



ARCUS

BREEDING BIRD REPORT 2019

**HAVERIGG II WIND FARM LIFE EXTENSION
NORTH LANE, HAVERIGG, CUMBRIA**

THRIVE RENEWABLES (HAVERIGG II) LTD

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ABBREVIATIONS

BAP:	Biodiversity Action Plan
BBS:	Breeding Bird Survey
BNGR:	British National Grid Reference
BoCC:	Birds of Conservation Concern
BOU:	British Ornithologists' Union
BTO:	British Trust for Ornithology
CBC:	Common Birds Census
DAS:	Discretionary Advice Service
GPS:	Global Positioning System
HMP:	Her Majesty's Prison
Km:	Kilometres
LNR:	Local Nature Reserve
NE:	Natural England
NERC:	Natural Environment and Rural Communities
NNR:	National Nature Reserve
RSH:	Rotor Swept Height
S41:	Section 41
SNH:	Scottish Natural Heritage
SPI:	Species of Principal Importance
SSSI:	Site of Special Scientific Interest
SPA:	Special Protection Area
VP:	Vantage Point

EXECUTIVE SUMMARY

Arcus Consultancy Services Ltd (Arcus) was commissioned by Thrive Renewables (Haverigg II) Ltd to carry out ornithology surveys at Haverigg II Wind Farm (the Development) in Cumbria, between September 2018 and August 2019. The scope of surveys was agreed with Natural England.

This report details the results of the breeding bird surveys completed between March 2019 and August 2019 (inclusive). The breeding bird surveys included:

- Carcass searches;
- Searcher efficiency trials;
- Carcass persistence trials;
- Breeding bird survey (BBS); and
- Flight activity survey.

Based on the results of the carcass persistence and searcher efficiency trials undertaken in parallel with the carcass searches to date, it is considered likely that the vast majority (at least 75%) of bird carcasses in situ (i.e. not removed by scavengers) at the time monitoring was carried out were detected. Breeding season results indicate highly variable levels of scavenger removal at the Development, ranging from a single day to several weeks. However, some evidence of a carcass (feathers or bones) typically remained visible for several weeks, suggesting that the majority of bird collisions were likely to have been detected by surveyors.

The BBS results indicate that a number of species of conservation concern bred within the Site Boundary at low densities. A greater number of species and higher densities of breeding territories are present within the 500 m buffer where there is increased habitat diversity. The most notable registrations of breeding birds were the herring gull and lesser black-backed gull colonies within HMP Haverigg.

The results of the flight activity surveys show that there are large numbers of certain target species flights over the Site Boundary during the breeding season. Species recorded most frequently were herring and lesser black-backed gulls, followed by oystercatcher, all three of which are qualifying features of the Morecambe Bay & Duddon Estuary SPA. Although the majority of target species flights (including both aforementioned gull species) occurred at rotor swept height, turbines seem to have little impact on bird flight behaviour, with the vast majority following a "Bullet" flight path. This may indicate that many birds breeding in the vicinity of the Development may have become habituated to the presence of the turbines and routinely avoid them, without exhibiting any sudden avoidance behaviour detectable by surveyors.

Based on the very high number of flights at rotor swept height, and low number of carcasses found during searches, collision rates appear to be relatively low. Most of the carcasses recorded were gull species, which is unsurprising given the proportion of flights at rotor swept height by herring and lesser black-backed gulls, both of which appear to follow regular flight paths across the Site between breeding and foraging, including one flight path between the turbines.

Taking into account the results of the searcher efficiency and carcass persistence trials, as well as the persistence of carcasses recorded during both the carcass searches and incidentally, it is considered likely that the number of carcasses recorded is likely to be broadly representative of actual collision rates, although it is acknowledged that there will be some level of underestimation due to carcass removal by scavenger species.

The results of these surveys, with other available data have been utilised in the Report to Inform a Habitats Regulations Assessment, which will accompany the planning application for the Development and assesses the impact of the life extension of the Development on the Morecambe Bay & Duddon Estuary Special Protection Area (SPA).

1 INTRODUCTION

1.1 Background

Arcus Consultancy Services Ltd (Arcus) was commissioned by Thrive Renewables (Haverigg II) Ltd to carry out ornithology surveys at Haverigg II Wind Farm (the Development) in Cumbria, during 2018-19. The results of the ornithology surveys will be used to inform an application for the life extension of the Development. Surveys commenced in September 2018 and were completed in September 2019. Details of the non-breeding season surveys completed between September 2018 and February 2019 (inclusive) are presented in a separate report¹ (hereafter referred to as 'the Winter Ornithology Report') and are not repeated here, except where relevant to put the breeding season results into context. This report should be read in conjunction with the Winter Ornithology Report.

Note that the bird collision monitoring at the Development took place concurrently with monitoring at the adjacent Haverigg III Wind Farm. Although this report will focus on monitoring at the Development, due to its close proximity to Haverigg III, relevant results of bird collision monitoring at the latter development are also included for reference.

Bird species names used in this report follow the British List², which is maintained by the British Ornithologists' Union (BOU), with all species referred to by their British (English) vernacular name. A list of scientific names, as well as details of relevant legislation and conservation status, of all bird species referred to in this report is provided in Table A1.1, Appendix 1.

1.2 Site Description

The Development is located approximately 2 km west of Haverigg, Cumbria and comprises four operational onshore wind turbines. It is sited east of Her Majesty's Prison (HMP) Haverigg, immediately to the east of the four-turbine Haverigg III Wind farm. Both wind farm developments are located within a single landownership area (the Site). The Site Boundary is shown in Figure 1, Appendix 2.

The southern part of the Site is largely comprised of intensively grazed grassland, while the northern part of the Site is a motocross track.

1.3 Nearby Statutory Sites Designated for Ornithological Features

The Site is located adjacent to the Morecambe Bay & Duddon Estuary Special Protection Area (SPA), which is designated for a range of waterfowl and seabird species, and the Duddon Estuary Ramsar site, which is partly designated for wintering waterfowl, as well as for natterjack toad (*Epidalea calamita*). In addition, Morecambe Bay Ramsar site, which is designated for a range of waterfowl and seabird species, is located approximately 11.4 km to the southwest of the Site.

A number of other statutory sites of national and local importance that support ornithological features were identified within 10 km of the Site.

Details of these statutory sites are presented in the Winter Ornithology Report¹ and are not repeated here.

¹ Arcus. (2019a). *Haverigg II Wind Farm Life Extension Winter Ornithology Report 2018-19*.

² British Ornithologists' Union. (2017). *The British List: A Checklist of Birds of Britain (9th edition)*. *Ibis* 160: 190-240.

1.4 Summary of Ornithological Consultation

1.4.1 Initial Consultation

A Discretionary Advice Service (DAS) request was made to Natural England (NE) in July 2018 relating to the scope of supporting information to be used in the assessment of ornithological and ecological impacts of a proposed life extension at the adjacent Haverigg III Wind Farm. Although this initial consultation with NE related specifically to Haverigg III Wind Farm, the approach to obtaining ornithological baseline data was the same for both developments.

A DAS consultation meeting with NE took place on 09/08/2018. Discussions during the meeting focussed on obtaining sufficient information to enable the competent authority to undertake an Appropriate Assessment of the proposals in the context of the Habitat Regulations. Following the meeting, Arcus issued a letter to NE (dated 10/09/2018) listing the available information and confirming the proposed survey scope. The response from NE (via email dated 18/09/2018) included the requirement for a breeding bird survey (BBS) to be undertaken in 2019 to update existing data, as well as flight activity surveys (between 01/05/2019 and 15/07/2019) to assess potential impacts on breeding gulls from the nearby SPA.

Further details of this initial consultation are presented in the Winter Ornithology Report.

1.4.2 Further Consultation

Further consultation with NE took place in March 2019 to confirm the scope of breeding season ornithology surveys (as well as bat surveys, as detailed in the Ecological Appraisal³). The proposed methods for the breeding season ornithology surveys were detailed in a letter dated 26/03/2019 and issued to NE on the same date.

Within this letter, Arcus suggested that, since the level of gull flight activity was likely to be high, it would, therefore, potentially be difficult to record gulls as target species during the flight activity surveys, with each flight mapped and detailed information recorded for each flight in accordance with standard survey guidance^{4,5}. Arcus therefore queried whether it was essential for gulls to be recorded as target species, or whether flight activity could be summarised (e.g., mapping of regular flight paths/areas of activity rather than mapping of individual flight lines, and a summary of overall numbers and flight height range).

In their response (via email dated 29/03/2019), NE stated that, overall, the proposed breeding season survey scope was suitable, but advised that gulls would need to be recorded as target species during the flight activity surveys since they are likely to be the main species impacted by the turbines.

Arcus replied to NE (via email dated 05/04/2019) to confirm that the breeding season ornithology surveys would proceed as per the letter issued to NE (dated and issued on 26/03/2019), with gull species included as target species during the surveys as requested.

The Arcus letter and email response from NE are provided in Appendix 3.

³ Arcus. (2019b). *Ecological Appraisal: Haverigg II Wind Farm Life Extension, Cumbria*.

⁴ Drewitt, A. (2010) *Assessing the effects of onshore wind farms on birds*. Natural England Guidance TIN 069.

⁵ Scottish Natural Heritage (2017) *Recommended bird survey methods to inform impact assessment of onshore wind farms*.

2 METHODS

The breeding season ornithology survey programme comprised the following:

- Collision monitoring:
 - Carcass searches;
 - Searcher efficiency trials;
 - Carcass persistence trials;
- BBS; and
- Flight activity surveys.

The methods followed for each of these surveys are detailed below and ornithology survey areas are shown in Figure 1, Appendix 2.

2.1 Collision Monitoring

The breeding season collision monitoring was completed each month between March and August 2019 (inclusive) and followed on directly from the non-breeding season surveys (i.e. with no gaps between seasons) detailed in the Winter Ornithology Report¹.

The aim of the collision monitoring was to determine the level of bird collision mortality due to the Development, particularly for species that are designated features of the nearby statutory sites.

The collision monitoring involved monthly searches for bird carcasses, together with trials to validate the search results; the methods were the same as those followed during the non-breeding season (detailed in the Winter Ornithology Report¹).

Deployment of items for the searcher efficiency trials was undertaken by Jim Harding; all other collision monitoring was completed by Matt Harding, who is a highly experienced ecologist and a full member of the Chartered Institute of Ecology and Environmental Management (CIEEM).

2.1.1 Carcass Searches

Searches of all four turbines were undertaken once per month to record bird mortality due to turbine collisions. Breeding season carcass search dates were as follows⁶:

- March: 22/03/2019;
- April: 23 & 24/04/2019;
- May: 16 & 17/05/2019;
- June: 21/06/2019;
- July: 16 & 17/07/2019; and,
- August: 22 & 23/08/2019.

Further details of each survey visit (including survey times, weather conditions and notable bird sightings) are provided in Table A4.1, Appendix 4.

During each carcass search, the ground within a 110 m grid centred on the base of each turbine was intensively visually searched to identify any evidence of bird collisions (i.e. bird carcasses or injured birds). Each of the turbine search areas, which are shown in Figure 2, Appendix 2, was divided into eleven transects, running north-south and parallel to each other, 10 m apart. Each was slowly walked by the surveyor, scanning the ground ahead and to 5 m either side of the transect line for bird carcasses and other remains (e.g. feathers).

For all carcasses identified within the search area the following information was recorded:

⁶ The March and June survey visits were completed within a single day, but all other visits were split over two consecutive days. However, the survey effort was the same for all visits, with each turbine searched once per survey visit.

- Species (and age/sex where this could be determined);
- Turbine number;
- Grid reference (to ten figures);
- Date and time of detection;
- Distance from the turbine base in metres, measured by Global Positioning System (GPS) or tape measure;
- Notes on condition, including evidence of scavenging post-mortem, any apparent injuries, apparent/likely cause of death, apparent freshness and persistence.

2.1.2 Searcher Efficiency Trials

Monthly searcher efficiency trials were undertaken, during the course of each carcass search visit, to determine the efficiency of surveyors at detecting bird carcasses. The breeding season searcher efficiency trials commenced in March 2019, with the final trial completed in August 2019.

For practical reasons, and due to landowner permission issues related to the deployment of carcasses (see Section 2.4), food items (biscuits and bread rolls) were deployed in place of bird carcasses.

This involved deployment of a variable number of items (between four and seven) at random locations within the turbine search area of two turbines per carcass search visit, and a second surveyor searching for them. The two turbines searched changed from visit to visit so that each turbine was searched a total of three times across the breeding season.

2.1.3 Carcass Persistence Trials

Monthly carcass persistence trials were carried out to determine how long bird carcasses remained in situ until removed by scavengers. The aim of these trials was to determine how long bird carcasses are likely to be detectable following collision with turbines.

Each carcass persistence trial involved the deployment of a single, feathered and intact woodpigeon or red-legged partridge carcass within the carcass search area of turbine 4 (at British National Grid Reference (BNGR) SD 13759 79756) which was left undisturbed by surveyors. The carcass was monitored using a Bushnell Trophy camera trap affixed to fence posts. The trap was triggered by movement, with photographs taken every five seconds during periods of continuous triggering. The camera trap location is shown in Figure 1, Appendix 2.

The breeding season carcass persistence trials commenced in March 2019 and were subsequently completed once per month, during the course of the monthly carcass searches. The camera trap was checked during each carcass search visit and memory cards/batteries replaced as required. All camera traps were retrieved in September 2019.

2.2 Breeding Bird Survey

A BBS was completed between April and July 2019 (inclusive) to identify breeding bird territories within 500 m of the Development (access permitting). The BBS followed a reduced version of the Common Birds Census (CBC)⁷ developed by the British Trust for Ornithology (BTO). This was considered to be the most appropriate method for the farmland habitats present on Site. The BBS Area is shown in Figure 1, Appendix 2.

During each BBS visit, with the exception of common and widespread species of low conservation concern (e.g. woodpigeon, corvids and wren), all birds seen and heard were recorded on large-scale maps using standard BTO species codes and symbology to denote

⁷ Marchant, J. (1983) *Common Birds Census Instructions*. British Trust for Ornithology, Thetford.

behaviour⁸, particularly where this related to breeding (e.g. singing, alarm calling, gathering nest material or food, feeding newly fledged young, etc.).

Four visits were carried out; survey dates were as follows:

- Visit 1: 23/04/2019;
- Visit 2: 14/05/2019;
- Visit 3: 13/06/2019; and
- Visit 4: 11/07/2019.

All survey visits commenced within the first hour after sunrise and lasted for up to seven hours. Weather conditions were logged at hourly intervals. All BBS were completed by Matt Harding and Chris Gomersall, both of whom have extensive experience of completing ornithology surveys, including breeding bird surveys.

Full details of timings and hourly weather conditions during each BBS visit are provided in Table A4.2, Appendix 4.

2.2.1 Territory Mapping Analysis

Upon completion of all four BBS visits, all registrations of species of conservation concern from the field maps were transcribed to produce 'species summary maps'. Species of conservation concern were defined as birds included on one or more of the following:

- Annex I of the Birds Directive⁹;
- Schedule 1 of the Wildlife and Countryside Act 1981 (as amended)¹⁰;
- Species of Principal Importance (SPI) under Section 41 (S41) of the Natural Environment and Rural Communities (NERC) Act 2006¹¹;
- UK Birds of Conservation Concern (BoCC) Red or Amber list¹²; and
- Cumbria Biodiversity Action Plan (BAP) species for priority action¹³.

From these species summary maps, the number and distribution of likely breeding territories for each species was determined through a combination of interpretation of behavioural observations and identification of clusters of registrations likely to relate to breeding territories. The method was based on Bibby (2000)¹⁴, with an element of professional judgement.

A precautionary approach was taken and a bird was deemed to be holding a breeding territory if it was recorded singing or exhibiting other behaviour indicative of breeding during just one of the four BBS visits, or if a pair of birds was observed in or near suitable nesting habitat on more than one occasion.

2.3 Flight Activity Surveys

Flight activity surveys were undertaken between May 2019 and mid-July 2019 (inclusive) using a series of vantage point (VP) watches to record flight activity of target bird species during the non-breeding season. Flight activity surveys followed standard methods published by NE⁴ and Scottish Natural Heritage (SNH)⁵. All flight activity surveys were completed by Chris Gomersall.

⁸ Summarised in Gilbert, G., Gibbons, D.W. & Evans, J. (1998) *Bird Monitoring Methods*. RSPB.

⁹ <https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:020:0007:0025:EN:PDF>

¹⁰ <http://www.legislation.gov.uk/ukpga/1981/69>

¹¹ <http://www.legislation.gov.uk/ukpga/2006/16/contents>

¹² Eaton, M.A., Aebischer, N.J., Brown, A., Hearn, R.D., Lock, L., Musgrove, A.J., Noble, D.G., Stroud, D.A., and Gregory, R.D. (2015). Birds of Conservation Concern 4: the population status of birds in the UK, Channel Islands and Isle of Man. *British Birds* 108, 708-746.

¹³ Available from <https://www.cumbria.gov.uk/eLibrary/Content/Internet/538/755/1929/42151103717.pdf> [Accessed 02/10/19]

¹⁴ Bibby, C.J., Burgess, N.D., Hill, D.A. and Mustoe, S.H. (2000). *Bird Census Techniques*, 2nd edition. Academic Press, London.

The primary aim of the flight activity surveys was to record flight activity over the Site by those gull species which are qualifying features of the Morecambe Bay & Duddon Estuary SPA¹⁵, namely herring gull and lesser black-backed gull, to determine how birds interact with, and are impacted by, the turbines.

However, other 'target' bird species were also recorded during the flight activity surveys, including the following:

- All wildfowl species (geese, swans and ducks);
- All grebes, herons and egrets;
- All raptor species (including owls) listed on Schedule 1 of the Wildlife and Countryside Act 1981 (as amended)¹⁰ or Annex I of the Birds Directive⁹;
- All wader species;
- All other gull species; and
- Any other qualifying features of the nearby SPA and Ramsar sites.

All watches were completed from a single VP located at BNGR SD 14262 79540, which is shown in Figure 1, Appendix 2.

A total of 36 hours of observation were completed during the core gull breeding season, i.e. May to mid-July. Survey dates are shown in Table 1.

Table 1: Flight activity survey dates

Month	Survey visit	Date
May	1	13/05/2019
	2	15/05/2019
June	3	12/06/2019
	4	14/06/2019
July	5	10/07/2019
	6	12/07/2019

A total of six hours of watches were completed during each survey visit. Survey times were stratified to cover a range of times during the survey period, including dawn, dusk and the middle of the day, to record observations of birds moving between feeding and breeding areas at different times. To avoid observer fatigue, individual survey sessions did not exceed a 2-hour period and surveys on the same date were separated by a 20-minute interval.

During all flight activity surveys, the flight line of each target species flight observed was drawn onto a large-scale map in the field. Each recorded flight line was numbered and cross-referenced to the following flight data:

- Time (when first seen);
- Species, age and sex (where identification of age/sex was possible);
- Number of birds;
- Duration of flight within the flight activity survey area; and

¹⁵ Morecambe Bay & Duddon Estuary SPA: *Site Citation*. Available online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/641980/morecambe-duddon-citation.pdf

- Flight height in one of three height bands corresponding approximately to below, at, or above, Rotor Swept Height (RSH), on detection and at 15 second intervals thereafter.

In addition, the behaviour of each flight in relation to the turbines was classified into one of the categories shown in Table 2, which are based on Meredith *et al.* (2002)¹⁶, to describe bird behaviour relative to the turbines.

Table 2: Flight behaviour categories

Flight behaviour category	Definition
Weave	Weaving flight line up to maximum height of turbine.
Direct	A direct flight line, within the turbine envelope but clearly in a line up to a maximum turbine blade height, avoiding turbines.
Horiz	A bird flying towards a wind farm site, which takes avoiding action by a horizontal movement (i.e. no change in height) so as to take it around the perimeter of the wind farm.
Vert	As for 'Horiz' but this time, the bird gains altitude to take it over the top of the wind farm site.
Bullet	Flight behaviour within or outside a wind farm site, which appears to take no avoiding action with regard to turbines (or other infrastructure).
Hit	A recorded collision event.
Avoid	Avoidance behaviour near a turbine, generally taken at short notice, and is likely to appear as a sudden change in direction or height (or both).
Other	Any behaviour not easily classifiable into any of the above categories.

In addition to recording target species flights, the number and activity of 'secondary' species observed during all flight activity surveys was summarised during each 5-minute period. Secondary species included the following: sparrowhawk, kestrel, buzzard, raven and cormorant, and flocks of 20+birds included on the UK BoCC Red list¹². Recording of target species took priority over that of secondary species.

The timing and type of any observed disturbance was recorded throughout the watch, and weather conditions were recorded on an hourly basis.

Full details of flight activity survey timings and hourly weather conditions are provided in Table A4.3, Appendix 4.

2.4 Survey Limitations

2.4.1 Collision Monitoring

2.4.1.1 Carcass Searches

As landowner permission was limited to the area within the Site Boundary, some parts of the search area around turbine 4 were inaccessible. As far as possible, this area was checked from within the adjacent Site Boundary using binoculars. In addition, during the June and July surveys, vegetation height in the turbine 4 search area was very high, which

¹⁶ Meredith, C., Venosta, M. and Ransom, R. (2002) *Cordington Wind Farm Avian Avoidance Behaviour Report, 2002*. Biosis Research Report.

impeded the surveyors to some extent and may also have reduced detectability of any carcasses.

Due to silage harvesting during the June survey visit, small sections of the carcass search survey areas around turbines 1 and 2 could not be accessed. As far as possible, these areas were checked from adjacent areas using binoculars.

All other breeding season carcass searches were completed in full with no constraints.

2.4.1.2 Searcher Efficiency Trials

The access restrictions noted above limited the areas within which search items could be deployed during the searcher efficiency trials. In addition, as noted above, food items (biscuits and bread rolls) were deployed in place of bird carcasses. However, the type of item was varied between survey visits to minimise the potential for bias in levels of detectability.

2.4.1.3 Carcass Persistence Trials

Due to landowner concerns relating to livestock welfare, permission to deploy bird carcasses for the carcass persistence trials was restricted to an area in the west of the Site, which is fenced off from livestock. Consequently, the carcass persistence trials were limited to the search area around turbine 4.

Due to the limited area suitable for carcass deployment, the location of the camera trap could not be varied between survey visits to reduce the potential for resident scavengers becoming habituated to carcass provisioning.

Note, however, that the persistence of incidental observations of bird carcasses across the Site was monitored each month to give an indication of scavenger removal rates.

2.4.2 Breeding Bird Survey

Access to parts of the BBS Area falling outside of the Site Boundary was restricted to public roads, footpaths and rights of way. As there are several such public roads and tracks etc., it was possible to adequately survey much of the inaccessible areas by scanning for birds from adjacent points (where access was permitted) using binoculars.

Due to access restrictions, the BBS did not cover HMP Haverigg, and it was not possible to scan for bird species in much of this area due to the presence of boundary fences, which obstructed views of the prison grounds from outside. However, notable breeding bird populations within the prison grounds (gull species and oystercatcher) were detected during the BBS; although numbers and status of the oystercatchers could not be determined accurately, it was possible to count gulls nesting on building roofs. As such, access restrictions are not considered to represent a material limitation to the robustness of the BBS dataset.

Although BBS were carried out in suitable weather conditions as far as possible, it was not always possible to completely avoid periods of poor weather, especially when conditions varied from those forecast. Consequently, sub-optimal conditions were experienced during BBS visit 3, with persistent (and at times heavy) rain. In addition, there was some light rain during visit 4 and occasional periods of reduced visibility at the start of visits 2-4. It is considered unlikely that the reduced visibility affected detectability of birds, since this was never less than 1 km and all parts of the Site were approached to within 100 m. Moreover, many breeding birds are detected and identified by songs and calls rather than visual sightings. In addition, it is considered unlikely that the light rain during BBS visit 4 will have resulted in significantly reduced bird activity or detectability, although it is acknowledged that conditions during visit 3 may have resulted in reduced levels of breeding bird activity

and/or detectability during this visit. However, as four visits were carried out, this is not considered to represent a material limitation to the robustness of the BBS dataset.

2.4.3 Flight Activity Surveys

During the flight activity surveys, noise from sirens from HMP Haverigg was noted. However, no birds within the Survey Area appeared to exhibit any behavioural response to this potential disturbance. It is possible that some local bird populations may be habituated to siren noise from the prison. However, it was noted during BBS visit 2 that gulls sometimes appeared to be flushed by the noise. Nonetheless, sampling bird activity during periods when the sirens were both silent and activated is likely to mean that levels of flight activity during the flight activity surveys were representative of local conditions. As such, this is not considered to represent a material limitation to the robustness of the dataset.

Weather conditions during some flight activity surveys were sub-optimal, with heavy rain during both June surveys and the second July visit, and occasional periods of reduced visibility, particularly around the hours of dawn and dusk. However, large numbers of flights were recorded during all flight activity surveys, and sampling bird activity during a range of weather conditions is likely to mean that recorded levels of flight activity were representative of local conditions. As a result, weather is not considered to represent a material limitation to the robustness of the flight activity survey dataset.

3 RESULTS

3.1 Collision Monitoring

3.1.1 Carcass Searches

3.1.1.1 Bird Carcasses/Remains Found During Carcass Searches

Carcasses or other remains from up to seven¹⁷ birds were found during the breeding season carcass searches. These comprised four herring gulls, a single great black-backed gull, a gull that could not be identified to species level and a domestic chicken.

Four of the carcasses/remains were found within the turbine 4 search area, up to two within the turbine 1 search area¹⁷, and one within the turbine 3 search area. Remains of each carcass persisted on the Site for several visits.

Full details of all carcasses found during the breeding season carcass searches are presented in Table 3.

Note that it is not certain that these carcasses/remains were attributable to collision events with the Development – it was considered likely that the chicken was killed by a mammalian predator and it is possible that one or more of the gull carcasses was attributable to a raptor (e.g. peregrine) kill¹⁸.

Note that three remains of three bird carcasses/remains first identified during the non-breeding season carcasses searches (completed between September 2018 and February 2019 inclusive) persisted into the breeding season. As details of these are included in the Winter Ornithology Report, they are not included in Table 3. However, updated persistence is provided below.

- Feathers from 20190124T108 (woodpigeon), which was first observed on 24/01/2019 persisted until 23/04/2019 (89 days);
- Feathers and wing parts from 20190124T207 (herring gull), which was first observed on 24/01/2019 persisted until 23/04/2019 (89 days); and
- Remains from 20190214T111 (herring gull), which was first observed on 14/02/2019 persisted until 21/06/2019 (127 days).

¹⁷ As noted in Table 3, it is possible that one of the herring gulls was recorded on two different occasions (as the unidentified gull species on the second occasion)

¹⁸ When assessing whether the cause of death was likely predation by a raptor (rather than a turbine collision, with the carcass subsequently scavenged by a raptor), this was partly determined by signs of plucking and partly by proximity of the carcass to a likely plucking post; although professional judgement was used, it is acknowledged that this is subjective. As such, apparent/likely cause of death in Table 3 is speculative based on the evidence observed.

Table 3: Summary of bird remains identified during the 2018-19 breeding carcass searches

Carcass reference number	Date first recorded	Turbine no.	Distance (m) from turbine	Species (and age/sex if determined)	Carcass condition (including any evidence of scavenging)	Apparent/likely cause of death	Apparent freshness	Persistence	Other notes
20190322T413	22/03/2019	4	22	Herring gull – first or second year bird	Dismembered; two wings, two legs, feathers and backbone present	Potential collision or bird of prey	Several weeks old	3 visits – 8 weeks	Feathers appeared to have been plucked and were found at fence line
20190322T314	22/03/2019	3	28	Herring gull adult	Feathers at one location, left wing primaries at second. Primaries bitten off by scavenger	Unknown	Several weeks old	4 visits – 13 weeks	Scattered feathers were present elsewhere in the survey area; note that the remains were not detected during the April carcass search but were seen during the May and June carcass searches
20190424T415	24/04/2019	4	30	Herring gull – third year bird	Only right wing present, sheared off	Collision	Days old	4 visits – 12 weeks	No rigor mortis, very recent. Found next to following record
20190424T416	24/04/2019	4	25	Herring gull – adult	Left wing missing, with some damage to the left of the neck	Collision	Days old.	3 visits – 9 weeks	No rigor mortis, very recent. Found next to previous record in a ditch
20190717T123	17/07/2019	1	38 and 11	Great black-backed gull - adult	Left wing severed at first location, breast feathers at second. Rest of bird presumably scavenged	Collision (likely)	Several weeks old	1 visit – 5 weeks	

Carcass reference number	Date first recorded	Turbine no.	Distance (m) from turbine	Species (and age/sex if determined)	Carcass condition (including any evidence of scavenging)	Apparent/likely cause of death	Apparent freshness	Persistence	Other notes
20190823T425	23/08/2019	4	37 and 44	Chicken	Right wing – chewed breast bone and wing feathers at first location. Legs and backbone at second location	Mammalian predator likely	Several weeks old	Undetermined (no further carcass searches completed)	Likely taken by a mammalian predator from livestock pen at east end of Site
20190823T126	23/08/2019	1	54	Gull sp.	Just breast feathers bitten off	Unknown	Several weeks old	Undetermined (no further carcass searches completed)	Possibly same bird as 20190717T123

3.1.1.2 Other Records of Bird Carcasses/Remains

In addition to the carcasses/remains found during the formal breeding season carcass searches, there were two incidental records of bird remains observed outside the turbine area. Five additional carcasses/remains were found during concurrent surveys at the adjacent Haverigg III Wind Farm. A summary of these records is presented in Table 4.

Table 4: Summary of incidental records of bird remains identified during the breeding season surveys

Carcass reference number	Date first recorded	Grid reference	Species (and age/ sex if determined)	Carcass condition	Apparent/ likely cause of death	Apparent freshness	Persistence	Other notes
20190516NA17	16/05/2019	SD 14216 79486	Lesser black-backed gull	Intact – no injuries visible	Unknown	A few days old	No further registrations	Incidental record from outside turbine area to east
20190517T418	17/05/2019	SD 13596 78872	Passerine ¹⁹ species	Left wing and occasional feathers	Raptor kill (plucked on knoll)	Several weeks old	No further registrations	Recorded during carcass searches at adjacent Haverigg III
20190620T419	20/06/2019	SD 13629 78876	Passerine species	Breast and wing feathers only	Raptor kill (plucked)	Several days old	No further registrations	Recorded during carcass searches at adjacent Haverigg III
20190716T120	16/07/2019	SD 13439 79577	Woodpigeon	Feathers only	Raptor kill	Days or weeks old	No further registrations	Recorded during carcass searches at adjacent Haverigg III
20190716T121	16/07/2019	SD 13447 79595	Lesser black-backed gull	Half bird (right wing, lower torso, legs and tail); entrails eaten	Collision	Several weeks old	No further registrations	Recorded during carcass searches at adjacent Haverigg III
20190717T222	17/07/2019	SD 13259 79337	Blackbird	Feathers only	Raptor kill	Several days old	No further registrations	Recorded during carcass searches at adjacent Haverigg III
20190822NA24	22/08/2019	SD 14235 79475	Possible lesser black-backed gull	Intact – no injuries visible	Unknown, possibly vehicle collision	Less than a day old	Undetermined (no further carcass searches completed)	Incidental record from outside turbine area to east

¹⁹ 'Passerine' is a common term used by ornithologists, which applies to any bird in the order Passeriformes. Passerines are distinguished from other avian orders by the arrangement of their toes, which facilitates perching and are sometimes known as perching birds or, less accurately, songbirds.

3.1.2 Searcher Efficiency Trials

The total detection rate during the breeding season searcher efficiency trials at the Development ranged from 70.0- 100% per visit, with an overall detection rate of 93.0% across the survey period. All items deployed at turbines 1 and 2 were found during all three searches of these turbines, while the total detection rates for turbines 3 and 4 across the survey period were 87% and 78.9% respectively. A summary of the results during each search is provided in Table 5, while the detection rates per turbine and per item type are presented in Tables 6 and 7 respectively.

Detection rates during concurrent breeding season searcher efficiency trials at the adjacent Haverigg III Wind Farm were very similar, with an overall detection rate of 96.9% across the survey period (and were also in line with the overall detection rate during the non-breeding season searcher efficiency trials at the Site, which was 90.0%)¹.

There was a 100% detection rate for bread rolls across the survey period, while the lowest detection rate was for biscuits. This contrasts with detection rates for these items during the non-breeding season, when biscuit detection was still the lowest, but the detection rate bread rolls wrapped in cling film was higher than for non-wrapped bread rolls (100% and 95.5% respectively).

Table 5: Summary of detection rates during the breeding season searcher efficiency trials

Month & year	Type of item deployed	Turbine no.	Detection rate per turbine	Detection rate per visit	Percentage of detections per visit
March 2019	Bread rolls	1	7/7	12/12	100.0%
		2	5/5		
April 2019	Bread rolls	3	7/7	14/14	100.0%
		4	7/7		
May 2019	Bread rolls wrapped in cling film ²⁰	1	4/4	11/11	100.0%
		2	7/7		
June 2019	Bread rolls wrapped in cling film ²⁰	3	5/5	10/12	83.3%
		4	5/7		
July 2019	Bread rolls	1	5/5	12/12	100.0%
		2	7/7		
August 2019	Biscuits	3	4/5	7/10	70.0%
		4	3/5		
Total detections across survey period				66/71	93.0%

²⁰ This was to give the item a paler appearance

Table 6: Summary of total detection rate per turbine during the 2019 breeding season searcher efficiency trials

Turbine no.	Total detection rate	Total percentage of detections
1	16/16	100%
2	19/19	100%
3	16/17	94.1%
4	15/19	78.9%

Table 7: Summary of total detection rate per item type during the 2019 breeding season searcher efficiency trials

Item type	Total detection rate	Total percentage of detections
Biscuit	7/10	70.0%
Bread roll	36/36	100%
Bread roll wrapped in cling film ²⁰	21/23	91.3%

3.1.3 Carcass Persistence Trials

The carcasses deployed during each trial except July were eaten/removed by scavengers between surveys (i.e. the carcasses did not persist until the subsequent survey visit). However, some remains (feathers) of carcasses from most trials did persist until the subsequent survey visit. Further details are presented in Table 8.

Rates of carcass persistence during concurrent trials at the adjacent Haverigg III Wind Farm were broadly similar, with carcasses persisting for just 1-4 days but feathers generally persisting until the subsequent survey visit.

Table 8: Summary of the 2019 breeding season carcass persistence trial results

Trial number	Carcass Species	Deployment date	Minimum persistence period of ...		Notes
			carcass ²¹	remains ²¹	
1	Woodpigeon	21/03/2019	1 day	1 day	<ul style="list-style-type: none"> • Carcass was removed by a dog the day after deployment (22/03/2019). • Carcass area visited by fox (<i>Vulpes vulpes</i>), dog, sheep, brown hare (<i>Lepus europaeus</i>), buzzard and pheasant. • No signs remaining when camera trap was collected after 32 days.
2	Woodpigeon	24/04/2019	1 day	22 days	<ul style="list-style-type: none"> • Carcass was moved just outside the camera trap field of view by a carrion crow on day 1.

²¹ The exact number of days that remains persisted could not be detected because some remains (feathers) were not visible on the camera trap photographs, and the surveyor only visited the Site on a monthly (rather than daily) basis, so remains may have persisted for several additional days in between survey visits.

Trial number	Carcass Species	Deployment date	Minimum persistence period of ...		Notes
			carcass ²¹	remains ²¹	
					<ul style="list-style-type: none"> • Crow then plucked carcass on day 1, with the carcass out of view, but crow and feathers visible. • Carcass area visited by fox, dog, sheep, brown hare, kestrel, buzzard and roe deer (<i>Capreolus capreolus</i>). • Plucked feathers remained when camera trap was collected after 22 days.
3	Woodpigeon	16/05/2019	1 day	35 days	<ul style="list-style-type: none"> • Carcass plucked and foraged on day 1 by carrion crow. • Carcass moved out of field of view by carrion crow on day 2, plucked feathers still visible. • Remains inspected on various dates by fox, dog and carrion crow. • By 16/06/2019 carcass remains no longer visible due to vegetation growth. • Plucked feathers remained when camera trap was inspected after 35 days.
4	Red-legged partridge	21/06/2019	1 day	25 days	<ul style="list-style-type: none"> • Carcass initially foraged by carrion crow. • Carcass then moved out of camera field of view by buzzard on day 2. • Carcass foraged on by carrion crow and buzzard. • Carcass area also visited by sheep, pheasant and dog. • Plucked feathers remained when camera trap was collected after 25 days.
5	Woodpigeon	16/07/2019	37 days	37 days	<ul style="list-style-type: none"> • Initially foraged by carrion crow. • Carcass partially removed by stoat (<i>Mustela ermina</i>) after 2 days. • Also foraged by kestrel on day 3. • Area also investigated by dog, buzzard and pheasant. • Bones remained when camera trap was collected after 37 days.
6	Woodpigeon	22/08/2019	2 days	2 days	<ul style="list-style-type: none"> • Initially foraged by buzzard, and removed from field of view after 2 days. • Area investigated by buzzard, fox, dogs, brown hare and various bird species. • No signs remaining when camera trap collected after 37 days

3.2 Breeding Bird Survey

A total of 61 species were recorded within the BBS Area during the 2019 BBS.

3.2.1 *Species of Conservation Concern*

Of the 61 species recorded, 34 were of conservation concern, as defined in Section 2.1.

Seventeen of the species of conservation concern recorded within the BBS Area were assessed as breeding²². Numbers of territories of each of these species are provided in Table 9 and territory locations are shown in Figures 2 (non-passerines) and 3 (passerines¹), Appendix 2.

No evidence of breeding was observed for the remaining seventeen species of conservation concern, which were as follows: greylag goose, shelduck, eider, manx shearwater, little egret, gannet, whimbrel, curlew, black-headed gull, sandwich tern, common tern, black guillemot, black-tailed godwit, barn owl, swift, house martin and reed bunting. Registrations of these species are likely to include non-breeding birds, and birds from the local area which were breeding outside the BBS Area, although it is possible that small numbers of some of these species (e.g. reed bunting) were breeding undetected within the BBS Area.

Two species listed on Schedule 1 of the Wildlife and Countryside Act 1981 (as amended) were recorded, namely whimbrel and barn owl. A barn owl roost was recorded in a disused building in the west of the BBS Area, but there was no evidence of breeding, while whimbrel was recorded on passage migration (the species does not breed in England).

Little egret and sandwich tern, both of which are listed on Annex I of the Birds Directive⁹, were recorded within the BBS Area, but were not considered to be breeding.

During BBS visit 2, when visible migration of whimbrel over the Site was recorded, it was further noted that these birds may use the Site as a feeding/staging area. Similarly, during BBS visit 4, approximately 280 curlew and four black-tailed godwits were observed in the BBS Area, providing further evidence that waders may use the Site for feeding/staging.

²² Defined as all birds that were potentially breeding (identified as described in Section 2.1), including birds that were defending or holding a territory (even if this was not subsequently occupied by any nesting birds) and regardless of the outcome (i.e. including birds that may have been unsuccessful in their breeding attempts).

Table 9: Summary of species of conservation concern assessed as breeding²² within the BBS Area

Species*	Number of territories in BBS Area			Relevant legislation/conservation listings**	Corresponding Figure no.
	Within Site Boundary	In 500m buffer	Total		
Mute swan	0	1	1	Amber	2
Mallard	1	2	3	Amber	2
Oystercatcher	2	7	9****	Amber	2
Lapwing	1	2	3	Red; SPI;	2
Herring gull	0	100	100*****	Red; SPI	2
Lesser black-backed gull	0	60	60*****	Amber	2
Stock dove	1	1	2	Amber	2
Skylark	4	22	26	Red; SPI	3
Willow warbler	0	6	6	Amber; SPI	3
Grasshopper warbler	0	4	4	Red; SPI	3
Starling	6	36	42	Red; SPI	3
Song thrush	0	2	2	Red; SPI; BAP	3
House sparrow	0	13	13	Red; SPI	3
Dunnock	1	17	18	Amber; SPI	3
Pied wagtail***	3	2	5	NT; Amber	3
Meadow pipit	2	17	19	Amber	3
Linnet	8	29	37	Red; SPI	3

*Species names and order follow the British List maintained by the BOU².
** Red = UK Red-listed BoCC¹²; Amber = UK Amber-listed BoCC¹²; SPI = listed as SPI under S41 of the NERC Act 2006¹¹; BAP = listed in the Cumbria BAP as a species for priority action¹³
***Although the 'parent' species is Green-listed, both pied wagtail subspecies occurring in the UK (*yarelli* and *alba*), are Amber-listed
****During visit 4, the surveyor noted that ~20 Oystercatchers appeared to be nesting in the prison grounds, this has not been included due to access restrictions which meant prison grounds were not accurately surveyed.
*****Although there was no access to prison grounds, gull territories were determined by scanning building rooftops allowing for an accurate population estimate to be made.

3.2.2 Species of Low Conservation Concern

The remaining 27 species, which are generally common and widespread, were as follows: pheasant, grey heron, sparrowhawk, buzzard, feral pigeon, woodpigeon, collared dove, magpie, jackdaw, rook, carrion crow, hooded crow, raven, blue tit, great tit, sand martin, swallow, chiffchaff, sedge warbler, whitethroat, wren, blackbird, robin, stonechat, wheatear, chaffinch and goldfinch. The majority of these species were confirmed or likely to be breeding within the BBS Area.

3.3 Flight Activity Surveys

3.3.1 Target Species

A total of 786 flights by 15 target species were recorded during the flight activity surveys. Herring gull was the species recorded most frequently (354 flights), followed by lesser black-backed gull (261 flights), oystercatcher (72 flights) and black-headed gull (50 flights). There were also 16 curlew flights, 10 whimbrel flights, five great black-backed gull flights, four flights of each of greylag goose flights, mallard and lapwing, two little egret flights, and single flights of grey heron, gannet, black-tailed godwit and common gull.

A total of 744 flights (94.7 %) occurred at least partially at RSH. The majority of flights (726 flights) followed a 'Bullet' flight line, with birds apparently taking no avoiding action towards the turbines. Nine flights followed a 'Weave' flight line, two flights followed a 'Horiz' flight line and seven flights followed an 'Other' flight line or were not recorded.

A summary of all target species flights recorded during the flight activity surveys, broken down by species, is provided in Table 10. The Table includes details of relevant legislation and conservation listings.

Target species flight lines are shown in Figures 4-10, Appendix 2 and full details of each target species flight are presented in Appendix 5.

Table 10: Summary of target species flights recorded during the Year 3 FAS

Species*	Total no. of flights	No. of flights occurring at RSH**	Mean count no. of (birds)	Maximum flock size (no. of birds)	No. of flights in each recorded flight category		Schedule 1/ Annex I listings	Conservation listing(s)***	Corresponding figure no.
Greylag goose	4	4	5.3	7	Bullet	3		Amber	10
					Horiz	1			
Mallard	4	3	2.5	3	Bullet	4		Amber	10
Grey heron	1	1	1.0	1	Bullet	1			10
Little egret	2	2	2.0	3	Bullet	2	Annex I		10
Gannet	1	1	1.0	1	Horiz	1		Amber	10
Oystercatcher	72	46	1.9	6	Bullet	70		Amber	8
					Other	2			

Species*	Total no. of flights	No. of flights occurring at RSH**	Mean count no. of (birds)	Maximum flock size (no. of birds)	No. of flights in each recorded flight category		Schedule 1/ Annex I listings	Conservation listing(s)***	Corresponding figure no.
Lapwing	4	4	13.8	26	Bullet	3		Red; SPI	9
					Other	1			
Whimbrel	10	10	4.0	12	Bullet	12	Schedule 1	Red; SPI	9
Curlew	16	16	14.4	90	Bullet	15		Red; SPI	9
					Weave	1			
Black-tailed godwit	1	1	3.0	3	Bullet	1	Schedule 1	Red; SPI	9
Black-headed gull	50	39	2.7	8	Bullet	50		Amber	6
Common gull	1	0	2.0	3	Bullet	1		Amber	7
Great black-backed gull	5	2	2.0	4	Bullet	5		Amber	7
Herring gull	354	354	4.9	50	Bullet	341		Red; SPI	4
					Weave	4			
					Other	2			
					Not recorded	1			
Lesser black-backed gull	261	261	3.9	30	Bullet	255		Amber	5
					Weave	4			
					Not recorded	1			

**Red = UK Red-listed BoCC¹²; Amber = UK Amber-listed BoCC¹²; SPI = listed as SPI under S41 of the NERC Act 2006¹¹; BAP = listed in the Cumbria BAP as a species for priority action¹³

3.3.2 Secondary Species Registrations

Four secondary species were recorded during the flight activity surveys. The majority of these were raptor species, with kestrel recorded most frequently (10 registrations), followed by buzzard (seven registrations), with raven and sparrowhawk recorded in lower numbers (five and four registrations respectively).

3.3.3 Disturbance Events

The only noted disturbance event noted during FAS surveys was sirens from the prison sounding during the first visit.

4 SUMMARY OF KEY FINDINGS

4.1 Carcass Searches

- Carcasses or other remains from up to seven¹⁷ birds were found during the carcass searches, including one outside the search area (but observed from within the search area, while completing the searches).
- Of these seven birds, herring gull was the species encountered most frequently (four individuals). There was also one great-black backed gull, a domestic chicken and an unidentified gull species.
- Four of the carcasses/remains were found within the turbine 4 search area, two were within the turbine 1 search area (although these may have been remains of the same individual¹⁷), and a single carcass was found within the search area of turbine 3.
- Remains from seven additional birds were found outside the formal breeding season carcass searches (five during concurrent surveys at the adjacent Haverigg III Wind Farm, and two in other parts of the Site, outside the search areas).
- However, it is not certain that all the carcasses/remains were attributable to collision events; there was evidence that some carcasses may have been the remains of mammal and/or raptor kills, and others for which likely cause of death could not be assessed (due to the condition of the remains).
- Four of the carcasses/remains (all of which were herring gulls) persisted on the Site for several weeks or months; it is possible that remains from a further three individuals recorded during the final carcass search in August persisted for prolonged periods.

4.2 Searcher Efficiency Trials

- Searcher efficiency trials indicated that the detection rate was high, with an overall detection rate of 93.0% across the survey period (which is consistent with the results of the winter searcher efficiency trials¹).
- Across all searcher efficiency trials, detection rates varied from 78.9% at turbine 4 to 100% at turbines 1 and 2. It is notable that the lowest detection rate was for turbine 4 on the moto-cross track which, unlike the other three turbines (which are located within a heavily grazed part of the Site), includes large patches of tall, dense vegetation, rough/uneven ground and some ditches within the search area.
- There was also some variation in detectability of deployed items, ranging from 70.0% for biscuits to 100% for bread rolls, suggesting that bird carcasses may be more easily detected at certain turbines, and detection rates could vary according to the type of remains (e.g. size, colour and shape).
- These results indicate that detectability is high ($\geq 70\%$), regardless of the location or size/type of remains. Therefore, the majority of birds colliding with turbines and still in situ (i.e. not removed by scavengers) were likely to be detected by surveyors during the carcass searches.

4.3 Carcass Persistence Trials

- Although all but one of the carcasses deployed during breeding season carcass persistence trials were eaten/removed by scavengers between monthly survey visits, some remains (feathers) from carcasses persisted until at least one subsequent survey visit.
- Persistence rates of remains were highly variable, with half persisting for over three weeks, one for 12 days and two for just 1-2 days (the mean persistence time across the breeding season was 20 days).

- During the two non-breeding season persistence trials at the Development, evidence of carcasses (feathers) persisted for long periods (56 and 36 days).
- These results indicate that carcasses/remains of birds colliding with turbines are likely to persist for two weeks on average, although results were highly variable.
- This is supported by the persistence of carcasses found during the searches and other incidental records, several of which were present for a period of several weeks, while others did not persist until the subsequent visit.
- Carcass persistence rates during concurrent trials at the adjacent Haverigg III Wind Farm were similar, with no carcasses remaining until the subsequent visit, but some remains (feathers) persisting for a mean period of 27 days.
- Given the similarities in carcass persistence rates between the Development and the adjacent Haverigg II Wind Farm, it is considered that trials represent typical levels of scavenger removal.
- Results of the carcass persistence trials suggest that the number of birds present during the carcass searches is broadly representative of the actual number of carcasses; although the results indicate that a proportion of carcasses will be removed by scavengers between visits, they also suggest that some remains (feathers) will generally persist for several weeks. It is therefore considered unlikely that significant numbers of carcasses are eaten/removed by scavengers before they are detected during monthly visits.
- A range of different avian and mammalian scavengers inspected and/or consumed the carcasses, with carrion crow the scavenger species observed most frequently.
- It is acknowledged that levels of removal by scavengers may vary at different times of year (e.g. rates may be higher when scavengers are breeding and have young to feed, and/or when other food resources are scarce), and may also vary across the Site (e.g. there may be more scavengers in areas with dense vegetation to provide cover), or possibly according to bird species (e.g. some bird species may be more palatable to scavengers than others).
- There is also likely to be some natural variation in local scavenger populations, which may also result in fluctuating levels of scavenging/predation; furthermore there is anecdotal evidence that the landowner controls certain scavenger species (e.g. foxes), which may increase the variation in predation levels.

4.4 Breeding Bird Survey

- A total of 61 species were recorded during the BBS. This included 33 species of conservation concern, of which 17 were assessed as breeding within the BBS Area (with no evidence of breeding observed for the remaining 17 species of species of conservation concern). Ten of the breeding species of conservation concern were breeding within the Site Boundary (and all 17 species were breeding within the 500 m buffer).
- A total of 350 breeding territories of birds of conservation concern (all species combined) were recorded during the BBS. This comprised
- 29 territories within the Site Boundary and 321 territories within the 500 m buffer.
- The contrast in numbers of breeding territories between the Site and surrounding 500 m buffer unsurprising given the greater habitat diversity and larger area within the 500 m buffer, which will support greater species diversity and abundance.
- The most notable results were the herring gull and lesser black-backed gull breeding colonies (comprising ~100 and ~60 territories respectively) recorded on building roofs within the grounds of HMP Haverigg. Relatively large numbers of oystercatcher also appeared to be breeding within the prison grounds.
- It was also noted that relatively large numbers of (non-breeding) waders such as whimbrel and curlew may use the BBS Area as a stopover site during their spring migration.

- No Schedule 1¹⁰ or Annex I species were recorded breeding within the BBS Area, although there was evidence that a barn owl was roosting in one of the buildings.

4.5 Flight Activity Survey

- A total of 786 flights by 15 target species were recorded during the flight activity surveys.
- Herring gull was the species recorded most frequently (354 flights), followed by lesser black-backed gull (261 flights). Flight activity by both species was strongly associated with the breeding colonies within HMP Haverigg, with gulls apparently moving along three distinct (but broad) flight paths, presumably between nest sites and particular feeding areas. One of the three flight paths passes very close to the turbines, with most birds moving between the two northernmost turbines (3 and 4).
- In contrast, flight activity of black-headed gull (which was not breeding within the BBS Area) was concentrated to the north of the Site and largely followed an east-west orientation, with very few flights close to the turbines.
- Relatively high levels of oystercatcher flight activity were also recorded during the 2019 breeding season, concentrated over the eastern half of the Site, with relatively few flights in close proximity to the turbines.
- Flight activity of other target species recorded during the breeding season flight activity surveys was generally low.
- A total of 744 flights occurred at least partially at RSH; this included all of the herring gull and lesser black-backed gull flights.
- The majority of flights (726 flights) followed a 'Bullet' flight line, with birds apparently taking no avoiding action towards the turbines.
- Results show that there was a high density of flights within the Site Boundary, with the vast majority occurring at least partially at RSH, with no obvious flight response. However, no collisions were observed during any of the flight activity surveys.

5 CONCLUSION

Based on the results of the carcass persistence and searcher efficiency trials undertaken in parallel with the carcass searches to date, it is considered likely that the vast majority (at least 75%) of bird carcasses in situ (i.e. not removed by scavengers) at the time monitoring was carried out were detected. Breeding season results indicate highly variable levels of scavenger removal at the Development, ranging from a single day to several weeks. However, some evidence of a carcass (feathers or bones) typically remained visible for several weeks, suggesting that the majority of bird collisions were likely to have been detected by surveyors.

Up to seven¹⁷ carcasses were found during the six breeding season carcass searches, mainly gull species, with a further seven carcasses found in other parts of the Site during the same period. However, cause of death was not always apparent and one or more of these carcasses may have been killed by predators rather than turbines. No collisions were observed during the 36 hours of breeding season flight activity surveys. These results indicate that, although bird collisions regularly occur, a large proportion of which are gulls, the numbers of collisions are relatively low, particularly given the high levels of flight activity across the Site for certain species, including some gulls.

The BBS results indicate that a number of species of conservation concern bred within the Site Boundary at low densities. A greater number of species and higher densities of breeding territories are present within the 500 m buffer where there is increased habitat diversity. The most notable registrations of breeding birds were the herring gull and lesser black-backed gull colonies within HMP Haverigg.

The results of the flight activity surveys show that there are large numbers of certain target species flights over the Site Boundary during the breeding season. Species recorded most frequently were herring and lesser black-backed gulls, followed by oystercatcher, all three of which are qualifying features of the Morecambe Bay & Duddon Estuary SPA. Although the majority of target species flights (including both aforementioned gull species) occurred at RSH, turbines seem to have little impact on bird flight behaviour, with the vast majority following a "Bullet" flight path. This may indicate that many birds breeding in the vicinity of the Development may have become habituated to the presence of the turbines and routinely avoid them, without exhibiting any sudden avoidance behaviour detectable by surveyors.

Based on the very high number of flights at RSH, and low number of carcasses found during searches, collision rates appear to be relatively low. Most of the carcasses recorded were gull species, which is unsurprising given the proportion of flights at RSH by herring and lesser black-backed gulls, both of which appear to follow regular flight paths across the Site between breeding and foraging, including one flight path between the turbines.

Taking into account the results of the searcher efficiency and carcass persistence trials, as well as the persistence of carcasses recorded during both the carcass searches and incidentally, it is considered likely that the number of carcasses recorded is likely to be broadly representative of actual collision rates, although it is acknowledged that there will be some level of underestimation due to carcass removal by scavenger species.

APPENDIX 1: BIRD SPECIES NAMES AND CONSERVATION DESIGNATIONS

Table A1.1 list provides English vernacular and scientific names for all bird species recorded during the survey. Taxonomic order and nomenclature is based on the BOU 'British List'².

Table A1.1: List of English vernacular and scientific names of bird species mentioned in this report

Species*		Schedule 1/Annex I listings	Conservation listings**
English (British) vernacular name	Scientific name		
Greylag Goose	<i>Anser anser</i>		Amber
Mute Swan	<i>Cygnus olor</i>		Amber
Shelduck	<i>Tadorna tadorna</i>		Amber
Mallard	<i>Anas platyrhynchos</i>		Amber
Eider	<i>Somateria mollissima</i>		Amber
Red-legged Partridge	<i>Alectoris rufa</i>		
Pheasant	<i>Phasianus colchicus</i>		
Manx Shearwater	<i>Puffinus puffinus</i>		Amber
Grey Heron	<i>Ardea cinerea</i>		
Little Egret	<i>Egretta garzetta</i>		
Gannet	<i>Morus bassanus</i>		Amber
Cormorant	<i>Phalacrocorax carbo</i>		
Sparrowhawk	<i>Accipiter nisus</i>		
Buzzard	<i>Buteo buteo</i>		
Oystercatcher	<i>Haematopus ostralegus</i>		Amber
Lapwing	<i>Vanellus vanellus</i>		Red; Sec41
Golden Plover	<i>Pluvialis apricaria</i>	Ann1	
Whimbrel	<i>Numenius phaeopus</i>	Sch1.1	Red;
Curlew	<i>Numenius arquata</i>		Red; Sec41
Black-tailed Godwit	<i>Limosa limosa</i>	Sch1.1	Red; Sec41
Black-headed Gull	<i>Chroicocephalus ridibundus</i>		Amber
Common Gull	<i>Larus canus</i>		Amber
Great black-backed Gull	<i>Larus marinus</i>		Amber
Herring Gull	<i>Larus argentatus</i>		Red; Sec41
Lesser Black-backed Gull	<i>Larus fuscus</i>		Amber
Sandwich Tern	<i>Thalasseus sandvicensis</i>	Ann1	Amber
Common Tern	<i>Sterna hirundo</i>	Ann1	Amber
Black Guillemot	<i>Cephus grylle</i>		Amber
Feral Pigeon	<i>Columba livia</i>		
Stock Dove	<i>Columba oenas</i>		Amber
Woodpigeon	<i>Columba palumbus</i>		
Collared Dove	<i>Streptopelia decaocto</i>		
Barn Owl	<i>Tyto alba</i>	Sch1.1	BAP
Swift	<i>Apus apus</i>		Amber
Kestrel	<i>Falco tinnunculus</i>		Amber
Peregrine	<i>Falco peregrinus</i>	Sch1.1; Ann1	
Magpie	<i>Pica pica</i>		
Jackdaw	<i>Coloeus monedula</i>		
Rook	<i>Corvus frugilegus</i>		
Carrion Crow	<i>Corvus corone</i>		

Species*		Schedule 1/Annex I listings	Conservation listings**
English (British) vernacular name	Scientific name		
Hooded Crow	<i>Corvus cornix</i>		
Raven	<i>Corvus corax</i>		
Blue Tit	<i>Cyanistes caeruleus</i>		
Great Tit	<i>Parus major</i>		
Skylark	<i>Alauda arvensis</i>		Red; Sec41
Sand Martin	<i>Riparia riparia</i>		
Swallow	<i>Hirundo rustica</i>		
House Martin	<i>Delichon urbica</i>		Amber
Willow Warbler	<i>Phylloscopus trochilus</i>		Amber
Chiffchaff	<i>Phylloscopus collybita</i>		
Sedge Warbler	<i>Acrocephalus schoenobaenus</i>		
Grasshopper Warbler	<i>Locustella naevia</i>		Red; Sec41
Whitethroat	<i>Sylvia communis</i>		
Wren	<i>Troglodytes troglodytes</i>		
Starling	<i>Sturnus vulgaris</i>		Red; Sec41
Blackbird	<i>Turdus merula</i>		
Song Thrush	<i>Turdus philomelos</i>		Red; Sec41; BAP
Robin	<i>Erithacus rubecula</i>		
Stonechat	<i>Saxicola rubicola</i>		
Wheatear	<i>Oenanthe oenanthe</i>		
House Sparrow	<i>Passer domesticus</i>		Red; Sec41
Duncock	<i>Prunella modularis</i>		Amber; Sec41
Pied Wagtail***	<i>Motacilla alba ssp. yarellii</i>		Amber
Meadow Pipit	<i>Anthus pratensis</i>		Amber
Chaffinch	<i>Fringilla coelebs</i>		
Linnet	<i>Linaria cannabina</i>		Red; Sec41
Goldfinch	<i>Carduelis carduelis</i>		
Reed Bunting	<i>Emberiza schoeniclus</i>		Amber; Sec41

*Species names and order follow the British List maintained by the BOU²
** Red = UK Red-listed BoCC¹²; Amber = UK Amber-listed BoCC¹²; SPI = listed as SPI under S41 of the NERC Act 2006¹¹; BAP = listed in the Cumbria BAP as a species for priority action¹³
***Although the 'parent' species is Green-listed, both pied wagtail subspecies occurring in the UK (*yarelli* and *alba*), are Amber-listed

APPENDIX 2: FIGURES

Figure 1: Ornithology Study Areas

Figure 2: Breeding Bird Territories: Non-passerines

Figure 3: Breeding Bird Territories: Passerines

Figure 4: Herring Gull Flights

Figure 5: Lesser Black-backed Gull Flights

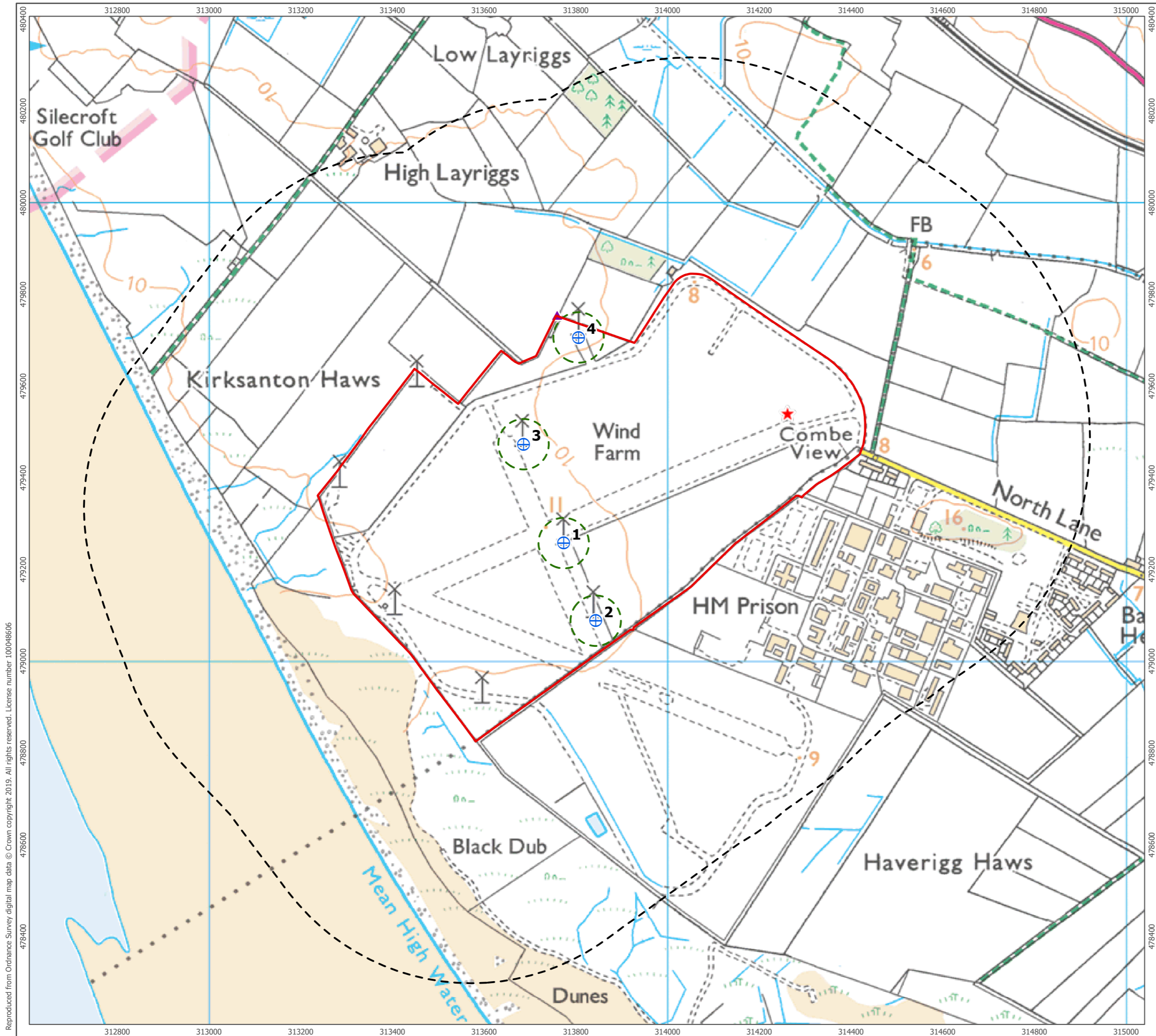
Figure 6: Black-headed Gull Flights

Figure 7: Other Gull Flights


Figure 8: Oystercatcher Flights

Figure 9: Other Wader Flights

Figure 10: Other Target Species Flights



- Site Boundary
- Carcass Search Area
- Breeding Bird Survey Area
- ⊕ Haverigg II Turbines
- ⊕ Haverigg III Turbines
- ★ Vantage Points
- ▲ Camera Trap Location

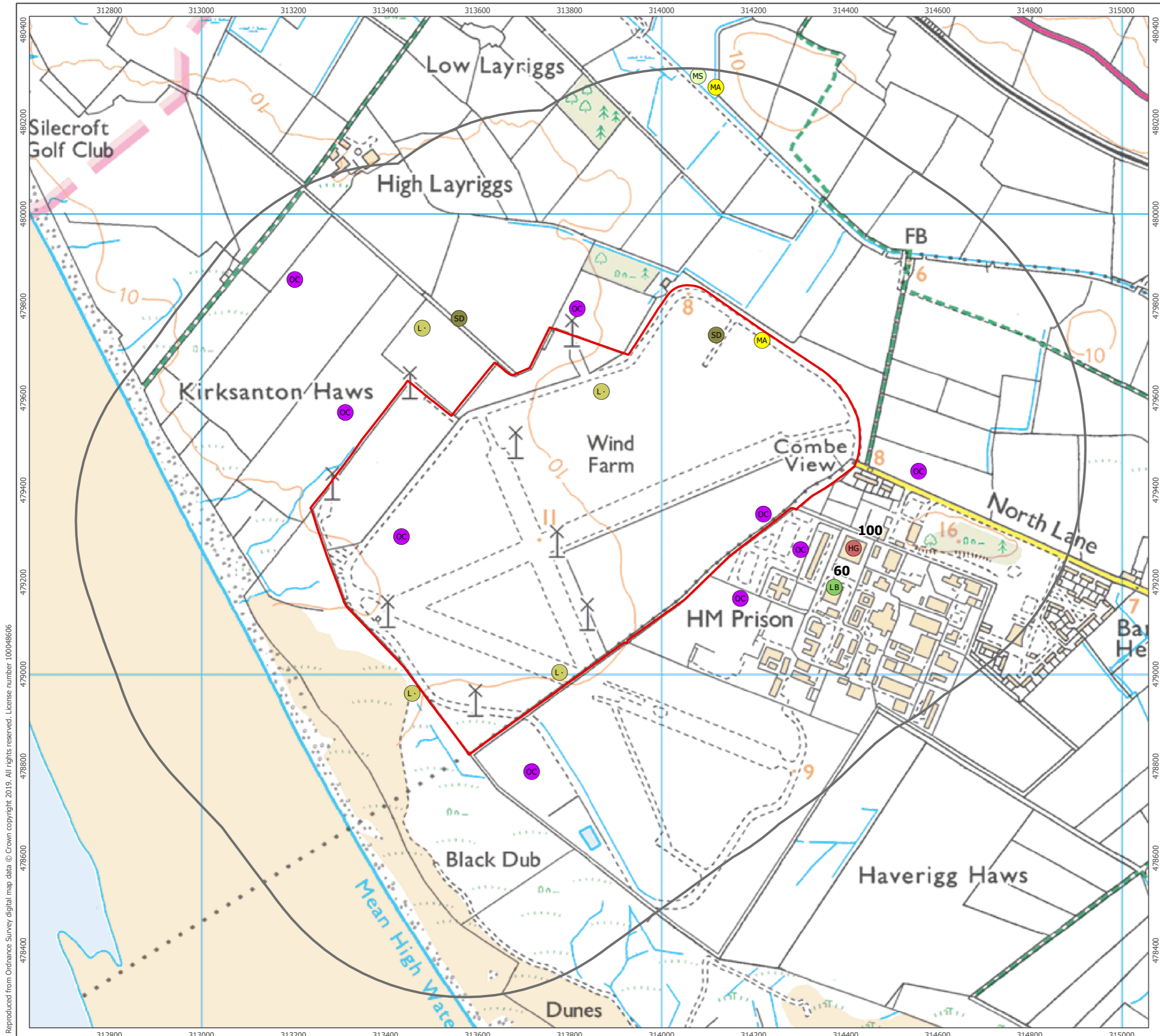
1:8,000 Scale @ A3

 0 0.1 0.2 km

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Checked By: LC	Date: 08/10/2019

Ornithology Study Areas
Figure 1

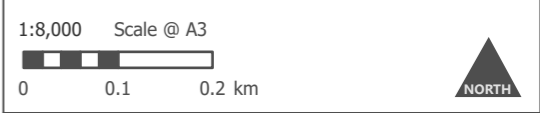
**Haverigg II Wind Farm Life Extension
Breeding Bird Report 2019**

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- Site Boundary
- Breeding Bird Survey Area (500 m Buffer of Site Boundary)
- HG Herring Gull
- L Lapwing
- LB Lesser Black-backed Gull
- MA Mallard
- MS Mute Swan
- OC Oystercatcher
- SD Stock Dove

Numbers on map denote number of territories where more than one territory was recorded in close proximity.

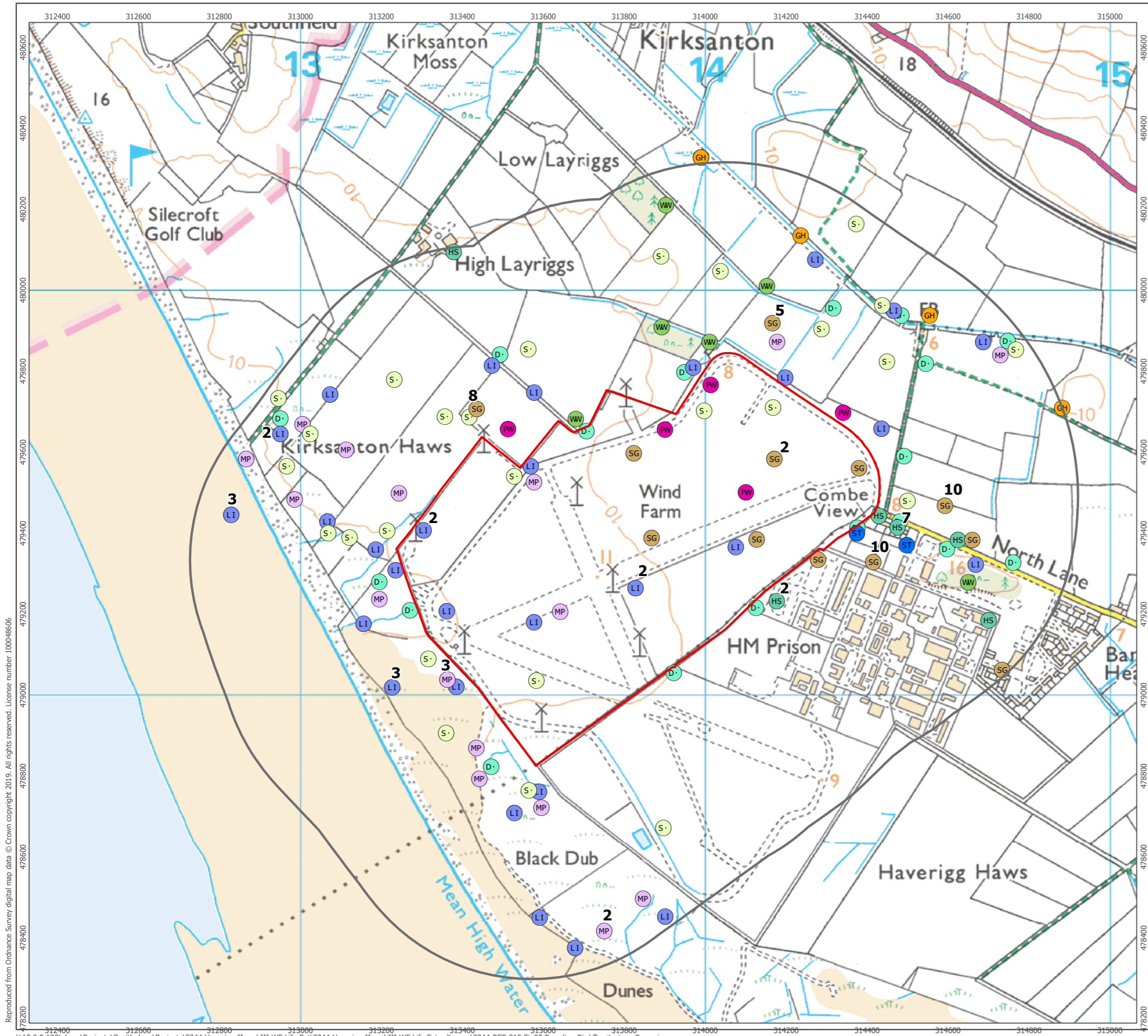


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**Breeding Bird Territories:
Non-Passerines**
Figure 2

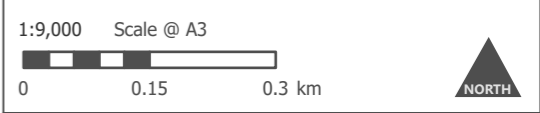
**Haverigg II Wind Farm Life Extension
Breeding Bird Report 2019**

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- Site Boundary
- Breeding Bird Survey Area (500 m Buffer of Site Boundary)
- D• Dunnock
- GH• Grasshopper Warbler
- HS• House Sparrow
- LI• Linnet
- MP• Meadow Pipit
- PW• Pied Wagtail
- S• Skylark
- ST• Song Thrush
- SG• Starling
- WW• Willow Warbler

Numbers on map denote number of territories where more than one territory was recorded in close proximity.

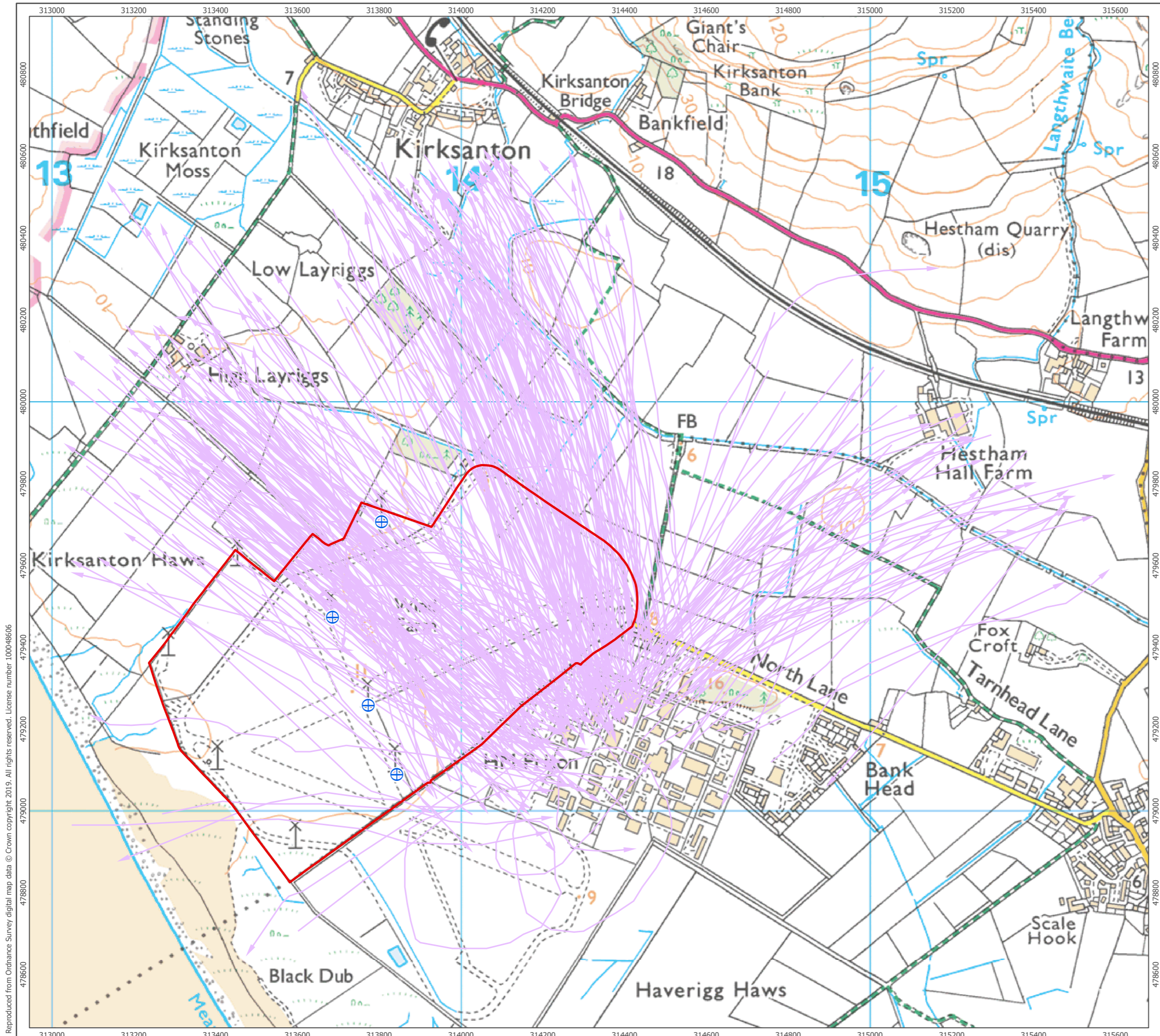


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**Breeding Bird Territories:
Passerines
Figure 3**

**Haverigg II Wind Farm Life Extension
Breeding Bird Report 2019**

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- Site Boundary
- ⊕ Haverigg II Turbines
- Herring Gull

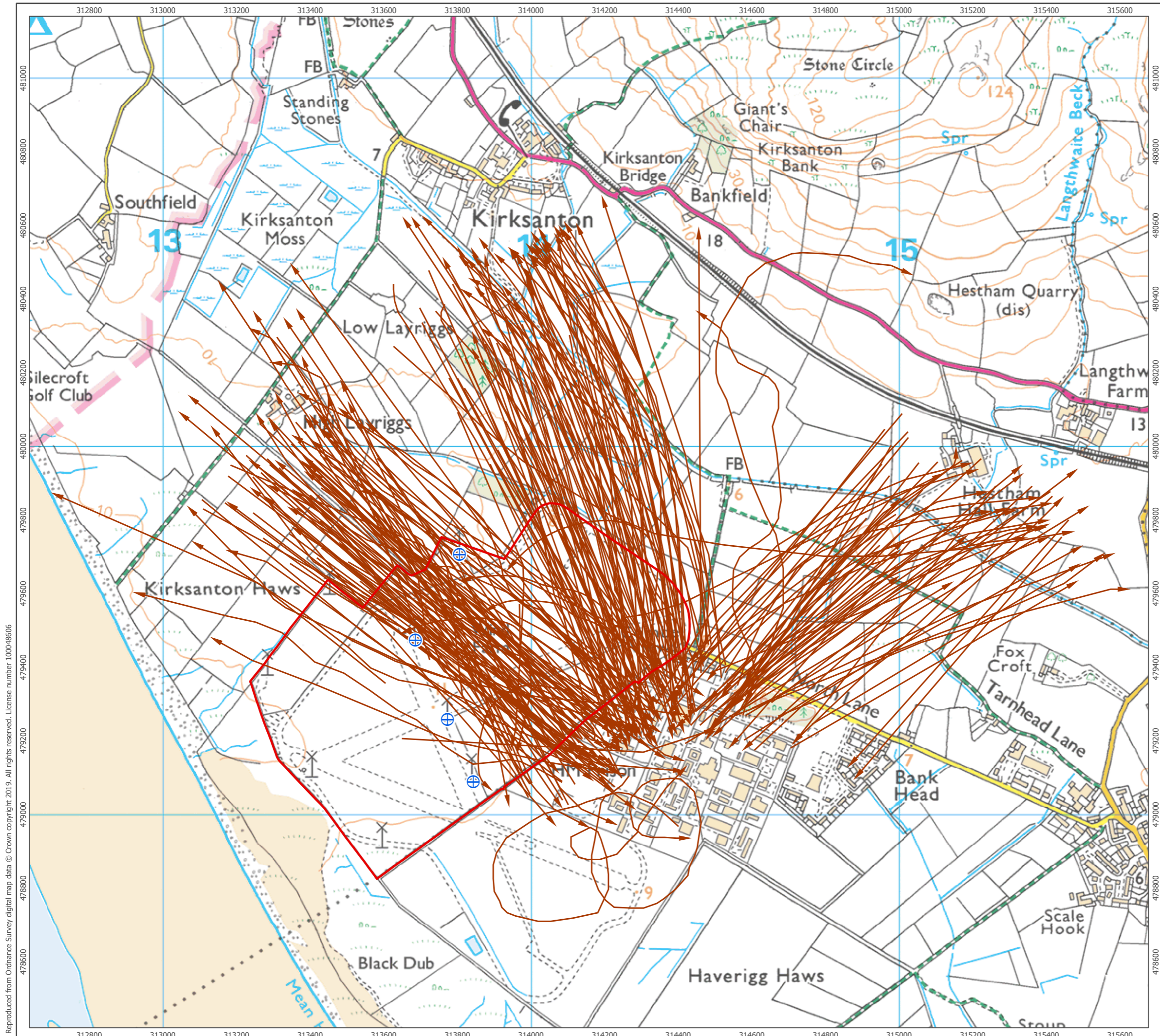
1:9,000 Scale @ A3



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Herring Gull Flights
Figure 4

**Haverigg II Wind Farm Life Extension
Breeding Bird Report 2019**

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- Site Boundary
- ⊕ Haverigg II Turbines
- Lesser Black-backed Gull

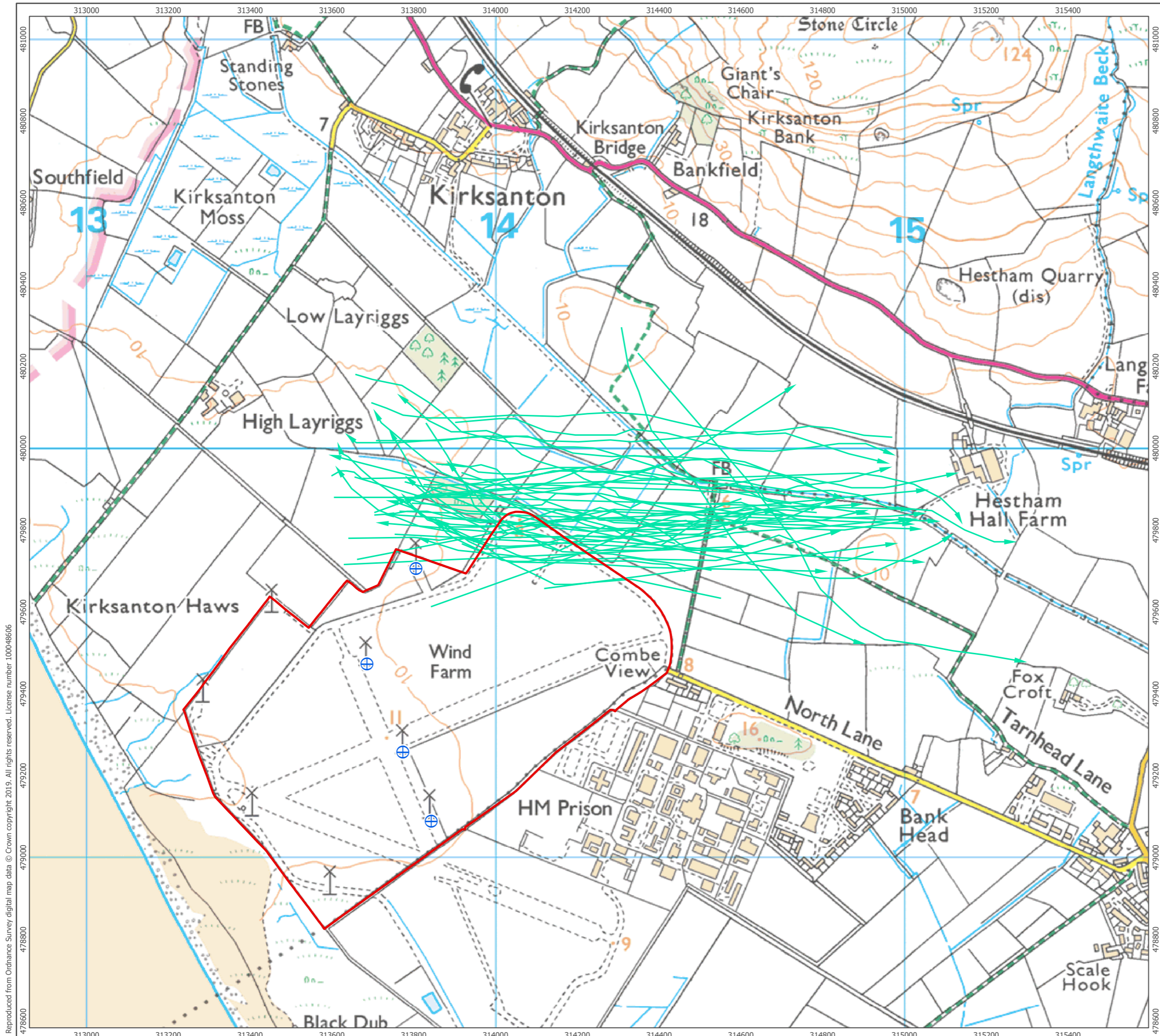
1:10,000 Scale @ A3
 0 0.1 0.2 km



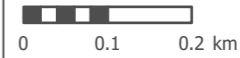

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Lesser Black-backed Gull Flights
Figure 5

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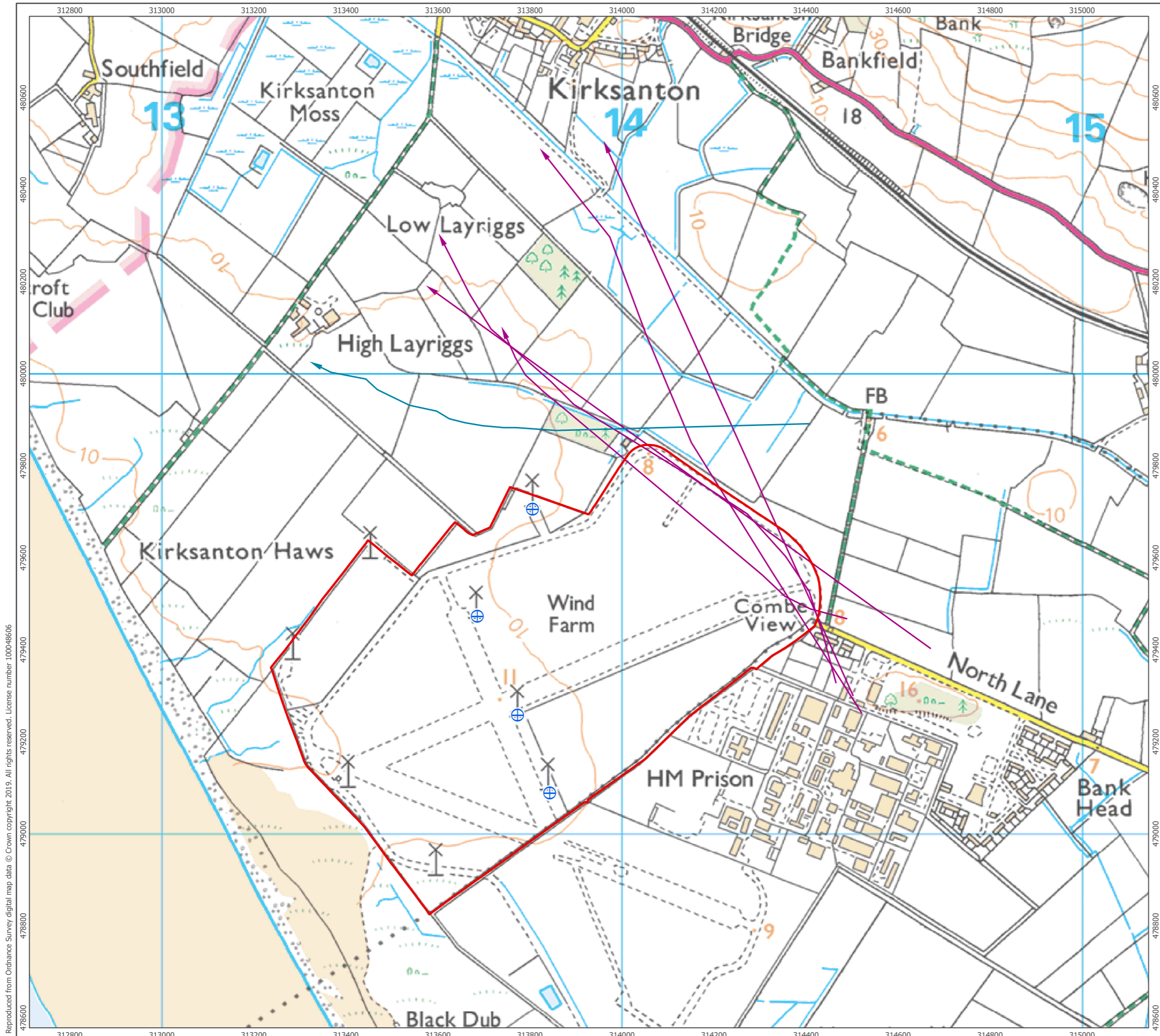
- Site Boundary
- ⊕ Haverigg II Turbines
- Black-headed Gull

1:9,000 Scale @ A3



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Black-headed Gull Flights
Figure 6

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- Site Boundary
- ⊕ Haverigg II Turbines
- Common Gull
- Great Black-backed Gull

1:8,000 Scale @ A3
 0 0.1 0.2 km

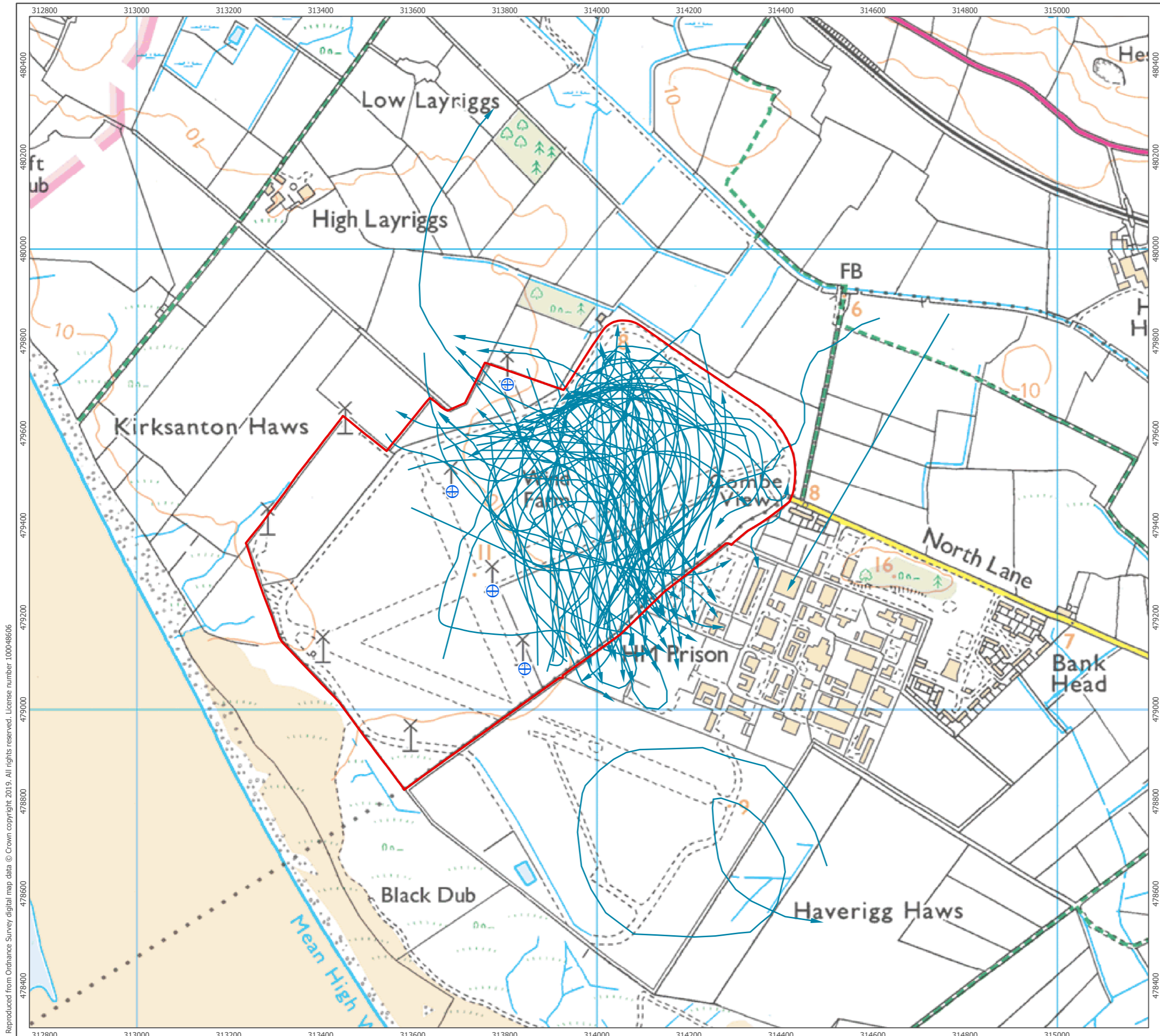


Produced By: LS	Ref: 3344-REP-019
Checked By: LC	Date: 08/10/2019

Other Gull Flights
Figure 7

**Haverigg II Wind Farm Life Extension
Breeding Bird Report 2019**

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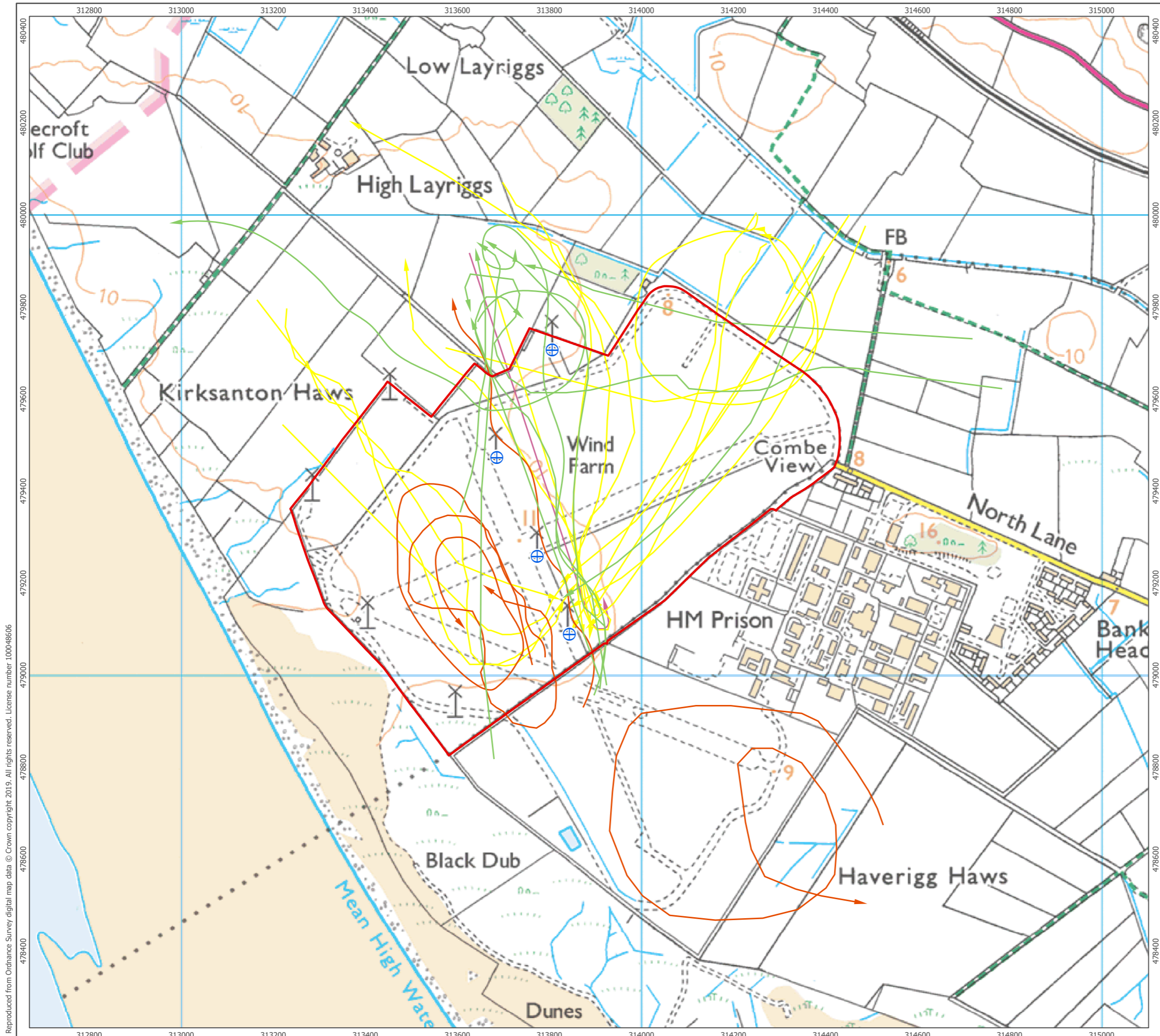
- Site Boundary
- ⊕ Haverigg II Turbines
- Oystercatcher

1:8,000 Scale @ A3
 0 0.1 0.2 km

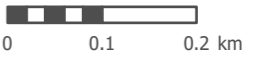

Produced By: LS	Ref: 3344-REP-020
Checked By: LC	Date: 08/10/2019

Oystercatcher Flights
Figure 8

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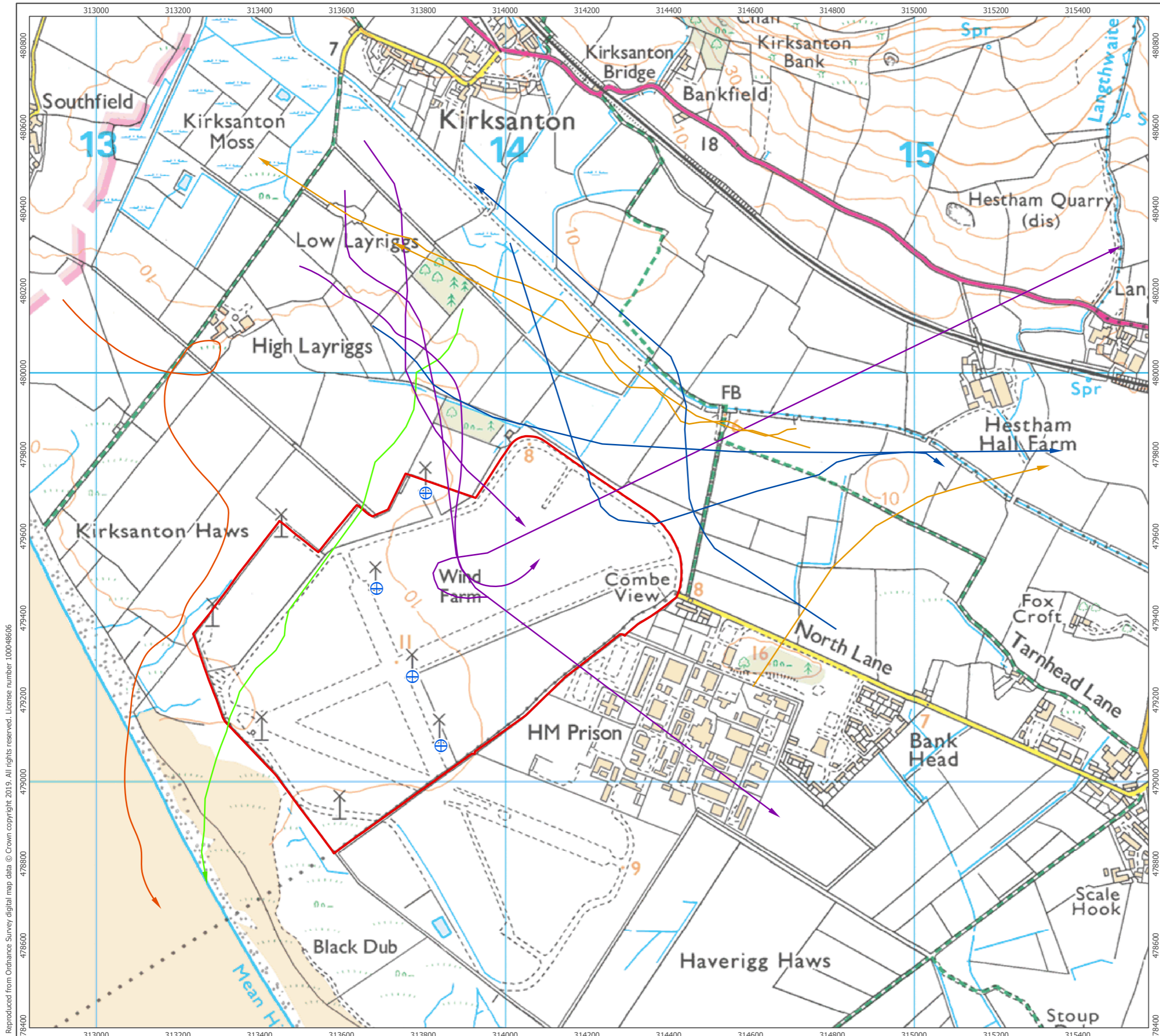
- Site Boundary
- ⊕ Haverigg II Turbines
- Black-tailed Godwit
- Curlew
- Lapwing
- Whimbrel

1:8,000 Scale @ A3





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Other Wader Flights
Figure 9

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- Site Boundary
- ⊕ Haverigg II Turbines
- Gannet
- Grey Heron
- Greylag Goose
- Little Egret
- Mallard

1:9,000 Scale @ A3



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Other Target Species Flights
Figure 10

**Haverigg II Wind Farm Life Extension
Breeding Bird Report 2019**

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APPENDIX 3: DETAILS OF CONSULTATION WITH NATURAL ENGLAND RELATING TO WINTER BIRD COLLISION MONITORING

- Letter from Arcus summarising existing information and confirming proposed survey scope
- Email response from Natural England



1c Swinegate Court East
3 Swinegate
York
YO1 8AJ

Kate Berry
Advisor – Cumbria Team
Natural England
Lake District National Park Building
Murley Moss Business Park
Oxenholme Road
Kendal
Cumbria
LA9 7RL

26 March 2019

Our Reference: 2022_3191/NE_DAS
Natural England Reference: 252221
Copeland BC Reference: 4/02/0505/0 [Haverigg III]

Dear Kate,

Haverigg II and III Wind Farms – Life Extension Applications –Breeding Season Ornithology Surveys and Non-Avian Ecology Surveys - Scope Confirmation

Further to DAS consultation with Natural England last year, Arcus has been commissioned to also undertake the necessary ornithology and non-avian ecology surveys in relation to a life extension of the adjacent Haverigg II wind farm (previous consultation was particularly in relation to Haverigg III wind farm). Surveys agreed on Haverigg III to date have therefore been undertaken for both sites.

The non-breeding season ornithological surveys at Haverigg III and Haverigg II wind farms were undertaken between September 2018 and March 2019. Arcus would now like to confirm the scope of the breeding season ornithology surveys and the non-avian ecology surveys with Natural England.

We will continue the monthly collision risk monitoring (carcass searches, along with observer efficiency and carcass persistence trials) until August 2019.

In addition, in line with the recommendations in an email from Natural England dated 18/09/2018, we will complete breeding bird survey and vantage point (VP) surveys during the breeding season.

During the bat activity season (April to August) the carcass searches for birds will be extended to include searches for bat casualties.

Arcus would be grateful if you could confirm that the methods for the surveys are suitable for assessing impacts of a proposed life extension on breeding birds and bats, particularly in relation to the proposed VP surveys (VP location, recording method and level of survey effort) and the bat survey methodology.

Scope of Breeding Season Ornithology Surveys

Collision Monitoring (April to August 2019)

Collision risk monitoring will continue with the same methods as during the non-breeding season (September 2018 to March 2019), with monthly searches for bird carcasses within a 50 m radius of each turbine base. Monthly carcass persistence and observer efficiency trials will also be completed to validate the results of the carcass searches.

Breeding Bird Survey (April to July 2019)

As requested by Natural England (NE) during initial consultation (via email dated 18/09/2019), a breeding bird survey will be completed, to map the territories of breeding birds within 500 m of the Site (access permitting). The survey will follow a reduced version of the British Trust for Ornithology's (BTO) Common Birds Census (CBC)¹ as this is considered to be the most appropriate method for the predominantly farmland habitats present on the Site. Four survey visits will be completed, at least seven days apart, between April and July 2019.

Vantage Point Surveys (May to mid-July 2019)

As requested by NE during initial consultation (via email dated 18/09/2019), Flight Activity Surveys will be undertaken between 1st May and 15th July 2019 to record flight activity of target species such as wildfowl, waders and protected raptors and owls, and to monitor the impacts of the Haverigg turbines on breeding gulls from the adjacent Morecambe Bay and Duddon Estuary Special Protection Area (SPA).

The level of gull flight activity has the potential to be high, and it may therefore be difficult to record gulls as target species with each flight mapped and detailed information recorded for each flight. We would therefore be grateful if you could confirm whether it is essential for gulls to be recorded as target species, or whether flight activity can be summarised (e.g., mapping of regular flight paths/areas of activity rather than mapping of individual flight lines, and a summary of overall numbers and flight height range).

A single VP location will be sufficient to cover the turbines within both Developments, and a surrounding 500 m buffer around them². A viewshed analysis will be carried out to identify the most suitable VP location.

This is based on a 2 km viewshed from the VP location, which is in line with current Scottish Natural Heritage (SNH) guidance³, but exceeds the 1 km viewshed recommended in the earlier NE guidance⁴. We consider that this approach is preferable to using a 1 km viewshed because:

- (a) all turbines would be within 1 km of the VP with only the 500 m buffer area extending beyond this; and
- (b) restricting viewsheds to 1 km would require an additional VP location, which (due to potential access restrictions) would likely be located within 500 m of the turbines and/or close to the SPA, which could affect flight behaviour of birds from the SPA and/or within 500 m of the turbines.

A total of 36 hours of watches per VP location will be carried out between 1st May and 15th July 2019. This meets the survey effort requirement in NE guidance⁵.

¹ Marchant, J. (1983) *Common Birds Census Instructions*. British Trust for Ornithology, Thetford.

² This is the recommended maximum buffer in the current Scottish Natural Heritage (2017) document, and the maximum buffer in the older NE guidance⁴.

³ Scottish Natural Heritage. (2017). *Recommended bird survey methods to inform impact assessment of onshore wind farms*.

⁴ Natural England. (2010). *Natural England Technical Information Note TIN069 Assessing the effects of onshore wind farms on birds*.

⁵ *ibid*

Scope of Bat Surveys

Desk Study (April 2019)

A data search request will be submitted to Cumbria Biodiversity Data Centre (CBDC) for bat records within 10 km of the wind farms, and a desk study search of online geographical data sources will be undertaken to identify known bat roosts and determine local distribution of bat species. The desk study will provide further information regarding bat species likely to use the site and therefore inform analysis of the collision monitoring element.

Ecological Appraisal and Preliminary Assessment for Bats (April 2019)

An onsite assessment of habitats for their potential to support commuting, foraging and roosting bats, will be undertaken on site, extending up to 200 m from the site boundaries. The survey will be undertaken by a licenced bat ecologist in order to identify any roosts, should they be present. The onsite assessment will determine features of value for bats.

Bat Collision Monitoring

New bat survey guidance⁶ puts emphasis on the importance of undertaking casualty searches around the existing turbines. In combination with a review of existing baseline information, site based assessment, knowledge gained during ornithology surveys (in terms of habitat distribution, flight paths by other animals and site conditions such as wind speed and exposure) it is considered the collision monitoring will provide a robust evidence base for assessment of the existing wind farm's impact on bats. Therefore, whilst carcass searches are undertaken as part of the ornithology surveys, during the 2019 bat survey season (April to August), additional survey effort for bats will be included, and alternative carcasses will be deployed to ensure the scavenging rates are applicable to bats as well as birds. This will be undertaken monthly between April and August with searches for bat carcasses within a 50 m radius of each turbine base. Monthly carcass persistence and observer efficiency trials will also be completed to validate the results of the carcass searches.

It would be much appreciated if you could confirm that the survey approach set out is considered to form an appropriate baseline for the Development and is acceptable to NE.

The surveys described in this letter will commence in April 2019, therefore we would be grateful if you are able to respond at your earliest opportunity, and by 12 April 2019 if possible.

Yours sincerely,



Mike Bird

Associate Director

⁶ Scottish Natural Heritage (January 2019). Bats and Onshore Wind Turbines: Survey, Assessment and Mitigation. Available at: <https://www.nature.scot/sites/default/files/2019-01/Bats%20and%20onshore%20wind%20turbines%20-%20survey%2C%20assessment%20and%20mitigation.pdf> [accessed March 2019].

From: Berry, Kate <Kate.Berry@naturalengland.org.uk>
Sent: 29 March 2019 13:58
To: Mike Bird <mikeb@arcusconsulting.co.uk>
Subject: RE: NE response: Scope of Ecology and Ornithology Surveys

Hi Mike

I've discussed the scope of the surveys with Bart. Overall the scope is suitable, however as gulls are likely to be the main species impacted by the turbines they will need to be a target species as part of the vantage point surveys.

Kind regards

Kate

Kate Berry
Sustainable Development Adviser
Solway, Coast & Sustainable Development Team
Cumbria Area Team
Natural England
Murley Moss
Kendal, LA9 7RL
T: 0208 026 2178

Please note I do not work Wednesdays

<http://www.gov.uk/natural-england>

We are here to secure a healthy natural environment for people to enjoy, where wildlife is protected and England's traditional landscapes are safeguarded for future generations.

Do you need help negotiating your way through environmental legislation? Using Natural England's Discretionary Advice Service (DAS) at an early stage in the development of your proposals can help minimise delay, uncertainty and overall costs. There are three strands to this service: help with [Planning Applications](#), help with [Protected Species Mitigation Plans](#) and help with [Consent to carry out works on Sites of Special Scientific Interest \(SSSIs\)](#)

From: Mike Bird
Sent: 05 April 2019 13:11
To: Berry, Kate
Cc: Adrian Warman; Colin Palmer; Lisette Coiffait; Clare Walters
Subject: RE: NE response: Scope of Ecology and Ornithology Surveys

Hi Kate,

Thank you for confirming the survey scope is suitable.

The ecology and breeding season ornithology surveys will proceed as per the letter from Arcus to Natural England dated 26 March 2019 with gull species being included as target species in the surveys as requested.

Many thanks for the quick response on this – it's much appreciated.

Kind regards,

Mike

Michael Bird

Tel: 01904 715470

Mob: 07878 950645

Email: MikeB@arcusconsulting.co.uk

Arcus

1C Swinegate Court East

3 Swinegate

York

YO1 8AJ

www.arcusconsulting.co.uk



APPENDIX 4: SURVEY DETAILS

Full details of the 2019 breeding season surveys are presented in Tables A4.1 (carcass searches), A4.2 (BBS) and A4.3 (flight activity surveys) below.

Table A4.1: Details of the 2019 breeding season carcass searches

Survey date	Turbine number	Search start time	Search end time	Weather conditions at start and end of search					Notable observations of birds and mammals
				Wind speed	Wind direction	Rain	Cloud cover	Notes	
22/03/19	4	10:22	11:06	5	SW	0	8	Newborn lambs in fenced part of turbine 1 survey area restricted search area	<ul style="list-style-type: none"> • 85+ gulls in east of site (predominantly herring gulls, with some lesser black-backed gulls); • Peregrine flew south past turbine 2 and into prison grounds; • Golden plover breast feathers in search area; probably from roosting/foraging birds rather than collisions
	3	11:14	11:53						
	1	12:24	13:00						
	2	13:08	13:48						
23/04/19	1	14:50	15:47	4	E	0	3		<ul style="list-style-type: none"> • 10 whimbrel flew through turbine envelope
	2	15:55	16:35						
24/04/19	4	13:19	14:31	5-4	NE	0	8-3	High cloud	
	3	14:45	15:45						
16/05/19	4	15:27	16:28	4	E	0	1-2		
17/05/19	2	14:02	14:59	2	NNW	0	5-3	Rain overnight; strong sun from 14:00	<ul style="list-style-type: none"> • 3 lapwing alarming near turbine 2, mobbing carrion crow (may be using prison grounds as well); • Oystercatcher flew past turbine 3
	1	15:31	16:42						
	3	16:52	17:38						
21/06/19	4	12:49	13:53	3-2	WNW	0	2-1	Height of vegetation in motocross area to chest height in	<ul style="list-style-type: none"> • Kestrel to north-east of turbine 4, over woodland; • 3 oystercatchers flew through turbine envelope
	3	14:28	15:30						
	1	17:56	18:32						

Survey date	Turbine number	Search start time	Search end time	Weather conditions at start and end of search					Notable observations of birds and mammals
				Wind speed	Wind direction	Rain	Cloud cover	Notes	
	2	18:35	19:08					some places and prohibitive to searches; turbine 1 and 2 search areas restricted due to silage harvesting; very bright light	
16/07/19	4	16:28	17:18	2-3	WSW	0	6-5	Vegetation to head height in places	
17/07/19	2	14:01	14:58	3-5	SSE/SW	0-4	8	Heavy rain from 12:30 (very heavy during search of turbine 3); visibility <1 km from 16:00	<ul style="list-style-type: none"> • Single curlew and oystercatcher flew through turbine envelope; • 3 curlew flew past turbine 1; • Mixed flock of 350+ rooks and jackdaw feeding in cut silage field at turbine 1, along with 30+ large gulls
	1	15:29	16:25						
	3	16:43	17:16						
22/08/19	2	17:13	17:56	6-4	SW	0	8		
23/08/19	4	10:25	11:45	4-2	SW	0	8-3		<ul style="list-style-type: none"> • 60+ curlew, including juveniles, foraging in turbine envelope
	3	14:46	15:37						
	1	15:43	16:24						
	2	13:58	14:30						
Key: <ul style="list-style-type: none"> • Wind speed: according to Beaufort Scale • Wind direction: according to 16-point compass • Rain: 0 = None; 1 = Drizzle/Mist; 2 = Light showers; 3 = Heavy showers; 4 = Light rain; 5 = Heavy rain • Cloud cover: in eighths of sky (oktas) 									

Table A4.2: 2019 BBS times and hourly weather conditions

Visit	Date	Observer	Start time	End time	Hour	Wind speed	Wind direction	Rain	Cloud cover	Cloud height	Visibility	Frost	Snow
1	23/04/2019	MH	06:20	12:39	1	3	NE	0	7	2	2	0	0
					2	3	NE	0	7	2	2	0	0
					3	3	NE	0	7	2	2	0	0
					4	3	NE	0	8	2	2	0	0
					5	4	E	0	6	2	2	0	0
					6	4	E	0	4	2	2	0	0
					7	4	E	0	4	2	2	0	0
2	14/05/2019	CG	05:15	11:15	1	1	SE	0	3	2	1-2	0	0
					2	1	SE	0	2	2	2	0	0
					3	2	SE	0	2	2	2	0	0
					4	2	SE	0	4	2	2	0	0
					5	3	SE	0	4	2	2	0	0
					6	3	SE	0	5	2	2	0	0
3	13/06/2019	CG	05:15	11:15	1	1	N	3	8	1	1-2	0	0
					2	2	N	3	8	2	2	0	0
					3	2	N	5	8	1	1	0	0
					4	2	N	4	8	2	2	0	0
					5	2	N	2	8	2	2	0	0
					6	2	N	0	8	2	2	0	0
4	11/07/2019	CG	05:10	11:10	1	3	SW	1	8	1	1	0	0
					2	3	SW	0	8	1	1	0	0
					3	2	W	0	8	1	1	0	0
					4	2	W	2	8	1	2	0	0
					5	3	SW	2	8	2	2	0	0
					6	3	SW	0	7	2	2	0	0

Key:

- Observer: CG = Chris Gomersall; MH = Matt Harding
- Wind speed: according to Beaufort Scale
- Wind direction: according to 16-point compass
- Rain: 0 = None; 1 = Drizzle/Mist; 2 = Light showers; 3 = Heavy showers; 4 = Light rain; 5 = Heavy rain
- Cloud cover: in eighths of sky (oktas)
- Cloud height: 0 = <150 m; 1 = 150-500 m; 2 = >500 m
- Visibility: 0 = Poor (<1 km); 1 = Moderate (1-2 km); 2 = Good (>2 km)
- Frost: 0 = None; 1 = Ground frost; 2 = All day frost
- Snow: 0 = None; 1 = On site; 2 = On high ground

Table A4.3: 2019 breeding season flight activity survey times and hourly weather conditions

Date	Start time	End time	Hour	Wind speed	Wind direction	Rain	Cloud cover	Cloud height	Visibility	Frost	Snow	Notes
13/05/2019	12:30	14:30	1	2-3	SSW	0	3	2	2	0	0	
			2	3	SSW	0	4	2	2	0	0	
	14:50	16:50	1	2	SSW	0	4	2	2	0	0	
			2	2	SW	0	2	2	2	0	0	
	17:10	19:10	1	1	SW	0	2	2	2	0	0	
			2	1	SW	0	1	2	2	0	0	
15/05/2019	05:15	07:15	1	2	SE	0	3	2	1-2	0	0	
			2	0	SE	0	2	2	2	0	0	
	07:35	09:35	1	2	SE	0	2	2	2	0	0	
			2	3	SE	0	1	2	2	0	0	
	09:55	11:55	1	3	SE	0	1	2	2	0	0	
			2	3	SE	0	3	2	2	0	0	
12/06/2019	15:05	17:05	1	2	NNE	1	8	2	2	0	0	14 °C
			2	3	NNE	4	8	2	2	0	0	14 °C
	17:25	19:25	1	3	NNE	5	8	1	2	0	0	13 °C
			2	2	NNE	4	8	1	1	0	0	12 °C
	19:45	21:45	1	2	NE	4	8	1	2	0	0	11 °C
			2	2	N	4	8	1	1	0	0	11 °C
14/06/2019	05:15	07:15	1	2	S	0	5	2	2	0	0	9 °C
			2	2	S	2	7	2	2	0	0	9 °C
	07:35	09:35	1	2	S	5	8	1	2	0	0	9 °C
			2	2	S	3	8	1	2	0	0	9 °C
	09:55	11:55	1	2	S	4	8	1	2	0	0	9 °C
			2	1	S	5	8	1	1	0	0	9 °C
10/07/2019	15:05	17:05	1	3	WSW	0	7	2	2	0	0	
			2	3	WSW	0	8	2	2	0	0	
	17:25	19:25	1	2	SW	0	8	2	2	0	0	
			2	2	SW	0	5	2	2	0	0	
	19:45	21:45	1	2	SW	0	7	2	2	0	0	
			2	2	SW	0	5	2	1-2	0	0	
12/07/2019	05:10	07:10	1	2	NW	1-4	8	1	1-2	0	0	
			2	2	NW	5	8	1	1	0	0	
	07:30	09:30	1	2	NW	4	8	1	1	0	0	

Date	Start time	End time	Hour	Wind speed	Wind direction	Rain	Cloud cover	Cloud height	Visibility	Frost	Snow	Notes
			2	3	NW	2	8	1	1	0	0	
	09:50	11:50	1	3	NW	4	8	1	1	0	0	
			2	3	NW	2	8	1	2	0	0	

Key:

- Wind speed: according to Beaufort Scale
- Wind direction: according to 16-point compass
- Rain: 0 = None; 1 = Drizzle/Mist; 2 = Light showers; 3 = Heavy showers; 4 = Light rain; 5 = Heavy rain
- Cloud cover: in eighths of sky (oktas)
- Cloud height: 0 = <150 m; 1 = 150-500 m; 2 = >500 m
- Visibility: 0 = Poor (<1 km); 1 = Moderate (1-2 km); 2 = Good (>2 km)
- Frost: 0 = None; 1 = Ground frost; 2 = All day frost
- Snow: 0 = None; 1 = On site; 2 = On high ground

APPENDIX 5: DETAILS OF TARGET SPECIES FLIGHTS

Details of each target species flight recorded during the 2019 breeding season flight activity surveys are presented below in Table A5.1. All flights were recorded by Chris Gomersall. Shaded flights are at least partially at RSH.

Table A5.1: Details of each target species flight recorded during the 2019 breeding season flight activity surveys*

Species**	Date	Flight start time	Duration (s)	Minimum no. of birds	Flight behaviour***	Key no.****	Notes
Greylag Goose	12/06/2019	16:52	193	4	Transit	418	Horiz
	12/06/2019	19:04	102	7	Transit	458	Bullet
	12/06/2019	21:36	91	4	Transit	513	Bullet
	14/06/2019	08:59	226	6	Transit	627	Bullet
Mallard	12/06/2019	16:32	106	2	Transit	406	Bullet
	12/06/2019	18:07	136	3	Transit	437	Bullet
	14/06/2019	06:07	104	2	Transit	550	Bullet
	14/06/2019	11:48	179	3	Transit	665	Bullet
Grey Heron	15/05/2019	09:19	174	1	Transit	215	Bullet
Little Egret	12/07/2019	07:52	171	3	Transit	849	Bullet
	12/07/2019	10:58	98	1	Transit	885	Bullet
Gannet	12/06/2019	20:09	191	1	Transit	478	Horiz
Oystercatcher	13/05/2019	12:41	71	2	Transit	268	Bullet
	13/05/2019	13:37	109	2	Courtship	281	Bullet
	13/05/2019	13:59	86	1	Courtship	287	Bullet
	13/05/2019	14:14	72	3	Courtship	290	Bullet
	13/05/2019	14:27	71	2	Courtship	299	Bullet
	13/05/2019	16:02	76	2	Courtship	321	Bullet
	13/05/2019	16:19	61	2	Transit	329	Bullet
	13/05/2019	16:30	109	2	Transit	333	Bullet
	13/05/2019	16:42	124	1	Courtship	340	Bullet
	13/05/2019	16:47	61	2	Transit	343	Bullet
	13/05/2019	17:17	93	1	Courtship	348	Bullet
	13/05/2019	18:41	88	1	Courtship	367	Bullet
	15/05/2019	05:36	68	1	Transit	110	Bullet
	15/05/2019	06:11	108	3	Courtship	121	Bullet
15/05/2019	06:39	61	2	Transit	134	Bullet	

Species**	Date	Flight start time	Duration (s)	Minimum no. of birds	Flight behaviour***	Key no.****	Notes
	15/05/2019	07:04	68	1	Courtship	151	Bullet
	15/05/2019	07:09	70	2	Transit	157	Bullet
	15/05/2019	07:43	93	2	Courtship	168	Bullet
	15/05/2019	07:52	80	1	Transit	171	Bullet
	15/05/2019	08:22	66	1	Transit	182	Bullet
	15/05/2019	08:58	68	1	Transit	196	Bullet
	15/05/2019	09:09	87	2	Courtship	203	Bullet
	15/05/2019	09:13	66	2	Transit	207	Other (flushed by buzzard)
	15/05/2019	09:16	105	5	Transit	208	Other (flushed by buzzard)
	15/05/2019	09:27	89	1	Transit	222	Bullet
	15/05/2019	09:32	111	3	Courtship	226	Bullet
	15/05/2019	10:22	79	1	Transit	238	Bullet
	15/05/2019	11:19	81	1	Transit	253	Bullet
	15/05/2019	11:32	97	2	Transit	257	Bullet
	15/05/2019	11:45	78	2	Transit	261	Bullet
	12/06/2019	15:15	59	1	Transit	379	Bullet
	12/06/2019	15:18	66	1	Transit	381	Bullet
	12/06/2019	15:30	64	2	Transit	387	Bullet
	12/06/2019	15:46	70	1	Courtship	393	Bullet
	12/06/2019	16:28	66	1	Courtship	404	Bullet
	12/06/2019	16:42	79	2	Courtship	413	Bullet
	12/06/2019	17:40	87	1	Courtship	430	Bullet
	12/06/2019	17:59	59	2	Courtship	436	Bullet
	12/06/2019	18:29	64	1	Courtship	442	Bullet
	12/06/2019	18:59	76	1	Courtship	455	Bullet
	12/06/2019	19:48	91	1	Courtship	471	Bullet
	12/06/2019	21:19	91	1	Courtship	503	Bullet
	14/06/2019	05:51	81	1	Courtship	539	Bullet
	14/06/2019	06:25	65	1	Courtship	564	Bullet
	14/06/2019	06:58	72	1	Courtship	584	Bullet
	14/06/2019	07:02	57	1	Courtship	588	Bullet
	14/06/2019	07:10	98	2	Courtship	593	Bullet

Species**	Date	Flight start time	Duration (s)	Minimum no. of birds	Flight behaviour***	Key no.****	Notes
	14/06/2019	07:58	104	1	Courtship	606	Bullet
	14/06/2019	09:03	92	2	Courtship	629	Bullet
	14/06/2019	09:07	64	1	Transit	632	Bullet
	14/06/2019	10:46	119	1	Courtship	650	Bullet
	14/06/2019	11:21	104	2	Courtship	660	Bullet
	10/07/2019	15:31	63	1	Transit	675	Bullet
	10/07/2019	15:36	109	4	Transit	678	Bullet
	10/07/2019	16:14	57	3	Courtship	689	Bullet
	10/07/2019	17:39	72	2	Courtship	721	Bullet
	10/07/2019	18:23	93	2	Courtship	734	Bullet
	10/07/2019	19:13	84	1	Courtship	754	Bullet
	10/07/2019	19:49	119	2	Courtship	760	Bullet
	12/07/2019	06:02	81	1	Courtship	813	Bullet
	12/07/2019	06:21	69	2	Transit	821	Bullet
	12/07/2019	06:32	98	2	Courtship	829	Bullet
	12/07/2019	07:05	71	1	Transit	840	Bullet
	12/07/2019	07:39	156	5	Courtship	846	Bullet
	12/07/2019	07:59	82	2	Courtship	850	Bullet
	12/07/2019	08:21	76	1	Transit	854	Bullet
	12/07/2019	08:46	93	2	Transit	859	Bullet
	12/07/2019	09:14	77	3	Courtship	868	Bullet
	12/07/2019	10:03	95	3	Courtship	873	Bullet
	12/07/2019	10:24	62	4	Courtship	876	Bullet
	12/07/2019	10:56	132	6	Courtship	884	Bullet
	12/07/2019	11:06	74	4	Courtship	889	Bullet
Lapwing	13/05/2019	16:45	92	1	Transit	342	Bullet
	15/05/2019	09:16	105	6	Transit	209	Other (flushed by buzzard)
	12/07/2019	06:42	159	22	Transit	833	Bullet
	12/07/2019	10:40	178	26	Transit	880	Bullet
Whimbrel	13/05/2019	15:26	172	5	Transit	312	Bullet
	13/05/2019	15:54	91	2	Transit	319	Bullet
	13/05/2019	16:32	128	5	Transit	334	Bullet
	13/05/2019	18:33	141	12	Transit	364	Bullet

Species**	Date	Flight start time	Duration (s)	Minimum no. of birds	Flight behaviour***	Key no.****	Notes
	15/05/2019	06:48	92	2	Transit	137	Bullet
	15/05/2019	06:53	78	4	Transit	140	Bullet
	15/05/2019	07:14	59	3	Transit	163	Bullet
	15/05/2019	09:26	83	4	Transit	221	Bullet
	15/05/2019	10:28	93	2	Transit	241	Bullet
	12/07/2019	18:46	118	1	Transit	743	Bullet
Curlew	10/07/2019	16:40	73	11	Transit	701	Bullet
	10/07/2019	17:04	52	4	Transit	714	Bullet
	10/07/2019	17:32	91	12	Transit	719	Bullet
	10/07/2019	18:13	92	23	Transit	731	Weave
	10/07/2019	18:36	116	14	Transit	738	Bullet
	10/07/2019	18:46	118	17	Transit	742	Bullet
	10/07/2019	19:05	92	7	Transit	750	Bullet
	10/07/2019	19:16	129	4	Transit	756	Bullet
	10/07/2019	20:11	116	16	Transit	766	Bullet
	10/07/2019	21:18	96	4	Transit	786	Bullet
	12/07/2019	06:26	112	5	Transit	824	Bullet
	12/07/2019	06:35	172	90	Transit	831	Bullet
	12/07/2019	06:58	87	4	Transit	838	Bullet
	12/07/2019	08:04	106	11	Transit	851	Bullet
	12/07/2019	08:38	101	4	Transit	857	Bullet
	12/07/2019	11:39	132	5	Transit	895	Bullet
Black-tailed Godwit	12/07/2019	06:58	87	3	Transit	837	Bullet
Black-headed Gull	13/05/2019	12:56	73	2	Transit	272	Bullet
	13/05/2019	15:42	93	2	Transit	316	Bullet
	13/05/2019	16:44	78	2	Transit	341	Bullet
	13/05/2019	18:05	87	1	Transit	358	Bullet
	13/05/2019	19:06	81	3	Transit	372	Bullet
	15/05/2019	05:38	124	6	Transit	111	Bullet
	15/05/2019	05:51	96	8	Transit	116	Bullet
	15/05/2019	06:24	119	4	Transit	126	Bullet
	15/05/2019	06:38	125	3	Transit	133	Bullet
	15/05/2019	07:01	78	2	Transit	147	Bullet

Species**	Date	Flight start time	Duration (s)	Minimum no. of birds	Flight behaviour***	Key no.****	Notes
	15/05/2019	07:04	86	2	Transit	150	Bullet
	15/05/2019	07:57	79	6	Transit	175	Bullet
	15/05/2019	08:06	106	3	Transit	178	Bullet
	15/05/2019	08:47	132	2	Transit	190	Bullet
	15/05/2019	10:09	127	2	Transit	233	Bullet
	15/05/2019	10:13	139	3	Transit	234	Bullet
	15/05/2019	10:25	116	4	Transit	240	Bullet
	15/05/2019	11:52	109	2	Transit	264	Bullet
	12/06/2019	15:39	109	2	Transit	391	Bullet
	12/06/2019	16:05	118	1	Transit	399	Bullet
	12/06/2019	16:19	71	1	Transit	402	Bullet
	12/06/2019	16:45	108	1	Transit	415	Bullet
	12/06/2019	16:59	94	1	Transit	420	Bullet
	12/06/2019	18:45	108	3	Transit	447	Bullet
	12/06/2019	18:54	94	2	Transit	452	Bullet
	12/06/2019	19:07	81	2	Transit	460	Bullet
	12/06/2019	19:12	108	2	Transit	463	Bullet
	12/06/2019	19:16	93	4	Transit	466	Bullet
	12/06/2019	20:05	116	1	Transit	477	Bullet
	12/06/2019	20:43	95	3	Transit	490	Bullet
	12/06/2019	21:21	109	6	Transit	504	Bullet
	14/06/2019	05:45	91	2	Transit	535	Bullet
	14/06/2019	06:34	119	1	Transit	569	Bullet
	14/06/2019	06:38	87	1	Transit	573	Bullet
	14/06/2019	07:04	91	2	Transit	590	Bullet
	14/06/2019	07:43	90	4	Transit	601	Bullet
	14/06/2019	08:14	107	5	Transit	610	Bullet
	14/06/2019	08:48	114	2	Transit	619	Bullet
	14/06/2019	08:55	121	3	Transit	624	Bullet
	14/06/2019	09:06	106	2	Transit	631	Bullet
	14/06/2019	09:22	172	3	Transit	636	Bullet
	14/06/2019	10:06	115	4	Transit	642	Bullet
	14/06/2019	10:54	94	3	Transit	652	Bullet

Species**	Date	Flight start time	Duration (s)	Minimum no. of birds	Flight behaviour***	Key no.****	Notes
	10/07/2019	16:01	103	2	Transit	685	Bullet
	10/07/2019	16:30	116	3	Transit	695	Bullet
	10/07/2019	17:52	117	2	Transit	725	Bullet
	12/07/2019	08:11	88	2	Transit	852	Bullet
	12/07/2019	08:53	127	4	Transit	861	Bullet
	12/07/2019	10:51	113	3	Transit	882	Bullet
	12/07/2019	11:09	86	1	Transit	890	Bullet
Common Gull	15/05/2019	07:08	82	2		156	Bullet
Great Black-backed Gull	10/07/2019	16:03	112	1	Transit	686	Bullet
	10/07/2019	17:45	119	4	Transit	723	Bullet
	10/07/2019	18:24	108	2	Transit	735	Bullet
	12/07/2019	06:29	97	2	Transit	826	Bullet
	12/07/2019	11:02	168	1	Transit	888	Bullet
Herring Gull	13/05/2019	12:32	129	8	Transit	265	Bullet
	13/05/2019	12:44	136	7	Transit	270	Bullet
	13/05/2019	13:07	140	50	Transit	273	Bullet
	13/05/2019	13:16	124	17	Transit	276	Bullet
	13/05/2019	13:22	95	8	Transit	277	Bullet
	13/05/2019	13:28	112	3	Transit	279	Bullet
	13/05/2019	13:49	138	11	Transit	284	Bullet
	13/05/2019	13:54	93	5	Transit	285	Bullet
	13/05/2019	14:08	81	4	Transit	289	Bullet
	13/05/2019	14:17	78	7	Transit	291	Bullet
	13/05/2019	14:20	84	8	Transit	293	Bullet
	13/05/2019	14:21	122	7	Transit	294	Bullet
	13/05/2019	14:22	127	4	Transit	295	Bullet
	13/05/2019	14:24	91	6	Transit	297	Bullet
	13/05/2019	14:28	137	8	Transit	301	Bullet
	13/05/2019	14:54	118	5	Transit	305	Bullet
	13/05/2019	15:08	114	4	Transit	308	Bullet
	13/05/2019	15:34	103	6	Transit	313	Bullet
	13/05/2019	15:51	116	9	Transit	318	Bullet
13/05/2019	15:58	87	7	Transit	320	Bullet	

Species**	Date	Flight start time	Duration (s)	Minimum no. of birds	Flight behaviour***	Key no.****	Notes
	13/05/2019	16:03	134	9	Transit	323	Bullet
	13/05/2019	16:07	118	7	Transit	325	Bullet
	13/05/2019	16:16	107	6	Transit	327	Bullet
	13/05/2019	16:23	119	6	Transit	330	Bullet
	13/05/2019	16:28	138	5	Transit	332	Bullet
	13/05/2019	16:35	112	2	Transit	336	Bullet
	13/05/2019	16:37	96	4	Transit	337	Bullet
	13/05/2019	16:40	117	6	Transit	338	Bullet
	13/05/2019	16:48	138	2	Transit	344	Bullet
	13/05/2019	16:48	116	4	Transit	345	Bullet
	13/05/2019	17:14	142	3	Transit	347	Bullet
	13/05/2019	17:25	94	4	Transit	350	Bullet
	13/05/2019	17:31	107	4	Transit	352	Bullet
	13/05/2019	17:46	114	3	Transit	354	Bullet
	13/05/2019	17:56	115	3	Transit	357	Bullet
	13/05/2019	18:19	136	4	Transit	360	Bullet
	13/05/2019	18:31	81	2	Transit	363	Bullet
	13/05/2019	18:37	108	6	Transit	365	Bullet
	13/05/2019	18:46	127	4	Transit	368	Bullet
	13/05/2019	18:55	122	14	Transit	369	Bullet
	15/05/2019	05:16	64	16	Transit	103	Bullet
	15/05/2019	05:21	107	30	Transit	105	Bullet
	15/05/2019	05:25	132	17	Transit	107	Bullet
	15/05/2019	05:25	132	5	Transit	108	Bullet
	15/05/2019	05:43	96	24	Transit	112	Bullet
	15/05/2019	05:44	73	7	Transit	113	Bullet
	15/05/2019	05:48	128	4	Transit	115	Bullet
	15/05/2019	06:02	103	9	Transit	119	Bullet
	15/05/2019	06:06	139	6	Transit	120	Bullet
	15/05/2019	06:18	106	4	Transit	123	Bullet
	15/05/2019	06:22	132	4	Transit	125	Bullet
	15/05/2019	06:29	109	8	Transit	128	Bullet
	15/05/2019	06:33	139	6	Transit	129	Bullet

Species**	Date	Flight start time	Duration (s)	Minimum no. of birds	Flight behaviour***	Key no.****	Notes
	15/05/2019	06:37	106	3	Transit	132	Bullet
	15/05/2019	06:42	112	6	Transit	135	Bullet
	15/05/2019	06:44	127	3	Transit	136	Bullet
	15/05/2019	06:49	116	5	Transit	138	Bullet
	15/05/2019	06:56	94	3	Transit	141	Bullet
	15/05/2019	06:58	108	4	Transit	143	Bullet
	15/05/2019	07:00	123	3	Transit	145	Bullet
	15/05/2019	07:02	108	4	Transit	148	Bullet
	15/05/2019	07:08	121	3	Transit	155	Bullet
	15/05/2019	07:11	129	5	Transit	158	Bullet
	15/05/2019	07:12	109	8	Transit	160	Bullet
	15/05/2019	07:13	73	2	Transit	162	Bullet
	15/05/2019	07:36	88	5	Transit	164	Bullet
	15/05/2019	07:38	136	2	Transit	166	Bullet
	15/05/2019	07:41	119	3	Transit	167	Bullet
	15/05/2019	07:46	111	3	Transit	170	Bullet
	15/05/2019	07:54	94	4	Transit	172	Bullet
	15/05/2019	08:12	122	4	Transit	179	Bullet
	15/05/2019	08:16	113	3	Transit	181	Bullet
	15/05/2019	08:28	119	7	Transit	183	Bullet
	15/05/2019	08:33	121	2	Transit	185	Bullet
	15/05/2019	08:43	118	5	Transit	187	Bullet
	15/05/2019	08:44	99	2	Transit	189	Bullet
	15/05/2019	08:51	128	3	Transit	191	Bullet
	15/05/2019	08:57	124	2	Transit	194	Bullet
	15/05/2019	09:01	91	4	Transit	198	Bullet
	15/05/2019	09:04	112	3	Transit	199	Bullet
	15/05/2019	09:06	110	4	Transit	201	Bullet
	15/05/2019	09:08	118	3	Transit	202	Bullet
	15/05/2019	09:10	121	3	Transit	204	Bullet
	15/05/2019	09:12	113	4	Transit	206	Bullet
	15/05/2019	09:16	120	30	Transit	210	Other (flushed by buzzard)
	15/05/2019	09:18	112	6	Transit	212	Bullet

Species**	Date	Flight start time	Duration (s)	Minimum no. of birds	Flight behaviour***	Key no.****	Notes
	15/05/2019	09:19	116	2	Transit	214	Bullet
	15/05/2019	09:21	122	4	Transit	216	Bullet
	15/05/2019	09:24	117	2	Transit	219	Bullet
	15/05/2019	09:26	124	5	Transit	220	Bullet
	15/05/2019	09:29	138	3	Transit	223	Bullet
	15/05/2019	09:30	106	6	Transit	224	Bullet
	15/05/2019	09:32	116	4	Transit	227	Bullet
	15/05/2019	09:58	125	4	Transit	229	Bullet
	15/05/2019	10:06	106	2	Transit	232	Bullet
	15/05/2019	10:14	129	4	Transit	235	Bullet
	15/05/2019	10:17	117	5	Transit	237	Bullet
	15/05/2019	10:28	122	2	Transit	242	Bullet
	15/05/2019	10:38	138	3	Transit	244	Bullet
	15/05/2019	10:44	107	5	Transit	245	Bullet
	15/05/2019	11:04	128	2	Transit	249	Bullet
	15/05/2019	11:08	144	3	Transit	251	Bullet
	15/05/2019	11:31	141	6	Transit	255	Bullet
	15/05/2019	11:34	159	11	Transit	258	Bullet
	15/05/2019	11:41	121	3	Transit	260	Bullet
	15/05/2019	11:49	86	3	Transit	262	Bullet
	12/06/2019	15:06	52	4	Transit	373	Bullet
	12/06/2019	15:09	118	2	Transit	375	Bullet
	12/06/2019	15:11	123	5	Transit	376	Bullet
	12/06/2019	15:12	72	2	Transit	377	Bullet
	12/06/2019	15:17	127	2	Transit	380	Bullet
	12/06/2019	15:20	85	6	Transit	382	Bullet
	12/06/2019	15:21	103	3	Transit	383	Weave
	12/06/2019	15:26	107	1	Transit	385	Bullet
	12/06/2019	15:27	68	4	Transit	386	Bullet
	12/06/2019	15:35	114	3	Transit	389	Bullet
	12/06/2019	15:41	116	3	Transit	392	Bullet

Species**	Date	Flight start time	Duration (s)	Minimum no. of birds	Flight behaviour***	Key no.****	Notes
	12/06/2019	15:49	103	2	Transit	394	Bullet
	12/06/2019	15:57	128	6	Transit	396	Bullet
	12/06/2019	15:58	161	4	Transit	397	Bullet
	12/06/2019	16:12	148	5	Transit	400	Bullet
	12/06/2019	16:16	82	3	Transit	401	Bullet
	12/06/2019	16:31	117	5	Transit	405	Bullet
	12/06/2019	16:33	101	4	Transit	407	Bullet
	12/06/2019	16:35	116	2	Transit	408	Bullet
	12/06/2019	16:37	133	3	Transit	409	Bullet
	12/06/2019	16:39	119	6	Transit	411	Bullet
	12/06/2019	16:41	174	7	Transit	412	Bullet
	12/06/2019	16:44	91	3	Transit	414	Bullet
	12/06/2019	16:48	125	2	Transit	416	Bullet
	12/06/2019	16:54	117	11	Transit	419	Bullet
	12/06/2019	17:01	123	5	Transit	421	Bullet
	12/06/2019	17:03	126	3	Transit	423	Bullet
	12/06/2019	17:25	109	4	Transit	424	Bullet
	12/06/2019	17:28	118	3	Transit	426	Bullet
	12/06/2019	17:34	114	2	Transit	428	Bullet
	12/06/2019	17:37	132	4	Transit	429	Bullet
	12/06/2019	17:47	111	5	Transit	432	Bullet
	12/06/2019	17:50	94	3	Transit	433	Bullet
	12/06/2019	17:56	91	4	Transit	435	Bullet
	12/06/2019	18:14	107	3	Transit	438	Bullet
	12/06/2019	18:22	116	3	Transit	440	Bullet
	12/06/2019	18:34	119	6	Transit	443	Bullet
	12/06/2019	18:40	127	4	Transit	445	Bullet
	12/06/2019	18:48	142	12	Transit	449	Bullet

Species**	Date	Flight start time	Duration (s)	Minimum no. of birds	Flight behaviour***	Key no.****	Notes
	12/06/2019	18:51	107	2	Transit	450	Bullet
	12/06/2019	18:53	86	5	Transit	451	Bullet
	12/06/2019	18:57	88	3	Transit	453	Bullet
	12/06/2019	18:58	139	4	Transit	454	Bullet
	12/06/2019	19:01	163	9	Transit	457	Bullet
	12/06/2019	19:05	122	6	Transit	459	Bullet
	12/06/2019	19:09	128	7	Transit	461	Bullet
	12/06/2019	19:14	136	14	Transit	464	Bullet
	12/06/2019	19:18	128	5	Transit	467	Bullet
	12/06/2019	19:19	91	3	Transit	468	Bullet
	12/06/2019	19:22	132	3	Transit	470	Bullet
	12/06/2019	19:54	131	5	Transit	473	Bullet
	12/06/2019	19:56	139	6	Transit	474	Bullet
	12/06/2019	20:04	134	3	Transit	476	Bullet
	12/06/2019	20:14	96	2	Transit	480	Bullet
	12/06/2019	20:19	146	14	Transit	481	Bullet
	12/06/2019	20:22	114	6	Transit	483	Weave
	12/06/2019	20:27	78	3	Transit	485	Bullet
	12/06/2019	20:31	111	4	Transit	486	Bullet
	12/06/2019	20:32	63	6	Transit	487	Bullet
	12/06/2019	20:38	114	2	Transit	488	Bullet
	12/06/2019	20:49	129	4	Transit	491	Bullet
	12/06/2019	20:54	154	5	Transit	493	Bullet
	12/06/2019	21:01	123	1	Transit	496	Bullet
	12/06/2019	21:06	131	12	Transit	498	Bullet
	12/06/2019	21:10	74	5	Transit	499	Bullet
	12/06/2019	21:14	96	7	Transit	501	Bullet
	12/06/2019	21:16	143	1	Transit	502	Bullet

Species**	Date	Flight start time	Duration (s)	Minimum no. of birds	Flight behaviour***	Key no.*****	Notes
	12/06/2019	21:24	146	14	Transit	505	Bullet
	12/06/2019	21:25	98	5	Transit	506	Bullet
	12/06/2019	21:30	67	3	Transit	509	Bullet
	12/06/2019	21:32	104	19	Transit	510	Bullet
	12/06/2019	21:34	122	7	Transit	512	Bullet
	12/06/2019	21:39	80	2	Transit	515	Bullet
	12/06/2019	21:42	79	3	Transit	517	LOW
	12/06/2019	21:43	93	2	Transit	518	Bullet
	12/06/2019	21:44	129	2	Transit	519	Bullet
	14/06/2019	05:15	108	2	Transit	520	Bullet
	14/06/2019	05:20	133	2	Transit	523	Bullet
	14/06/2019	05:23	116	4	Transit	524	Bullet
	14/06/2019	05:27	123	5	Transit	527	Bullet
	14/06/2019	05:29	111	6	Transit	528	Bullet
	14/06/2019	05:31	107	2	Transit	529	Bullet
	14/06/2019	05:36	122	2	Transit	531	Bullet
	14/06/2019	05:38	102	3	Transit	532	Bullet
	14/06/2019	05:46	129	6	Transit	536	Bullet
	14/06/2019	05:48	97	5	Transit	537	Bullet
	14/06/2019	05:54	108	6	Transit	541	Bullet
	14/06/2019	05:56	129	9	Transit	542	Bullet
	14/06/2019	05:59	138	7	Transit	544	Weave
	14/06/2019	06:01	116	3	Transit	545	Bullet
	14/06/2019	06:04	134	5	Transit	547	Bullet
	14/06/2019	06:06	152	11	Transit	549	Bullet
	14/06/2019	06:09	109	6	Transit	551	Bullet
	14/06/2019	06:13	160	7	Transit	553	Bullet
	14/06/2019	06:16	132	7	Transit	555	Bullet

Species**	Date	Flight start time	Duration (s)	Minimum no. of birds	Flight behaviour***	Key no.******	Notes
	14/06/2019	06:18	156	10	Transit	557	Bullet
	14/06/2019	06:20	108	5	Transit	558	Bullet
	14/06/2019	06:21	126	4	Transit	559	Bullet
	14/06/2019	06:22	108	4	Transit	561	Bullet
	14/06/2019	06:25	148	3	Transit	563	Bullet
	14/06/2019	06:27	137	2	Transit	565	Bullet
	14/06/2019	06:28	112	3	Transit	566	Bullet
	14/06/2019	06:32	104	3	Transit	568	Bullet
	14/06/2019	06:38	138	6	Transit	572	Bullet
	14/06/2019	06:40	106	3	Transit	574	Bullet
	14/06/2019	06:42	149	7	Transit	575	Bullet
	14/06/2019	06:45	144	2	Transit	577	Bullet
	14/06/2019	06:51	93	4	Transit	580	Bullet
	14/06/2019	06:53	114	5	Transit	581	Bullet
	14/06/2019	06:55	148	5	Transit	582	Bullet
	14/06/2019	06:56	119	3	Transit	583	Bullet
	14/06/2019	06:59	128	4	Transit	585	Bullet
	14/06/2019	07:00	143	3	Transit	586	Bullet
	14/06/2019	07:02	112	7	Transit	589	Bullet
	14/06/2019	07:05	127	2	Transit	591	Bullet
	14/06/2019	07:12	84	4	Transit	594	Bullet
	14/06/2019	07:13	116	3	Transit	596	Bullet
	14/06/2019	07:36	123	3	Transit	597	Bullet
	14/06/2019	07:41	117	2	Transit	599	Bullet
	14/06/2019	07:50	102	3	Transit	603	Bullet
	14/06/2019	07:53	136	2	Transit	604	Bullet
	14/06/2019	07:56	119	4	Transit	605	Bullet
	14/06/2019	08:21	142	4	Transit	611	Bullet

Species**	Date	Flight start time	Duration (s)	Minimum no. of birds	Flight behaviour***	Key no.****	Notes
	14/06/2019	08:29	146	5	Transit	613	Bullet
	14/06/2019	08:43	114	5	Transit	616	Bullet
	14/06/2019	08:45	93	7	Transit	617	Bullet
	14/06/2019	08:51	111	2	Transit	620	Bullet
	14/06/2019	08:53	135	4	Transit	622	Bullet
	14/06/2019	08:57	138	3	Transit	625	Bullet
	14/06/2019	08:58	106	2	Transit	626	Bullet
	14/06/2019	09:01	129	2	Transit	628	Bullet
	14/06/2019	09:10	138	9	Transit	633	Bullet
	14/06/2019	09:18	129	4	Transit	635	Bullet
	14/06/2019	09:30	114	2	Transit	638	Bullet
	14/06/2019	09:33	163	4	Transit	639	Bullet
	14/06/2019	09:57	121	3	Transit	640	Bullet
	14/06/2019	10:02	139	5	Transit	641	Bullet
	14/06/2019	10:21	132	2	Transit	644	Bullet
	14/06/2019	10:29	141	3	Transit	646	Bullet
	14/06/2019	10:36	137	2	Transit	647	Bullet
	14/06/2019	10:43	156	5	Transit	649	Bullet
	14/06/2019	10:51	149	4	Transit	651	Bullet
	14/06/2019	10:58	131	5	Transit	653	Bullet
	14/06/2019	11:04	118	2	Transit	655	Bullet
	14/06/2019	11:11	132	4	Transit	658	Bullet
	14/06/2019	11:14	79	3	Transit	659	Bullet
	14/06/2019	11:27	122	3	Transit	661	Bullet
	14/06/2019	11:36	129	2	Transit	663	Weave
	14/06/2019	11:52	124	4	Transit	666	Bullet
	10/07/2019	15:09	86	3	Transit	668	Bullet
	10/07/2019	15:14	131	4	Transit	669	Bullet

Species**	Date	Flight start time	Duration (s)	Minimum no. of birds	Flight behaviour***	Key no.****	Notes
	10/07/2019	15:19	103	3	Transit	671	Bullet
	10/07/2019	15:26	122	5	Transit	673	Bullet
	10/07/2019	15:34	12	6	Transit	676	Bullet
	10/07/2019	15:45	106	5	Transit and courtship	680	Bullet (chasing sparrowhawk)
	10/07/2019	15:54	125	6	Transit	683	Bullet
	10/07/2019	16:08	99	5	Transit	687	Bullet
	10/07/2019	16:12	134	7	Transit	688	Bullet
	10/07/2019	16:17	113	3	Transit	690	Bullet
	10/07/2019	16:22	138	7	Transit	692	Bullet
	10/07/2019	15:51	98	4	Transit	682	Bullet
	10/07/2019	16:26	132	9	Transit	693	Bullet
	10/07/2019	16:29	127	4	Transit	694	Bullet
	10/07/2019	16:37	142	7	Transit	698	Bullet
	10/07/2019	16:38	93	2	Transit	699	Bullet
	10/07/2019	16:40	136	5	Transit	700	Bullet
	10/07/2019	16:42	129	2	Transit	702	Bullet
	10/07/2019	16:44	107	4	Transit	704	Bullet
	10/07/2019	16:46	88	6	Transit	706	Bullet
	10/07/2019	16:49	102	5	Transit	708	Bullet
	10/07/2019	16:52	137	5	Transit	710	Bullet
	10/07/2019	16:59	163	13	Transit	713	Bullet
	10/07/2019	17:27	133	5	Transit	718	Bullet
	10/07/2019	17:36	139	6	Transit	720	Bullet
	10/07/2019	17:48	142	7	Transit	724	Bullet
	10/07/2019	17:55	108	3	Transit	726	Bullet
	10/07/2019	17:59	124	2	Transit	727	Bullet
	10/07/2019	18:04	119	5	Transit	728	Bullet
	10/07/2019	18:10	117	2	Transit	730	Bullet

Species**	Date	Flight start time	Duration (s)	Minimum no. of birds	Flight behaviour***	Key no.******	Notes
	10/07/2019	18:19	143	6	Transit	733	Bullet
	10/07/2019	18:29	129	5	Transit	736	Bullet
	10/07/2019	18:37	125	4	Transit	739	Bullet
	10/07/2019	18:40	136	7	Transit	740	Bullet
	10/07/2019	18:42	91	4	Transit	741	Bullet
	10/07/2019	18:52	134	4	Transit	746	Bullet
	10/07/2019	18:57	139	6	Transit	748	Bullet
	10/07/2019	19:09	139	5	Transit	752	Bullet
	10/07/2019	19:15	112	3	Transit	755	Bullet
	10/07/2019	19:23	127	5	Transit	758	Bullet
	10/07/2019	19:47	122	5	Transit	759	Bullet
	10/07/2019	19:56	136	2	Transit	762	Bullet
	10/07/2019	19:59	126	3	Transit	763	Bullet
	10/07/2019	20:15	136	4	Transit	767	Bullet
	10/07/2019	20:18	103	2	Transit	768	Bullet
	10/07/2019	20:24	127	3	Transit	769	Bullet
	10/07/2019	20:31	117	2	Transit	772	Bullet
	10/07/2019	20:33	128	4	Transit	773	Bullet
	10/07/2019	20:42	123	3	Transit	775	Bullet
	10/07/2019	20:44	148	13	Transit	776	Bullet
	10/07/2019	20:46	131	3	Transit	777	Bullet
	10/07/2019	20:56	124	6	Transit	779	Bullet
	10/07/2019	21:04	143	6	Transit	781	Bullet
	10/07/2019	21:09	125	7	Transit	783	Bullet
	10/07/2019	21:15	129	8	Transit	785	Bullet
	10/07/2019	21:20	139	2	Transit	787	Bullet
	10/07/2019	21:24	98	3	Transit	789	Bullet
	10/07/2019	21:27	149	3	Transit	791	Bullet

Species**	Date	Flight start time	Duration (s)	Minimum no. of birds	Flight behaviour***	Key no.****	Notes
	10/07/2019	21:29	118	3	Transit	792	Bullet
	10/07/2019	21:33	106	3	Transit	794	Bullet
	10/07/2019	21:36	152	2	Transit	795	Bullet
	10/07/2019	21:42	117	1	Transit	797	Bullet
	12/07/2019	05:12	134	4	Transit	800	Bullet
	12/07/2019	05:16	117	2	Transit	801	Bullet
	12/07/2019	05:21	126	5	Transit	802	Bullet
	12/07/2019	05:29	137	4	Transit	804	Bullet
	12/07/2019	05:37	116	5	Transit	806	Bullet
	12/07/2019	05:47	142	2	Transit	809	Bullet
	12/07/2019	05:53	147	6	Transit	810	Bullet
	12/07/2019	05:59	164	5	Transit	812	Bullet
	12/07/2019	06:03	117	3	Transit	814	Bullet
	12/07/2019	06:09	122	4	Transit	816	Bullet
	12/07/2019	06:14	108	4	Transit	818	Bullet
	12/07/2019	06:17	133	5	Transit	819	Bullet
	12/07/2019	06:25	107	2	Transit	823	Bullet
	12/07/2019	06:28	142	4	Transit	825	Bullet
	12/07/2019	06:29	129	3	Transit	827	Bullet
	12/07/2019	06:33	130	5	Transit	830	Bullet
	12/07/2019	06:48	108	7	Transit	834	Bullet
	12/07/2019	06:51	136	3	Transit	835	Bullet
	12/07/2019	07:01	121	5	Transit	839	Bullet
	12/07/2019	07:08	142	7	Transit	841	Bullet
	12/07/2019	07:31	95	4	Transit	844	Bullet
	12/07/2019	07:46	136	6	Transit	847	Bullet
	12/07/2019	07:49	149	2	Transit	848	Bullet
	12/07/2019	08:13	146	3	Transit	853	Bullet

Species**	Date	Flight start time	Duration (s)	Minimum no. of birds	Flight behaviour***	Key no.****	Notes
	12/07/2019	08:27	138	5	Transit	855	Bullet
	12/07/2019	08:33	129	3	Transit	856	Bullet
	12/07/2019	08:56	108	3	Transit	862	Not recorded
	12/07/2019	09:02	124	3	Transit	865	Bullet
	12/07/2019	09:19	133	4	Transit	869	Bullet
	12/07/2019	09:08	128	3	Transit	867	Bullet
	12/07/2019	09:54	136	3	Transit	872	Bullet
	12/07/2019	10:34	137	4	Transit	877	Bullet
	12/07/2019	10:38	122	2	Transit	879	Bullet
	12/07/2019	10:54	144	3	Transit	883	Bullet
	12/07/2019	10:59	153	5	Transit	886	Bullet
	12/07/2019	11:32	117	2	Transit	894	Bullet
	12/07/2019	11:17	148	3	Transit	892	Bullet
Lesser Black-backed Gull	13/05/2019	12:38	95	6	Transit	267	Bullet
	13/05/2019	12:44	136	2	Transit	269	Bullet
	13/05/2019	12:47	82	1	Transit	271	Bullet
	13/05/2019	13:07	140	30	Transit	274	Bullet
	13/05/2019	13:16	124	12	Transit	275	Bullet
	13/05/2019	13:22	95	6	Transit	278	Bullet
	13/05/2019	13:28	112	5	Transit	280	Bullet
	13/05/2019	13:41	82	3	Transit	282	Bullet
	13/05/2019	13:45	97	2	Transit	283	Bullet
	13/05/2019	13:56	114	3	Transit	286	Bullet
	13/05/2019	14:06	144	2	Transit	288	Bullet
	13/05/2019	14:18	109	4	Transit	292	Bullet
	13/05/2019	14:22	86	4	Transit	296	Bullet
	13/05/2019	14:25	148	5	Transit	298	Bullet
	13/05/2019	14:27	67	3	Transit	300	Bullet
	13/05/2019	14:28	72	2	Transit	302	Bullet
13/05/2019	14:59	88	3	Transit	306	Bullet	
13/05/2019	15:02	107	2	Transit	307	Bullet	

Species**	Date	Flight start time	Duration (s)	Minimum no. of birds	Flight behaviour***	Key no.****	Notes
	13/05/2019	15:11	82	5	Transit	309	Bullet
	13/05/2019	15:17	126	4	Transit	310	Bullet
	13/05/2019	15:20	133	3	Transit	311	Bullet
	13/05/2019	15:34	103	5	Transit	314	Bullet
	13/05/2019	15:37	75	3	Transit	315	Bullet
	13/05/2019	15:49	149	6	Transit	317	Bullet
	13/05/2019	16:03	134	4	Transit	322	Bullet
	13/05/2019	16:07	118	11	Transit	324	Bullet
	13/05/2019	16:09	124	5	Transit	326	Bullet
	13/05/2019	16:16	107	2	Transit	328	Bullet
	13/05/2019	16:27	89	3	Transit	331	Bullet
	13/05/2019	16:35	112	3	Transit	335	Bullet
	13/05/2019	16:40	117	4	Transit	339	Bullet
	13/05/2019	17:14	142	6	Transit	346	Bullet
	13/05/2019	17:21	109	2	Transit	349	Bullet
	13/05/2019	17:31	107	3	Transit	351	Bullet
	13/05/2019	17:39	129	2	Transit	353	Bullet
	13/05/2019	17:46	114	2	Transit	355	Bullet
	13/05/2019	17:52	123	4	Transit	356	Bullet
	13/05/2019	18:19	136	8	Transit	359	Bullet
	13/05/2019	18:23	98	4	Transit	361	Bullet
	13/05/2019	18:31	81	5	Transit	362	Bullet
	13/05/2019	18:37	108	3	Transit	366	Bullet
	13/05/2019	18:55	122	8	Transit	370	Bullet
	13/05/2019	19:02	76	6	Transit	371	Bullet
	15/05/2019	05:16	64	9	Transit	104	Bullet
	15/05/2019	05:21	107	20	Transit	106	Bullet
	15/05/2019	05:32	111	12	Transit	109	Bullet
	15/05/2019	05:44	73	5	Transit	114	Bullet
	15/05/2019	05:57	122	5	Transit	117	Bullet
	15/05/2019	06:02	103	4	Transit	118	Bullet
	15/05/2019	06:15	124	2	Transit	122	Bullet
	15/05/2019	06:22	132	5	Transit	124	Bullet

Species**	Date	Flight start time	Duration (s)	Minimum no. of birds	Flight behaviour***	Key no.****	Notes
	15/05/2019	06:27	112	3	Transit	127	Bullet
	15/05/2019	06:33	139	3	Transit	130	Bullet
	15/05/2019	06:35	103	4	Transit	131	Bullet
	15/05/2019	06:51	123	4	Transit	139	Bullet
	15/05/2019	06:56	94	2	Transit	142	Bullet
	15/05/2019	06:58	108	3	Transit	144	Bullet
	15/05/2019	07:01	102	4	Transit	146	Bullet
	15/05/2019	07:04	124	3	Transit	149	Bullet
	15/05/2019	07:05	137	3	Transit	152	Bullet
	15/05/2019	07:06	106	2	Transit	153	Bullet
	15/05/2019	07:08	121	5	Transit	154	Bullet
	15/05/2019	07:11	114	6	Transit	159	Bullet
	15/05/2019	07:13	73	4	Transit	161	Bullet
	15/05/2019	07:38	136	3	Transit	165	Bullet
	15/05/2019	07:46	111	2	Transit	169	Bullet
	15/05/2019	07:54	94	2	Transit	174	Bullet
	15/05/2019	07:59	108	2	Transit	176	Bullet
	15/05/2019	08:04	115	5	Transit	177	Bullet
	15/05/2019	08:12	122	4	Transit	180	Bullet
	15/05/2019	08:28	119	4	Transit	184	Bullet
	15/05/2019	08:41	107	4	Transit	186	Bullet
	15/05/2019	08:43	118	3	Transit	188	Bullet
	15/05/2019	08:53	107	2	Transit	192	Bullet
	15/05/2019	08:55	139	5	Transit	193	Bullet
	15/05/2019	08:57	124	3	Transit	195	Bullet
	15/05/2019	09:00	119	5	Transit	197	Bullet
	15/05/2019	09:05	126	5	Transit	200	Bullet
	15/05/2019	09:10	98	6	Transit	205	Bullet
	15/05/2019	09:16	120	30	Transit	211	Bullet
	15/05/2019	09:19	131	3	Transit	213	Bullet
	15/05/2019	09:22	104	2	Transit	217	Bullet
	15/05/2019	09:24	129	3	Transit	218	Bullet
	15/05/2019	09:30	106	2	Transit	225	Bullet

Species**	Date	Flight start time	Duration (s)	Minimum no. of birds	Flight behaviour***	Key no.****	Notes
	15/05/2019	09:33	132	3	Transit	228	Bullet
	15/05/2019	09:58	125	5	Transit	230	Bullet
	15/05/2019	10:02	112	7	Transit	231	Bullet
	15/05/2019	10:17	117	6	Transit	236	Bullet
	15/05/2019	10:22	113	2	Transit	239	Bullet
	15/05/2019	10:36	101	5	Transit	243	Bullet
	15/05/2019	10:44	107	2	Transit	246	Bullet
	15/05/2019	10:53	126	4	Transit	247	Bullet
	15/05/2019	10:59	131	3	Transit	248	Bullet
	15/05/2019	11:04	128	4	Transit	250	Bullet
	15/05/2019	11:16	98	2	Transit	252	Bullet
	15/05/2019	11:23	135	2	Transit	254	Bullet
	15/05/2019	11:31	141	5	Transit	256	Bullet
	15/05/2019	11:36	127	5	Transit	259	Bullet
	15/05/2019	11:49	86	3	Transit	263	Bullet
	15/05/2019	12:33	114	4	Transit	266	Bullet
	12/06/2019	15:08	88	3	Transit	374	Bullet
	12/06/2019	15:14	136	2	Transit	378	Bullet
	12/06/2019	15:24	91	4	Transit	384	Bullet
	12/06/2019	15:32	149	4	Transit	388	Bullet
	12/06/2019	15:37	82	4	Transit	390	Bullet
	12/06/2019	15:54	117	5	Transit	395	Bullet
	12/06/2019	16:03	109	3	Transit	398	Bullet
	12/06/2019	16:22	98	2	Transit	403	Bullet
	12/06/2019	16:37	133	1	Transit	410	Bullet
	12/06/2019	16:48	125	4	Transit	417	Bullet
	12/06/2019	17:02	83	2	Transit	422	Bullet
	12/06/2019	17:27	93	2	Transit	425	Bullet
	12/06/2019	17:32	127	3	Transit	427	Bullet
	12/06/2019	17:46	141	6	Transit	431	Weave
	12/06/2019	17:54	116	2	Transit	434	Bullet
	12/06/2019	18:17	139	2	Transit	439	Bullet
	12/06/2019	18:27	125	5	Transit	441	Bullet

Species**	Date	Flight start time	Duration (s)	Minimum no. of birds	Flight behaviour***	Key no.****	Notes
	12/06/2019	18:37	138	3	Transit	444	Bullet
	12/06/2019	18:42	117	2	Transit	446	Bullet
	12/06/2019	18:48	142	4	Transit	448	Bullet
	12/06/2019	19:01	163	6	Transit	456	Bullet
	12/06/2019	19:10	113	4	Transit	462	Bullet
	12/06/2019	19:15	99	3	Transit	465	Weave
	12/06/2019	19:20	113	2	Transit	469	Bullet
	12/06/2019	19:51	119	2	Transit	472	Bullet
	12/06/2019	19:59	123	2	Transit	475	Bullet
	12/06/2019	20:11	135	3	Transit	479	Bullet
	12/06/2019	20:19	146	9	Transit	482	Bullet
	12/06/2019	20:27	78	3	Transit	484	Bullet
	12/06/2019	20:40	128	2	Transit	489	Bullet
	12/06/2019	20:52	119	2	Transit	492	Bullet
	12/06/2019	20:54	154	6	Transit	494	Bullet
	12/06/2019	20:57	115	3	Transit	495	Bullet
	12/06/2019	21:03	114	2	Transit	497	Bullet
	12/06/2019	21:10	74	4	Transit	500	Bullet
	12/06/2019	21:28	72	3	Transit	507	Bullet
	12/06/2019	21:29	93	2	Transit	508	Bullet
	12/06/2019	21:33	148	14	Transit	511	Bullet
	12/06/2019	21:38	109	3	Transit	514	Bullet
	12/06/2019	21:41	61	2	Transit	516	Bullet
	14/06/2019	05:17	131	2	Transit	521	Bullet
	14/06/2019	05:18	109	3	Transit	522	Bullet
	14/06/2019	05:23	116	2	Transit	525	Bullet
	14/06/2019	05:26	115	3	Transit	526	Bullet
	14/06/2019	05:34	103	4	Transit	530	Bullet
	14/06/2019	05:40	139	2	Transit	533	Bullet
	14/06/2019	05:43	125	4	Transit	534	Bullet
	14/06/2019	05:48	97	6	Transit	538	Bullet
	14/06/2019	05:53	130	4	Transit	540	Bullet
	14/06/2019	05:59	138	5	Transit	543	Weave

Species**	Date	Flight start time	Duration (s)	Minimum no. of birds	Flight behaviour***	Key no.****	Notes
	14/06/2019	06:03	121	8	Transit	546	Bullet
	14/06/2019	06:04	134	3	Transit	548	Bullet
	14/06/2019	06:11	117	4	Transit	552	Bullet
	14/06/2019	06:14	96	2	Transit	554	Bullet
	14/06/2019	06:17	143	4	Transit	556	Bullet
	14/06/2019	06:22	119	3	Transit	560	Bullet
	14/06/2019	06:23	112	2	Transit	562	Bullet
	14/06/2019	06:30	132	2	Transit	567	Bullet
	14/06/2019	06:35	148	2	Transit	570	Bullet
	14/06/2019	06:36	152	3	Transit	571	Bullet
	14/06/2019	06:44	162	4	Transit	576	Bullet
	14/06/2019	06:48	109	2	Transit	578	Bullet
	14/06/2019	06:50	126	3	Transit	579	Bullet
	14/06/2019	07:00	143	4	Transit	587	Bullet
	14/06/2019	07:08	121	3	Transit	592	Bullet
	14/06/2019	07:13	116	2	Transit	595	Bullet
	14/06/2019	07:38	134	2	Transit	598	Bullet
	14/06/2019	07:41	117	3	Transit	600	Bullet
	14/06/2019	07:46	149	2	Transit	602	Bullet
	14/06/2019	08:01	139	1	Transit	607	Bullet
	14/06/2019	08:07	116	2	Transit	608	Bullet
	14/06/2019	08:11	129	4	Transit	609	Bullet
	14/06/2019	08:24	128	2	Transit	612	Bullet
	14/06/2019	08:35	121	6	Transit	614	Bullet
	14/06/2019	08:39	110	3	Transit	615	Bullet
	14/06/2019	08:47	123	3	Transit	618	Bullet
	14/06/2019	08:52	92	1	Transit	621	Bullet
	14/06/2019	08:55	126	2	Transit	623	Bullet
	14/06/2019	09:04	152	5	Transit	630	Bullet
	14/06/2019	09:12	124	2	Transit	634	Bullet
	14/06/2019	09:27	116	3	Transit	637	Bullet
	14/06/2019	10:14	146	3	Transit	643	Bullet
	14/06/2019	10:25	128	4	Transit	645	Bullet

Species**	Date	Flight start time	Duration (s)	Minimum no. of birds	Flight behaviour***	Key no.****	Notes
	14/06/2019	10:39	95	1	Transit	648	Bullet
	14/06/2019	11:01	88	4	Transit	654	Bullet
	14/06/2019	11:05	109	2	Transit	656	Bullet
	14/06/2019	11:08	112	2	Transit	657	Bullet
	14/06/2019	11:34	108	4	Transit	662	Bullet
	14/06/2019	11:43	113	3	Transit	664	Bullet
	10/07/2019	15:06	139	2	Transit	667	Bullet
	10/07/2019	15:15	146	3	Transit	670	Bullet
	10/07/2019	15:26	122	11	Transit	672	Bullet
	10/07/2019	15:29	117	4	Transit	674	Bullet
	10/07/2019	15:34	12	3	Transit	677	Bullet
	10/07/2019	15:42	157	8	Transit	679	Bullet
	10/07/2019	15:58	107	7	Transit	684	Bullet
	10/07/2019	16:20	129	4	Transit	691	Bullet
	10/07/2019	15:47	63	4	Transit	681	Bullet
	10/07/2019	16:32	123	4	Transit	696	Bullet
	10/07/2019	16:34	62	8	Transit	697	Bullet
	10/07/2019	16:43	143	2	Transit	703	Bullet
	10/07/2019	16:46	138	4	Transit	705	Bullet
	10/07/2019	16:48	126	3	Transit	707	Bullet
	10/07/2019	16:52	137	3	Transit	711	Bullet
	10/07/2019	16:54	54	9	Transit	712	Bullet
	10/07/2019	16:49	132	4	Transit	709	Bullet
	10/07/2019	17:26	87	3	Transit	717	Bullet
	10/07/2019	17:44	126	4	Transit	722	Bullet
	10/07/2019	18:09	106	2	Transit	729	Bullet
	10/07/2019	18:17	131	3	Transit	732	Bullet
	10/07/2019	18:32	83	4	Transit	737	Weave
	10/07/2019	18:50	124	3	Transit	745	Bullet
	10/07/2019	18:54	118	2	Transit	747	Bullet
	10/07/2019	19:01	108	2	Transit	749	Bullet
	10/07/2019	19:07	153	4	Transit	751	Bullet
	10/07/2019	18:49	143	2	Transit	744	Bullet

Species**	Date	Flight start time	Duration (s)	Minimum no. of birds	Flight behaviour***	Key no.****	Notes
	10/07/2019	19:09	139	4	Transit	753	Bullet
	10/07/2019	19:20	151	2	Transit	757	Bullet
	10/07/2019	19:52	94	3	Transit	761	Bullet
	10/07/2019	20:03	131	4	Transit	764	Bullet
	10/07/2019	20:07	148	5	Transit	765	Bullet
	10/07/2019	20:27	134	4	Transit	770	Bullet
	10/07/2019	20:28	129	2	Transit	771	Bullet
	10/07/2019	20:36	139	3	Transit	774	Bullet
	10/07/2019	20:52	129	5	Transit	778	Bullet
	10/07/2019	20:58	132	8	Transit	780	Bullet
	10/07/2019	21:07	134	3	Transit	782	Bullet
	10/07/2019	21:12	108	2	Transit	784	Bullet
	10/07/2019	21:21	122	6	Transit	788	Bullet
	10/07/2019	21:27	149	9	Transit	790	Bullet
	10/07/2019	21:32	127	2	Transit	793	Bullet
	10/07/2019	21:39	141	2	Transit	796	Bullet
	10/07/2019	21:44	96	3	Transit	798	Bullet
	12/07/2019	05:24	112	3	Transit	803	Bullet
	12/07/2019	05:32	131	3	Transit	805	Bullet
	12/07/2019	05:39	90	3	Transit	807	Bullet
	12/07/2019	05:44	128	4	Transit	808	Bullet
	12/07/2019	05:55	127	3	Transit	811	Bullet
	12/07/2019	06:06	128	5	Transit	815	Bullet
	12/07/2019	06:11	129	2	Transit	817	Bullet
	12/07/2019	06:19	133	3	Transit	820	Bullet
	12/07/2019	06:23	114	3	Transit	822	Bullet
	12/07/2019	06:31	87	4	Transit	828	Bullet
	12/07/2019	06:39	113	3	Transit	832	Bullet
	12/07/2019	06:53	158	5	Transit	836	Bullet
	12/07/2019	07:08	142	5	Transit	842	Bullet
	12/07/2019	07:35	139	5	Transit	845	Bullet
	12/07/2019	08:44	112	3	Transit	858	Bullet
	12/07/2019	08:49	82	2	Transit	860	Bullet

Species**	Date	Flight start time	Duration (s)	Minimum no. of birds	Flight behaviour***	Key no.****	Notes
	12/07/2019	08:58	106	4	Transit	863	Not recorded
	12/07/2019	09:00	127	2	Transit	864	Not recorded
	12/07/2019	09:06	115	2	Transit	866	Bullet
	12/07/2019	09:24	121	2	Transit	870	Bullet
	12/07/2019	10:09	142	2	Transit	874	Bullet
	12/07/2019	10:17	109	1	Transit	875	Bullet
	12/07/2019	10:34	137	2	Transit	878	Bullet
	12/07/2019	10:46	139	2	Transit	881	Bullet
	12/07/2019	11:00	137	2	Transit	887	Bullet
	12/07/2019	11:13	122	3	Transit	891	Bullet
	12/07/2019	11:46	119	2	Transit	896	Bullet
	12/07/2019	11:26	114	4	Transit	893	Bullet

* Flights that were partially or entirely at RSH are shaded;
**Species names and order follow the British List maintained by the BOU²;
***As defined in Table 2;
**** Key numbers allow identification of individual flights