may be the case that nightjars are not always encountered during a two-visit survey. Also, churring males do not always equate to breeding pairs (Jenks *et al.*, 2014), and may better reflect distribution of unpaired birds.

Four pairs of long eared owl were recorded in 2022, with the same number being recorded on the first and second surveys; two pairs were recorded during the surveys in 2021, however comparison data from previous years surveys for this species is not given in previous survey reports so analysis of long-term trends cannot be made.

6. REFERENCES

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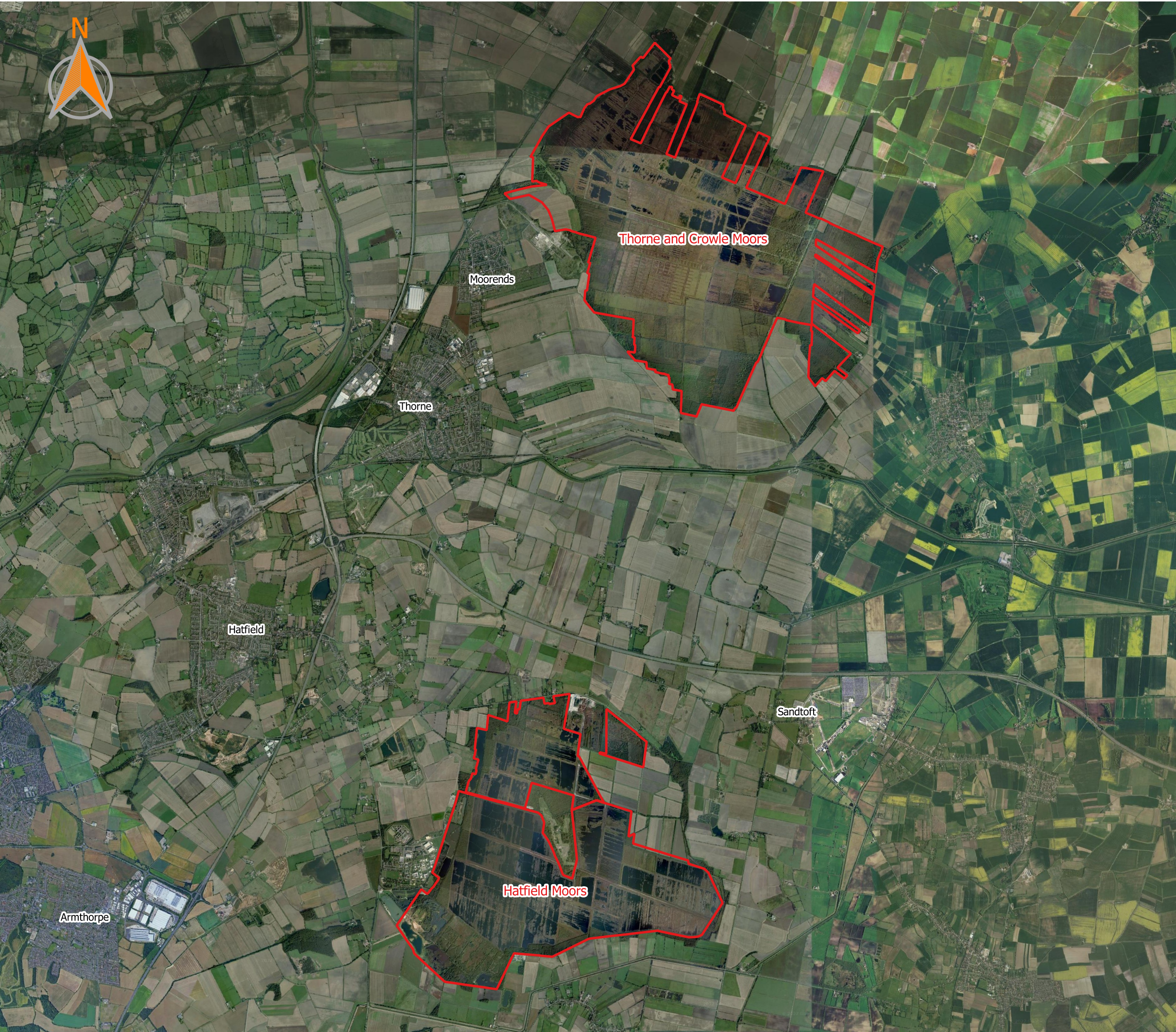
Middleton Bell (2021) *Breeding Nightjar Survey – 2021 – Humberhead Peatlands NNR, SAC, SSSI, SPA (Hatfield Moors)*.

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Drawings

Drawing 1 – Site Location Plan


Drawing 2 - Churring Nightjar Location Map



Legend

Humberhead Peatlands NNR Site Boundary

Base map from Google Satellite
Scale @ A3 1:25000

Client Natural England	
Project Humberhead Peatlands NNR – Hatfield Moors – Nightjar Survey	
Title Site Location Plan	
Project Number 2022/016	Date 31/08/2022
	Drawing Number 1



Legend

Humberhead Peatlands NNR Site Boundary

Transect Route

Churring Male Nightjar (Visit 1 only)

Churring Male Nightjar (Visit 2 only)

Churring Male Nightjar (Visits 1 & 2)

Base map from Google Satellite
Scale @ A3 1:20000

Client Natural England	
Project Humberhead Peatlands NNR – Hatfield Moors – Nightjar Survey	
Title Churring Nightjar Location Map	
Project Number 2022/016	Date 31/08/2022
<div><div>AB</div><div>Ecology</div></div>	Drawing Number 2

Appendix A

Chrring Male Coordinates

NIGHTJAR SURVEY REPORT – HATFIELD MOORS - APPENDIX A – CHURRING MALE COORDINATES

No	Latitude	Longitude	Survey Recorded	Wind Conditions	Temp Conditions
1	53.533345	-0.92439651	1 and 2	Poor	Good
2	53.559465	-0.91321707	1 and 2	Poor	Good
3	53.560288	-0.91326396	1 and 2	Poor	Good
4	53.563709	-0.91746569	1 and 2	Poor	Good
5	53.557107	-0.94831109	1 and 2	Poor	Good
6	53.561434	-0.94615459	1 and 2	Poor	Good
7	53.554641	-0.93013644	1 and 2	Poor	Good
8	53.539804	-0.92734694	1 and 2	Poor	Good
9	53.55022	-0.94112277	1 and 2	Poor	Good
10	53.552056	-0.95097184	1 and 2	Poor	Good
11	53.534805	-0.92956781	1 and 2	Poor	Good
12	53.533404	-0.93578517	1 and 2	Poor	Good
13	53.564375	-0.93669176	1 and 2	Poor	Good
14	53.56142	-0.94376148	1 and 2	Poor	Good
15	53.54969	-0.92223449	1 and 2	Poor	Good
16	53.540843	-0.91714382	1 and 2	Poor	Good
17	53.531679	-0.96064984	1 and 2	Poor	Good
18	53.530389	-0.94743669	1 and 2	Poor	Good
19	53.532053	-0.95163167	1 and 2	Poor	Good

NIGHTJAR SURVEY REPORT – HATFIELD MOORS - APPENDIX A – CHURRING MALE COORDINATES

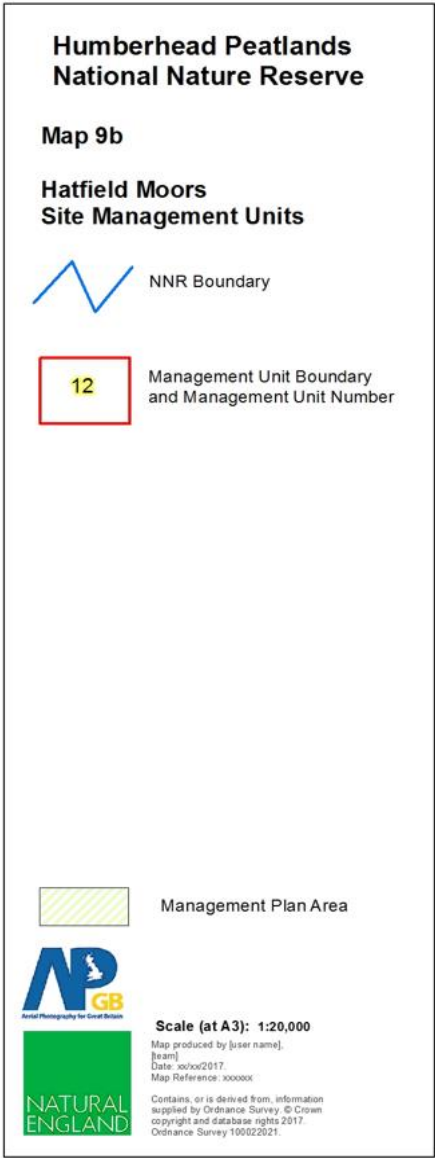
No	Latitude	Longitude	Survey Recorded	Wind Conditions	Temp Conditions
20	53.533179	-0.95509708	1 and 2	Poor	Good
21	53.536247	-0.95793469	1 and 2	Poor	Good
22	53.52801	-0.95340192	1 and 2	Poor	Good
23	53.54222	-0.94658375	1 and 2	Poor	Good
24	53.560791	-0.91828644	1 and 2	Poor	Good
25	53.536899	-0.91767557	1	Poor	Good
26	53.53967	-0.91212273	1	Poor	Good
27	53.54043	-0.93173353	1	Poor	Good
28	53.543363	-0.93370764	1	Poor	Good
29	53.554213	-0.94993114	1	Poor	Good
30	53.537953	-0.93395306	1	Poor	Good
31	53.532809	-0.93018003	1	Poor	Good
32	53.534805	-0.92956781	1	Poor	Good
33	53.538249	-0.9278512	1	Poor	Good
34	53.54053	-0.93851734	1	Poor	Good
35	53.536139	-0.93607678	1	Poor	Good
36	53.533	-0.9488249	1	Poor	Good
37	53.536116	-0.95209837	1	Poor	Good
38	53.530629	-0.95862335	1	Poor	Good

NIGHTJAR SURVEY REPORT – HATFIELD MOORS - APPENDIX A – CHURRING MALE COORDINATES

No	Latitude	Longitude	Survey Recorded	Wind Conditions	Temp Conditions
39	53.529693	-0.95544367	1	Poor	Good
40	53.562652	-0.93715159	1	Poor	Good
41	53.5526	-0.9247162	1	Poor	Good
42	53.55321	-0.92941761	1	Poor	Good
43	53.550825	-0.92505751	1	Poor	Good
44	53.545207	-0.92624858	1	Poor	Good
45	53.561406	-0.94059706	2	Poor	Good
46	53.565626	-0.93842464	2	Poor	Good
47	53.557782	-0.92792706	2	Poor	Good
48	53.548597	-0.93848934	2	Poor	Good
49	53.547344	-0.93641633	2	Poor	Good
50	53.533041	-0.96177829	2	Poor	Good
51	53.527975	-0.95149755	2	Poor	Good
52	53.53476	-0.93324973	2	Poor	Good

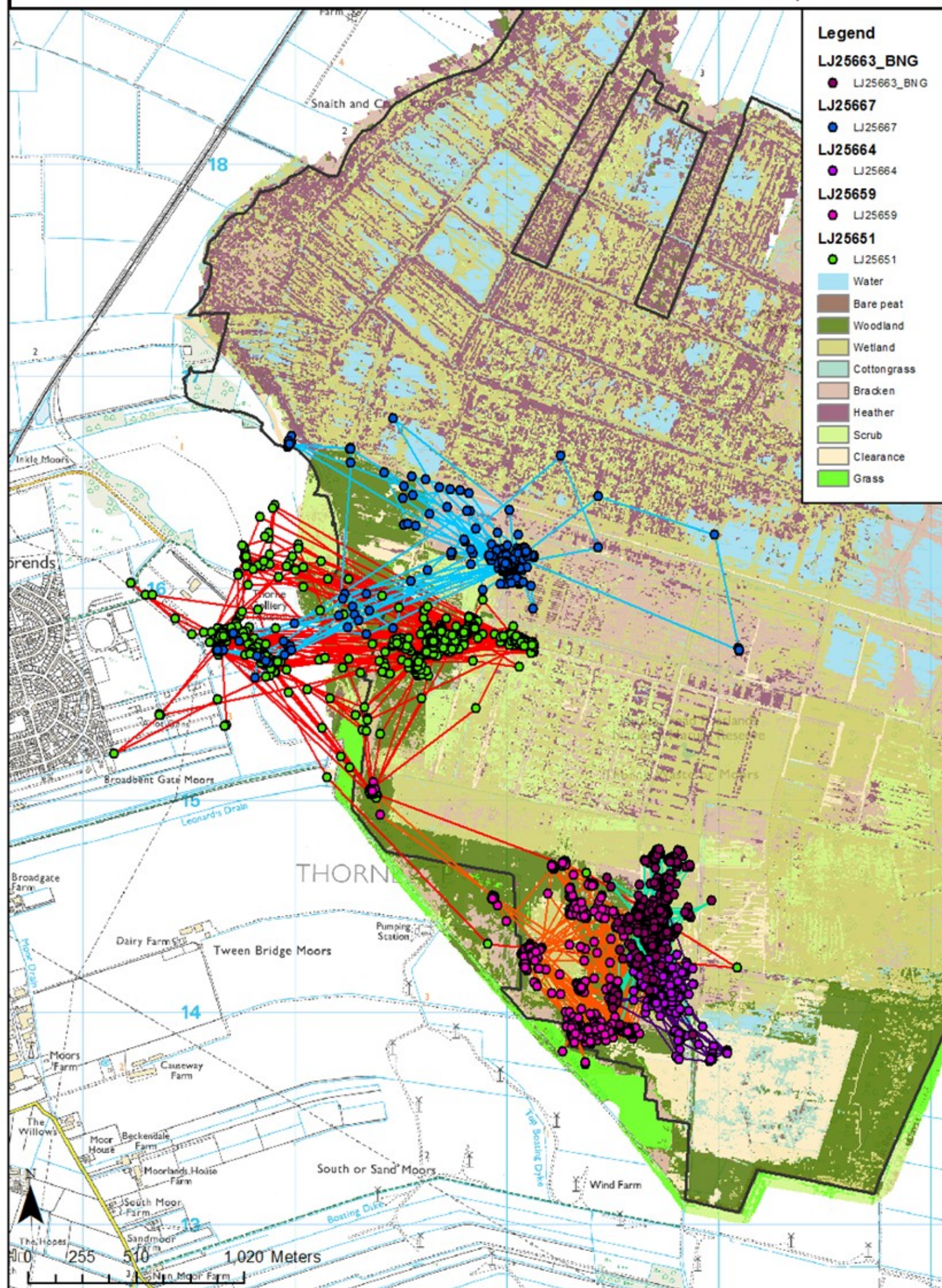
Appendix B

Management Compartment Map

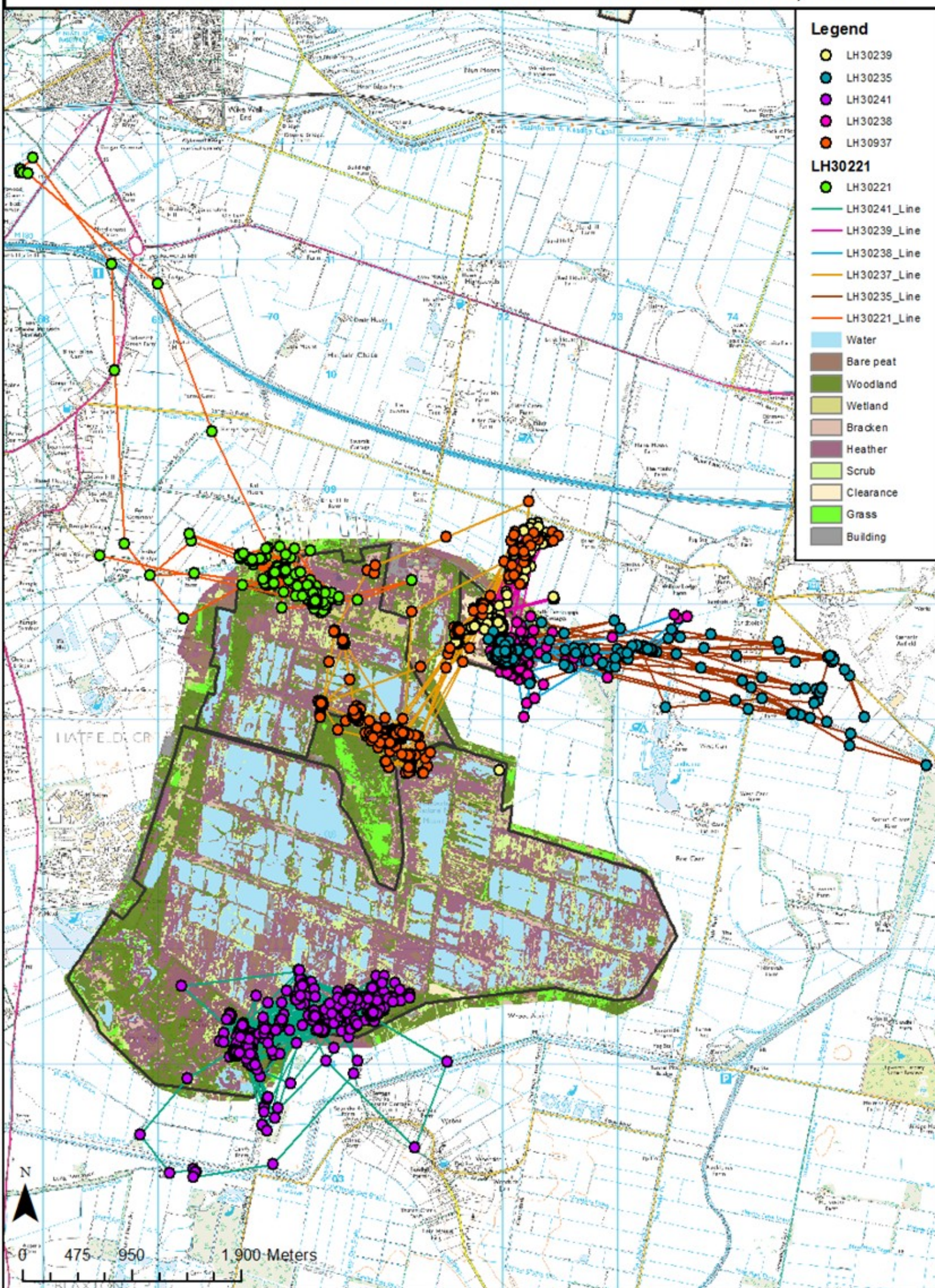


LIFE+ 'That's Life' Monitoring of European Nightjar' Survey Plans:

Tracks from 5 birds retrieved on Thorne Moor, 2016



Tracks from 6 birds retrieved on Hatfield Moor, 2016



Tracks from 7 tagged nightjars on Hatfield Moor in 2017.

