Technical Appendix 8.1: Ornithology Technical Report

Larbrax Wind Farm EIA Report

Ornithology

Appendix 8.1

CONTENTS

1 INTRODUCTION

MacArthur Green was commissioned by Ørsted to undertake ornithological surveys at the proposed Larbrax Wind Farm, west of Stranraer in Dumfries and Galloway (hereafter referred to as 'the Proposed Development'). The surveys were conducted between March and August 2021 to inform an assessment of the potential ornithological effects of the Proposed Development on the species assemblage present. Surveys undertaken in 2021 were update surveys to those undertaken between May 2012 and August 2013 by AMEC Environment & Infrastructure Ltd. (AMEC) for the Consented Larbrax Wind Farm which are also included as part of the baseline dataset for the Proposed Development and are summarised in this technical appendix (refer to **Annex F** for the detailed AMEC reports, survey methodology and data recorded).

This technical report summarises the methods employed and the results of the field surveys and is supported by the following Annexes.

- **Annex A**: Ornithological Legal Protection;
- **Annex B**: Ornithological Survey Methodologies;
- **Annex C**: Ornithological Survey Effort and General Information;
- **Annex D**: Ornithological Survey Results;
- **Annex E**: Collision Risk Assessments; and
- **Annex F**: AMEC Ornithological Baseline Reports.

Confidential information relating to species listed on Annex 1 of the EU Birds Directive or Schedule 1 of the Wildlife and Countryside Act 1981 (as amended) is detailed in **Confidential Appendix 8.2**.

A range of surveys were employed to accurately record baseline conditions within the Proposed Development and appropriate survey areas (detailed in **Annex B**). The following terms are referred to in this Technical Appendix, associated **Annexes A – E**, **Confidential Technical Appendix 8.2** and **Chapter 8 (Ornithology)** of the Environmental Impact Assessment Report:

- 'the Site' refers to the area within the red line boundary, e.g. **Figure 8.1**;
- 'survey area' is defined as the area covered by each survey type for the Proposed Development (**Figure 8.6**); and
- 'study area' is defined as the area of consideration of effects on each species at the time of assessment (**Figure 8.1**).

2 LEGAL PROTECTION

With limited exceptions, all wild birds and their eggs are protected by law. Specific levels of protection are determined by a species' inclusion on certain lists. **Annex A** to this report details the various levels of legal protection afforded to UK bird species.

3 FIELD SURVEYS

The following surveys were undertaken at the Site between May 2012 and August 2013 and March to August 2021:

- Flight activity surveys:
    - September 2012 to March 2013, three Vantage Point (VP) locations (**Figure 8.3**);
    - March to August 2013, three VP locations (**Figure 8.4**); and
    - March to August 2021, one VP location (**Figure 8.5**).
- Scarce[1] breeding bird surveys:
    - April to August 2013[2], 2 km from the preliminary site boundary (**Figure 8.6**); and
    - March to August 2021, 2 km from the consented turbine layout (**Figure 8.6**).
- Black grouse surveys: May 2021, 1.5 km survey area from the consented turbine layout (**Figure 8.6**);
- Breeding bird (wader) surveys:
    - May and June 2012, within the preliminary site boundary (**Figure 8.6**); and
    - April to July 2021, 500 m survey area from the consented turbine layout (**Figure 8.6**).
- Winter walkover surveys: November 2012 to March 2013, 1 km survey area buffered from the consented turbine layout (**Figure 8.6**).

Survey methods followed the recommended NatureScot (SNH 2017[i]) guidelines available at the time and methods are described in detail within **Annex B/Annex F**. Where possible, each survey was carried out beyond the Site within a buffer distance specific to that method (e.g. 2 km buffer for the scarce breeding bird surveys) and these are detailed within **Annex B/Annex F**.

[1] Scarce breeding birds are those listed on Annex 1 of the EU Birds Directive and/or Schedule 1 of the Wildlife and Countryside Act 1981 (as amended) and in the case of the Proposed Development consists of any raptor and owl species listed in Annex 1 and/or Schedule 1.
[2] Note that targeted dusk surveys for barn owl and hen harrier were also undertaken between January and July 2013.

A target species list for survey/recording was defined from the following lists and refined on the basis of the species perceived sensitivity to onshore wind farm developments (e.g., as set out in Annex 1 of NatureScot guidance, SNH 2018[ii]).

- Annex 1 of the EU Birds Directive;
- Schedule 1 of the Wildlife and Countryside Act 1981 (as amended); and
- Species included on the Birds of Conservation Concern (BoCC) red list (Stanbury *et al.* 2022[iii]).

Secondary species for survey/recording were defined as the non-red list[iii] raptor and owl species (i.e. buzzard, kestrel, sparrowhawk, tawny owl and long-eared owl), gulls (excluding herring gull), amber and green listed[iii] waders, feral species (e.g., canada goose), mallard, raven and any large concentrations of/regionally common Schedule 1 or red listed[iii] passerine species as noted to be present during surveys.

4 FIELD SURVEY RESULTS

All valid surveys were undertaken during suitable weather conditions (as described within **Annex B/Annex F**). Where weather conditions deteriorated below acceptable conditions (see definitions in **Annex B/Annex F**), surveys were either suspended or additional surveys were undertaken. In the case of flight activity surveys, any time where the visibility was <1 km was excluded from total survey effort and subsequent analysis (further detail in **section 4.1**). Schedule 1/Annex 1 surveys were carried out by appropriately licensed surveyors. All survey data were reviewed, inputted, and analysed by MacArthur Green.

Survey effort and results of the field surveys are detailed within **Annex C**, **Annex D** and **Annex F**. The following sections summarise the results from each survey undertaken.

4.1 Flight Activity

The flight activity surveys recorded all target species' flight activity within the Site and beyond. These data have been used in the collision risk modelling. The flights used included those within the 'Collision Risk Analysis Area' (CRAA) (i.e. the area to be occupied by operational turbines, together with a 500 m buffer).

Flight activity surveys across the 2013 and 2021 breeding seasons and 2012/2013 non-breeding season were undertaken across up to three VPs. Valid survey effort[3] is detailed in **Table 8-1-1** and full details of flight activity surveys are contained in **Annex C** with methodology in **Annex B/Annex F**.

[3] Hours where visibility was >1 km are not considered valid for use in collision risk modelling as less than half the 2 km viewshed can be seen.

Table 8-1-1 Summary of total hours of valid survey per VP in each season

Period	VP1	VP2	VP3	VP1a	VP2a	VP3a
2012/2013 non-breeding season	53.41	55.99	51	-	-	-
2013 breeding season	-	-	-	35.99	36	36.08
2021 breeding season	-	-	-	-	-	36

A total of 12 target species were recorded during the flight activity surveys (further details are provided in **Annex D**). For each species across the whole flight activity survey period, **Table 8-1-2** shows the total number of flights recorded and the total number of birds recorded[4]. The bird seconds are calculated for each observation as the product of flight duration and number of individuals. This is then summed per species to give the total bird seconds recorded across the entire surveyed period.

Table 8-1-2 Target species recorded and total number of flights recorded during flight activity surveys

Species	Total number of flightlines recorded	Total number of birds recorded	Total bird seconds recorded
Barn owl	2	2	17
Curlew	215	676	38,918
Golden plover	7	72	5,943
Greylag goose	18	46	1,369
Hen harrier	15	15	837
Herring gull	10	136	7,446
Lapwing	160	635	55,450
Merlin	5	5	117
Peregrine falcon	5	5	406
Short-eared owl	1	1	28
Whimbrel	17	75	2,912
Whooper swan	2	17	1,670

4.1.1 Flightlines Used in Collision Risk Modelling

Only flightlines identified to be within the CRAA and recorded within the 2 km viewshed of the associated VP were considered in the collision risk modelling and **Annex E** provides details of the bird seconds from flights identified to be 'at- risk'.

- 'At-risk' is defined as – a flight having at least part of its duration (i) at Potential Collision Height (PCH)[5]; (ii) within the CRAA; and (iii) recorded within the 2 km viewshed of the associated VP.

- PCH is defined as – the altitude between the minimum and maximum blade height[6] (taken to be from 16.9 m to 149.9 m for the Proposed Development).

[4] This includes flights that would not technically be 'at-risk' of collision (e.g. recorded outwith the CRAA and/or not at rotor height).
[5] In some cases, only part of a total flight duration was recorded at PCH, and it is assumed that this proportion is applicable for that part of the flight within the CRAA and 2 km viewshed area.
[6] Where the actual rotor blade altitude differs from the pre-defined survey height bands, the collision risk model accounts for this difference on the assumption of an even flight distribution within each particular survey height band, and an adjustment can be made to estimate total flight duration at actual rotor blade altitude.

Short-eared owl were recorded during flight activity surveys but no flights were considered to be 'at-risk'[7]. Full survey results detailing the findings from each survey visit (including target species' flightlines considered not 'at-risk' and secondary species information) can be found within **Annex D.** Only bird seconds for observations identified as within the CRAA and associated viewshed are considered in the following discussions. Full target species results are detailed within **Annex D** and the collision risk calculations are detailed in **Annex E.**

4.1.2 Collision Risk Model Outputs

The bird seconds for target species flights within the CRAA at PCH were then input into a Collision Risk Model (CRM) to calculate the predicted collision rates per season. The CRM calculations for each species can be found in **Annex E. Table 8-1-3** and **Table 8-1-4** provide the estimated collision rates and number of seasons per collision for each species.

Table 8-1-3 Estimated collision rates

Species	2012/2013 non-breeding season	2013 breeding season	2021 breeding season
Barn owl	0	0.0003	0
Curlew	0.3765	2.0472	0.0244
Golden plover	0	0.3556	0.0502
Greylag goose	0.0002	0.0008	0
Hen harrier	0.0046	0.0064	0
Herring gull	0	0	0.2188
Lapwing	1.4103	0.0986	0.0092
Merlin	0.0023	0.0011	0
Peregrine falcon	0.0058	0.0033	0
Whimbrel	0.0281	0	0
Whooper swan	0	0.0059	0

Table 8-1-4 Estimated number of seasons per collision

Species	2012/2013 breeding season	2013 breeding season	2021 breeding season
Barn owl	n/a	3262	n/a
Curlew	2.66	0.49	41.0
Golden plover	n/a	2.81	19.9
Greylag goose	4082	1223	n/a
Hen harrier	215	156	n/a
Herring gull	n/a	n/a	4.57
Lapwing	0.71	10.1	109
Merlin	439	907	n/a
Peregrine falcon	172	305	n/a
Whimbrel	36	n/a	n/a
Whooper swan	n/a	169	n/a

4.2 Breeding Birds

Two complete breeding bird seasons (comprising of two and four visits respectively) were surveyed in 2012 (May and June) and 2021 (April to July). Surveys recorded six wader species, of which four were considered to be breeding and one (common sandpiper) potentially breeding

[7] i.e. the flights were either not within the CRAA and associated viewshed or were only recorded flying above 150m.

(**Table 8-1-5**). A single dunlin was also recorded in August 2021 but was considered to be on migration and not breeding on the Site. Full details of the breeding bird surveys are provided within **Annex C** and **Annex D/Annex F** and survey methodology is provided within **Annex B/Annex F.**

Table 8-1-5 Breeding wader territories, 2012 and 2021[8]

Species	Number of territories 2012	Number of territories 2021
Common sandpiper	-	0-1
Curlew	2 (2)	2-3 (2-3)
Lapwing	5 (4)	0-2 (0-2)
Oystercatcher	2 (0)	1 (1)
Snipe	1 (0)	1 (1)

4.3 Winter Walkover

Winter walkover surveys were conducted during the 2012/2013 non-breeding season. Surveys recorded evidence of barn owl and short-eared owl (**Annex F**).

4.4 Scarce Breeding Birds

Scarce breeding bird surveys were conducted during the 2013 (April to August) and 2021 (March to August) breeding seasons. Targeted dusk surveys for barn owl and hen harrier were also undertaken between January and July 2013.

Barn owl and peregrine falcon were identified to be breeding within the survey area at one location each and **Confidential Technical Appendix 8.2** contains the full details of all breeding activity. Hen harrier were also recorded during surveys but were not considered to be breeding/no breeding attempts were located.

Full details of the scarce breeding bird surveys are provided within **Annex C** and **Annex D/Annex F** and **Confidential Technical Appendix 8.2** and survey methodology is provided within **Annex B/Annex F.**

4.5 Black Grouse

Surveys to identify areas of black grouse activity, locate lek locations and establish lek size were undertaken in May 2021. No black grouse or signs of black grouse were recorded. Full details of the black grouse surveys are provided within **Annex C** and survey methodology is provided within **Annex B.**

[i] Scottish Natural Heritage (2017) Recommended Bird Survey Methods to inform impact assessment of Onshore Windfarms.

[ii] Scottish Natural Heritage (2018) Assessing Significance of Impacts from Onshore Wind Farms Outwith Designated Areas.

[iii] Stanbury, A., Eaton, M., Aebischer, N., Balmer, D., Brown, A., Douse, A., Lindley, P., McCulloch, N., Noble, D., and Win I. (2021). The status of our bird populations: the fifth Birds of Conservation Concern in the United Kingdom, Channel Islands and Isle of Man and second IUCN Red List assessment of extinction risk for Great Britain. British Birds, 114, pp. 723-747

[8] Number of territories within the 500 m study area shown in (brackets).

ANNEX A. ORNITHOLOGICAL LEGAL PROTECTION

In Scotland, all wild birds are protected under the Wildlife and Countryside Act 1981 (the 'Act'), as amended by the Nature Conservation (Scotland) Act 2004. This protection also extends to their eggs and nests, with it being an offence to intentionally or recklessly[1]:

- Kill, injure or take any wild bird[2];
- Take, damage, destroy or otherwise interfere with the nest of any wild bird while it is being built or is in use[3];
- At any other time take, damage, destroy or otherwise interfere with any nest habitually used by any wild bird included in Schedule A1 (Protected Nests and Nest Sites for Birds: white-tailed eagle and golden eagle)[4];
- Obstruct or prevent any wild bird from using its nest[5]; or
- Take or destroy an egg of any wild bird[6].

It is also an offence to have in possession or control any live or dead wild bird or any part thereof; or any egg or part of an egg of any wild bird[7].

Further special protection under this legislation is afforded to those species listed on Schedule 1 of the Act. For these species, it is an offence to:

- Intentionally or recklessly disturb any wild bird listed on Schedule 1 while it is nest building, or is in, on or near a nest containing eggs or young, or disturb the dependent young of such a bird[8];
- Intentionally or recklessly disturb any wild birds included on Schedule 1 which leks, while it is doing so[9] (capercaillie is the only bird this offence applies to in Scotland);
- Intentionally or recklessly harass any wild bird included in Schedule 1A[10]. Section 1, subsection 5B states, '*Subject to the provisions of this Part, any person who intentionally or recklessly harasses any wild bird included in Schedule 1A shall be guilty of an offence*'. At this time, Schedule 1A includes golden eagle, hen harrier, red kite and white-tailed eagle. This updated legislation was introduced on 16 March 2013; or
- Intentionally or recklessly take, damage, destroy or otherwise interfere with any nest and/or nest site habitually used by any bird on Schedule A1 at any time. At this time, Schedule A1 includes golden eagle and white-tailed eagle[11];

It is also an offence to knowingly cause or permit to be done an act which is made unlawful by any of the above provisions.

Further protection is described under the EU Birds Directive which requires member states to maintain wild bird species in favourable conservation status[12] and promote the conservation of bird species listed within Annex 1 of the Birds Directive through the protection of their habitat. This is achieved via the designation of Special Protection Areas (SPAs).

Red List bird species are those deemed to be globally threatened and to be suffering population declines within the UK. Although not legally enforceable, the conservation of Red List bird species represents a material consideration, in planning terms.

[1] Exceptions to these offences exist under various circumstances (e.g. controlling pest species; taking birds during specific season; and killing sick or injured birds etc.).
[2] Wildlife and Countryside Act 1981, Section 1(1)(a)
[3] Wildlife and Countryside Act 1981, Section 1(1)(b)
[4] Wildlife and Countryside Act 1981, Section 1(1)(ba)
[5] Wildlife and Countryside Act 1981, Section 1(1)(bb)
[6] Wildlife and Countryside Act 1981, Section 1(1)(c)
[7] Wildlife and Countryside Act 1981, Section 1(2)
[8] Wildlife and Countryside Act 1981, Section 1(5)
[9] Wildlife and Countryside Act 1981, Section 1(5A)
[10] Wildlife and Countryside Act 1981, Section 1(5B)
[11] This reflects the changes introduced by the Wildlife and Countryside Act 1981 (as amended by: Variation of Schedules A1 and 1A (Scotland) Order 2013.
[12] While the term 'favourable conservation status' is not used in the Birds Directive, EU court cases over recent years have progressively interpreted the concept as meaningful in a Birds Directive context (SNH, 2006).

ANNEX B. ORNITHOLOGICAL SURVEY METHODOLOGY

A range of ornithological surveys have been conducted at the Proposed Development Site during the 2021 breeding season. The methodologies used in these surveys are summarised in the sections below; more detailed descriptions are provided in the NatureScot guidance (2017[i]) on which these surveys are based. Refer to **Annex F** for the survey methodology relating to the AMEC surveys undertaken between May 2012 and August 2013.

B.1 Flight Activity Surveys

The aims of the flight activity (vantage point) surveys are: (1) to record flight activity within the vicinity of the Site in order to identify areas of importance to birds; and (2) to quantify flight activity within 500 m of the proposed turbine locations in order to estimate the likelihood of collision (SNH 2017[i], P.14-19).

Timing

- A survey period of 36 hours is recommended as the minimum level of sampling intensity at each VP for each season (breeding, non-breeding, migratory) (SNH 2017[i], P.17);
- Watches were spread as evenly throughout the year as possible to ensure that temporally representative data are collected (see **Annex C**). Specific consideration was given to the period around dawn and twilight for breeding waders and to changing raptor behaviour across seasons (SNH 2017[i], P.17);
- Watches were suspended and resumed to take account of changes in visibility (e.g. fluctuations in cloud base). Watches were undertaken in conditions of good ground visibility when the cloud base was higher than the most elevated ground being observed; and
- Watches were conducted in a range of weather conditions and were spread throughout the day (see **Annex C** and **Annex D**).

Field Methods

- Viewshed analysis was conducted using ArcGIS to confirm suitable Vantage Point (VP) locations and their associated visible areas at 20m above ground level[1];
- Reconnaissance surveys were undertaken to refine VP locations;
- The VP locations and associated viewsheds are shown in **Figure 8.3**, **Figure 8.4** and **Figure 8.5**;
- Care was taken to maximize the area visible whilst minimising disturbance to birds;
- The three original VP locations (VPs 1-3) used in the 2012/2013 non-breeding season were selected with the aim of achieving coverage of all the consented turbine locations such that no turbine was more than 2 km from a VP. These VP locations were revised for the 2013 breeding season (VPs 1a-3a). For the Proposed Development turbine locations, all the turbines were covered by the viewshed of VP3a and therefore surveys during the 2021 breeding season were only undertaken from VP3a;
- A maximum 180˚ view arc was scanned by surveyors. This rule did not however apply when tracking migratory waterfowl, raptors or divers across the Site;
- Each watch lasted a maximum of three hours but was suspended and then resumed to take account of changes in visibility (e.g. fluctuations in the cloud base).

For each target and secondary species, the following data were recorded (SNH 2017[i], P.17-18):

- The flightlines by individuals or flocks of birds;
- The time the target bird was detected and the duration (seconds) spent flying over a defined survey area (the viewshed);
- The birds' flight heights, defined into five prescribed height bands (0-20 m, 21-40 m, 41-100 m, 101-150 m and >151 m were recorded at the point of detection and at 15 second intervals thereafter. From this the proportion of time spent flying below, within (referred to as Potential Collision Height (PCH)) and above approximate rotor height could be estimated. The proposed rotor height is 16.9 m to 149.9 m above ground level. This difference is accounted for within the collision risk models on the assumption of even flight distribution within each height band;
- The route followed was plotted in the field onto 1:25,000 scale maps;
- Observations of target species took priority over recording secondary species if both species were present simultaneously;
- The number of birds recorded were the minimum number of individuals that could account for the activity observed; and
- Observers only recorded perched birds and birds on waterbodies once only on arrival at the VP. Thereafter only flying birds and newly noticed perched/swimming birds were included in the activity summaries.

B.2 Upland Breeding Bird Survey

Upland breeding bird survey methodology was employed as detailed within NatureScot guidance (SNH 2017[i], P.11). In summary, surveys involved the following:

- Open upland (including hedgerows, scrub, isolated trees and copses) was surveyed using an intensive version of the Brown and Shepherd (1993[ii]) method for upland bird survey;
- The objectives were to map the distribution of breeding bird territories within 500 m of the Site and estimate the approximate size of breeding bird populations;
- After each survey visit one overview map was then produced showing all target species. The maps from all four survey visits from that year were then compared, enabling the estimation of numbers of breeding territories. This was done by grouping the observations into territories using the methodology described by Bibby *et al.* (2000[iii]). Due to the cryptic nature of many breeding birds and the necessary assumptions made when plotting territories, a minimum and maximum number of territories was identified for each target species;
- The survey covered all areas within 500 m of the Site; and
- All upland wader species were recorded during the breeding bird survey.

[1] The viewsheds are based on a 5 m DTM to provide a representation of visibility from the observer locations; this is confirmed and refined through field site visits.

Timing

- As recommended in Calladine *et al.* (2009[iv]), four survey visits were undertaken between April and July;
- Fieldwork was undertaken between sunrise and 1800hrs; and
- Fieldwork was not undertaken in conditions considered likely to affect bird detection rates, for example in winds greater than Beaufort Scale Force 4, persistent precipitation, poor visibility (less than 300 m), or in unusually hot weather.

Field Methods

- Walk-routes which optimised ground visibility were used;
- Surveyors paused at appropriate vantage and listening points;
- Isolated trees, copses and patches of scrub were approached and examined;
- Streams, ditches and hedgerows were walked;
- All other areas were approached to within 100 m; and
- Registrations were mapped at the first location that behaviour indicative of breeding was observed; and
- Standard British Trust for Ornithology (BTO) activity codes were used.

B.3 Scarce Breeding Bird Survey

The aim of the scarce breeding bird surveys was to determine the distribution of occupied nests/territories for target raptor and owl species within 2 km of the Site and record breeding success. Secondary species such as buzzard, sparrowhawk and kestrel were also noted but location of their nests was not the key focus of the surveys. Surveys were undertaken by experienced and licensed[2] field ornithologists. Extreme care was taken to avoid unnecessary disturbance to breeding birds.

Guidance from NatureScot (SNH 2017[i], P.11-14), 'Bird Monitoring Methods' (Gilbert *et al*. 1998[v]) and 'Raptors: a field guide to survey and monitoring' (Hardey *et al*. 2013[vi]) were all consulted to inform survey methodology and are referenced where appropriate in the species methodologies below.

Barn Owl

- The surveys followed methodology outlined in Gilbert *et al.* (1998[v]), as mentioned in NatureScot guidance (SNH 2017[i], P12-13);
- Surveys were undertaken within 1 km of the Site; and
- Surveyors checked for signs of occupation (moulted feathers, pellets) in all suitable buildings within this 1 km buffer.

Hen Harrier

Methodology outlined in Hardey *et al*. (2013[vi]) was used as guidance for the surveying of areas for potential hen harrier breeding. Extreme care was taken not to disturb potential nests especially around the time of year when females were likely to be laying or in cold/wet weather when females were likely to be incubating or brooding. Areas of suitable habitat[3] were visited during four time periods across the breeding season to:

- Check for territory occupancy (between March and mid-April) – this consisted of watching over suitable habitat from a good vantage point for displaying males (and females) and checking all areas of suitable habitat to within 250 m (watching out for signs of kills);
- Locate incubating females (between mid-April and late May) by listening for female begging calls and watching for food passes between the male and female – surveyors watched for at least four hours as Hardey *et al.* (2013[vi]) notes that when the female is incubating it can be up to six hours between feeding visits from the male, but on average it is less than every four hours. Surveys were undertaken between 06:00 to 12:00 or 16:00 to 20:00;
- Check for young or breeding evidence (between late May and late June) again by listening for female begging calls and watching for food passes between male and female when the female is brooding and watching for the male and female provisioning the nest with food once brooding has ended– surveyors should watch for at least two hours as Hardey *et al.* (2013[vi]) notes that an adult bird will visit the nest every 1-2 hours. Surveyors should also watch for display behaviour which could indicate a failed breeding attempt; and
- Check for fledged young (between late June and late August).

Merlin

Methodology outlined in Hardey *et al.* (2013[vi]) was used as guidance for the surveying of areas for potential merlin breeding.

- Areas of suitable nesting habitat (including forest edge where trees are >5 m high) were closely observed between 20th March and 30th April;
- Boulders, fence lines, isolated posts, stone dykes, grouse butts, hummocks, stream banks, crags, trees and recently burnt areas of heather were checked for signs of occupation (e.g. plucked prey, moulted feathers, pellets and faeces);
- If merlin were observed, or signs found, areas were visited at least twice to verify occupation of the territory; and
- Potential nest areas were watched for 4-6 hours if necessary.

Peregrine Falcon

- Potential nest sites were visited and checked for evidence of occupation between March and April;
- Sites checked included crags and steep banks identified from OS maps and searches of the survey area;
- Surveyors checked for signs of occupation (e.g. faecal splash, fresh plucked prey);
- If occupied sites were found they were re-visited to verify incubation; and

[2] All surveyors hold NatureScot Schedule 1 Licences.

[3] Unsuitable habitat areas include: land above 600 m; improved pasture and arable land; extensive areas of degraded land with no heather cover and low vegetation; the vicinity of cliffs, rocky outcrops, boulder fields and scree; areas within 100 m of hill farms and occupied dwellings.

- Searches were made for eyries. Where this was not possible sites were watched from a suitable vantage point for 3-4 hours or until a nest was located.

Red Kite

Care was taken not to disturb any birds, especially between mid-March and mid-April when disturbance to displaying red kites can cause them to move to another area (Hardey *et al.* 2013[vi]).

- Wooded areas were scanned from outside for the presence of nests, with signs occupation searched for between February and March;
- Potential territories were watched for 1-2 hours between March and April to observe any breeding or nest-building behaviour; and
- Where breeding was confirmed, nests were scanned to determine the breeding success between late April and late June/early July.

Short-Eared Owl

- At least two visits between early April and the end of May were carried out;
- Suitable habitat was visited and checked for evidence of hunting males, territorial activity and other signs of presence; and
- If breeding was confirmed, a further visit was be made in June to watch birds, locate nest-sites and confirm breeding behaviour wherever possible.

B.4 Black Grouse Survey

The survey methodology used is detailed in NatureScot guidance (SNH 2017[i], P.12). A summary is provided below.

- Breeding black grouse were surveyed within 1.5 km of the Site by counting total numbers of males and females at leks, most lekking activity taking place at or soon after dawn in spring.
- Known lek sites and other areas of suitable habitat which can host leks were identified and visited during April and May within 2 hours of dawn on calm dry days with good visibility;
- Visits involved listening and scanning for lekking black grouse from strategic locations (avoiding disturbance of leks) and during walks between these locations ensuring that all potential habitat was covered;
- The maximum count of males in the 2 hours around dawn gives the standard count estimate but the maximum number of females seen was also presented; and
- Leks that were at least 200 m apart within the same year were treated as separate leks.

[i] Scottish Natural Heritage (2017) Recommended bird survey methods to inform impact assessment of onshore windfarms.
[ii] Brown, A. F. and Shepherd, K. B. (1993) A method for censusing upland breeding waders. Bird Study, 40: 189-195.
[iii] Bibby, C. J., Neil D. Burgess, David A. Hill and Simon H. Mustoe (2000) Bird Census Techniques, 2nd Edition, London, Academic Press.
[iv] Calladine. J., Garner, G., Wernham, C., & Thiel, A. (2009) The influence of survey frequency on population estimates of moorland breeding birds. Bird Study, 56: 3, 381-388.
[v] Gilbert, G., Gibbons, D. W. and Evans, J. (1998) Bird Monitoring Methods. RSPB, Sandy.
[vi] Hardey, J., Crick, H., Wernham, C., Riley, H., Etheridge, B. and Thompson, D. (2013) Raptors: a field guide for surveys and monitoring (3rd edition). The Stationery Office, Edinburgh.

ANNEX C. ORNITHOLOGICAL SURVEY EFFORT & GENERAL INFORMATION

Table C-1 shows the system used for recording weather conditions on all the surveys (sections **C.1** to **C.4** below). Refer to **Annex F** for weather data relating to the AMEC surveys undertaken between May 2012 and August 2013.

Table C-1 Key to meteorological conditions recorded during all surveys

Wind speed				Rain		Cloud cover		Cloud height	
Calm	0	Moderate gale	7	None	0	In eighths		<150m	0
Light air	1	Fresh gale	8	Drizzle/Mist	1	*e.g.*	3/8	150-500m	1
Light breeze	2	Strong gale	9	Light showers	2			>500m	2
Gentle breeze	3	Whole gale	10	Heavy showers	3				
Moderate breeze	4	Storm	11	Heavy rain	4				
Fresh breeze	5	Hurricane	12	**Snow**		**Frost**		**Visibility**	
Strong breeze	6			None	0	None	0	Poor (<1km)	0
				On site	1	Ground	1	Moderate (1-2km)	1
				High ground	2	All day	2	Good (>2km)	2

C.1 Flight Activity Surveys

Additional flight activity surveys were undertaken by MacArthur Green during the 2021 breeding season (refer to **Annex F** for those undertaken by AMEC between September 2012 and August 2013). Details of the 2021 flight activity surveys undertaken across each Vantage Point (VP) location are supplied in **Table C-2** (survey hours per VP per season are summarised in **Technical Appendix 8.1**) and the associated weather data recorded is detailed in **Table C-3**. Refer to **Annex B** for survey methodology and **Annex D** for survey results.

Table C-2 Summary of flight activity surveys undertaken at Larbrax Wind Farm (sorted chronologically)

Date	Season	Observer	VP	Survey start time	Survey finish time	No. hours[1] surveyed
31/03/2021	2021 BR	MW	3a	0815	1115	3
31/03/2021	2021 BR	MW	3a	1145	1445	3
30/04/2021	2021 BR	MW	3a	0800	1100	3
30/04/2021	2021 BR	MW	3a	1130	1430	3
27/05/2021	2021 BR	MW	3a	0700	1000	3
28/05/2021	2021 BR	MW	3a	0700	1000	3
28/06/2021	2021 BR	MW	3a	0815	1115	3
28/06/2021	2021 BR	MW	3a	1145	1445	3
26/07/2021	2021 BR	MW	3a	0730	1030	3
26/07/2021	2021 BR	MW	3a	1100	1400	3
16/08/2021	2021 BR	MW	3a	0800	1100	3
16/08/2021	2021 BR	MW	3a	1130	1430	3
31/03/2021	2021 BR	MW	3a	0815	1115	3
31/03/2021	2021 BR	MW	3a	1145	1445	3
30/04/2021	2021 BR	MW	3a	0800	1100	3
30/04/2021	2021 BR	MW	3a	1130	1430	3
27/05/2021	2021 BR	MW	3a	0700	1000	3
28/05/2021	2021 BR	MW	3a	0700	1000	3
28/06/2021	2021 BR	MW	3a	0815	1115	3
28/06/2021	2021 BR	MW	3a	1145	1445	3
26/07/2021	2021 BR	MW	3a	0730	1030	3
26/07/2021	2021 BR	MW	3a	1100	1400	3
16/08/2021	2021 BR	MW	3a	0800	1100	3
16/08/2021	2021 BR	MW	3a	1130	1430	3

[1] Note: only valid hours (i.e. where visibility was at least 1 km) are presented in this column.

Table C-3 Meteorological conditions during flight activity surveys at Larbrax Wind Farm (sorted chronologically)

Date	VP	Observer	Survey start time	Survey finish time	Survey hour	Wind speed	Wind direction	Rain	Cloud cover	Cloud height	Visibility	Frost	Snow
31/03/2021	3a	MW	0815	1115	1	1	SW	0	7	2	2	0	0
31/03/2021	3a	MW	0815	1115	2	2	SSW	0	6	2	2	0	0
31/03/2021	3a	MW	0815	1115	3	3	S	0	6	2	2	0	0
31/03/2021	3a	MW	1145	1445	1	3	S	0	5	2	2	0	0
31/03/2021	3a	MW	1145	1445	2	3	SSE	0	5	2	2	0	0
31/03/2021	3a	MW	1145	1445	3	3	SSE	0	6	2	2	0	0
30/04/2021	3a	MW	0800	1100	1	2	NE	0	1	2	2	0	0
30/04/2021	3a	MW	0800	1100	2	3	NE	0	2	2	2	0	0
30/04/2021	3a	MW	0800	1100	3	4	NE	0	3	2	2	0	0
30/04/2021	3a	MW	1130	1430	1	5	NE	0	4	2	2	0	0
30/04/2021	3a	MW	1130	1430	2	5	NE	0	5	2	2	0	0
30/04/2021	3a	MW	1130	1430	3	5	NE	0	6	2	2	0	0
27/05/2021	3a	MW	0700	1000	1	2	SW	0	2	2	2	0	0
27/05/2021	3a	MW	0700	1000	2	2	SW	0	2	2	2	0	0
27/05/2021	3a	MW	0700	1000	3	2	SW	0	2	2	2	0	0
28/05/2021	3a	MW	0700	1000	1	5	SW	4	8	2	2	0	0
28/05/2021	3a	MW	0700	1000	2	6	SW	4	8	2	2	0	0
28/05/2021	3a	MW	0700	1000	3	7	SW	4	8	2	2	0	0
28/06/2021	3a	MW	0815	1115	1	4	NNW	0	6	2	2	0	0
28/06/2021	3a	MW	0815	1115	2	4	NNW	0	5	2	2	0	0
28/06/2021	3a	MW	0815	1115	3	5	NNW	0	5	2	2	0	0
28/06/2021	3a	MW	1145	1445	1	5	NNW	0	4	2	2	0	0
28/06/2021	3a	MW	1145	1445	2	5	NNW	0	3	2	2	0	0
28/06/2021	3a	MW	1145	1445	3	5	NNW	0	3	2	2	0	0
26/07/2021	3a	MW	0730	1030	1	5	NW	0	8	2	2	0	0
26/07/2021	3a	MW	0730	1030	2	5	NW	0	8	2	2	0	0
26/07/2021	3a	MW	0730	1030	3	5	NW	0	8	2	2	0	0
26/07/2021	3a	MW	1100	1400	1	5	NW	0	8	2	2	0	0
26/07/2021	3a	MW	1100	1400	2	6	NW	0	8	2	2	0	0
26/07/2021	3a	MW	1100	1400	3	6	NW	0	8	2	2	0	0
16/08/2021	3a	MW	0800	1100	1	6	NW	0	8	2	2	0	0
16/08/2021	3a	MW	0800	1100	2	7	NW	3	8	2	2	0	0
16/08/2021	3a	MW	0800	1100	3	7	NW	0	8	2	2	0	0
16/08/2021	3a	MW	1130	1430	1	7	NW	3	8	2	2	0	0
16/08/2021	3a	MW	1130	1430	2	7	NW	0	8	2	2	0	0
16/08/2021	3a	MW	1130	1430	3	7	NW	0	8	2	2	0	0
31/03/2021	3a	MW	0815	1115	1	1	SW	0	7	2	2	0	0
31/03/2021	3a	MW	0815	1115	2	2	SSW	0	6	2	2	0	0
31/03/2021	3a	MW	0815	1115	3	3	S	0	6	2	2	0	0
31/03/2021	3a	MW	1145	1445	1	3	S	0	5	2	2	0	0
31/03/2021	3a	MW	1145	1445	2	3	SSE	0	5	2	2	0	0
31/03/2021	3a	MW	1145	1445	3	3	SSE	0	6	2	2	0	0
30/04/2021	3a	MW	0800	1100	1	2	NE	0	1	2	2	0	0
30/04/2021	3a	MW	0800	1100	2	3	NE	0	2	2	2	0	0
30/04/2021	3a	MW	0800	1100	3	4	NE	0	3	2	2	0	0
30/04/2021	3a	MW	1130	1430	1	5	NE	0	4	2	2	0	0
30/04/2021	3a	MW	1130	1430	2	5	NE	0	5	2	2	0	0
30/04/2021	3a	MW	1130	1430	3	5	NE	0	6	2	2	0	0
27/05/2021	3a	MW	0700	1000	1	2	SW	0	2	2	2	0	0
27/05/2021	3a	MW	0700	1000	2	2	SW	0	2	2	2	0	0
27/05/2021	3a	MW	0700	1000	3	2	SW	0	2	2	2	0	0
28/05/2021	3a	MW	0700	1000	1	5	SW	4	8	2	2	0	0

Date	VP	Observer	Survey start time	Survey finish time	Survey hour	Wind speed	Wind direction	Rain	Cloud cover	Cloud height	Visibility	Frost	Snow
28/05/2021	3a	MW	0700	1000	2	6	SW	4	8	2	2	0	0
28/05/2021	3a	MW	0700	1000	3	7	SW	4	8	2	2	0	0
28/06/2021	3a	MW	0815	1115	1	4	NNW	0	6	2	2	0	0
28/06/2021	3a	MW	0815	1115	2	4	NNW	0	5	2	2	0	0
28/06/2021	3a	MW	0815	1115	3	5	NNW	0	5	2	2	0	0
28/06/2021	3a	MW	1145	1445	1	5	NNW	0	4	2	2	0	0
28/06/2021	3a	MW	1145	1445	2	5	NNW	0	3	2	2	0	0
28/06/2021	3a	MW	1145	1445	3	5	NNW	0	3	2	2	0	0
26/07/2021	3a	MW	0730	1030	1	5	NW	0	8	2	2	0	0
26/07/2021	3a	MW	0730	1030	2	5	NW	0	8	2	2	0	0
26/07/2021	3a	MW	0730	1030	3	5	NW	0	8	2	2	0	0
26/07/2021	3a	MW	1100	1400	1	5	NW	0	8	2	2	0	0
26/07/2021	3a	MW	1100	1400	2	6	NW	0	8	2	2	0	0
26/07/2021	3a	MW	1100	1400	3	6	NW	0	8	2	2	0	0
16/08/2021	3a	MW	0800	1100	1	6	NW	0	8	2	2	0	0
16/08/2021	3a	MW	0800	1100	2	7	NW	3	8	2	2	0	0
16/08/2021	3a	MW	0800	1100	3	7	NW	0	8	2	2	0	0
16/08/2021	3a	MW	1130	1430	1	7	NW	3	8	2	2	0	0
16/08/2021	3a	MW	1130	1430	2	7	NW	0	8	2	2	0	0
16/08/2021	3a	MW	1130	1430	3	7	NW	0	8	2	2	0	0

C.2 Moorland Breeding Bird Surveys

Additional moorland breeding bird surveys were undertaken by MacArthur Green during the 2021 breeding season (refer to **Annex F** for those undertaken by AMEC between May and June 2012). **Table C-4** details survey dates and weather data recorded. Refer to **Annex B** for survey methodology and **Annex D** for survey results.

Table C-4 Meteorological conditions during breeding bird surveys at Larbrax Wind Farm (sorted chronologically)

Date	Survey visit	Observer	Survey start time	Survey finish time	Survey hour	Wind speed	Wind direction	Rain	Cloud cover	Cloud height	Visibility	Frost	Snow
29/04/2021	1	MW	0800	1400	1	1	NE	0	4	2	2	0	0
29/04/2021	1	MW	0800	1400	2	2	NE	0	4	2	2	0	0
29/04/2021	1	MW	0800	1400	3	3	NE	0	4	2	2	0	0
29/04/2021	1	MW	0800	1400	4	4	NE	0	4	2	2	0	0
29/04/2021	1	MW	0800	1400	5	5	NE	0	4	2	2	0	0
29/04/2021	1	MW	0800	1400	6	5	NE	0	4	2	2	0	0
26/05/2021	2	MW	0800	1400	1	5	NW	0	8	2	2	0	0
26/05/2021	2	MW	0800	1400	2	5	NW	0	8	2	2	0	0
26/05/2021	2	MW	0800	1400	3	5	NW	0	8	2	2	0	0
26/05/2021	2	MW	0800	1400	4	6	NNW	0	8	2	2	0	0
26/05/2021	2	MW	0800	1400	5	5	NNW	0	7	2	2	0	0
26/05/2021	2	MW	0800	1400	6	5	NNW	0	7	2	2	0	0
29/06/2021	3	MW	0800	1400	1	5	NNW	0	8	2	2	0	0
29/06/2021	3	MW	0800	1400	2	5	NNW	0	8	2	2	0	0
29/06/2021	3	MW	0800	1400	3	6	NNW	0	7	2	2	0	0
29/06/2021	3	MW	0800	1400	4	6	NNW	0	5	2	2	0	0
29/06/2021	3	MW	0800	1400	5	6	NNW	0	4	2	2	0	0
29/06/2021	3	MW	0800	1400	6	7	NNW	0	4	2	2	0	0
28/07/2021	4	MW	0700	1300	1	3	NW	0	6	2	2	0	0
28/07/2021	4	MW	0700	1300	2	3	NW	0	5	2	2	0	0
28/07/2021	4	MW	0700	1300	3	3	NW	0	5	2	2	0	0
28/07/2021	4	MW	0700	1300	4	3	NW	0	5	2	2	0	0
28/07/2021	4	MW	0700	1300	5	3	NW	0	5	2	2	0	0
28/07/2021	4	MW	0700	1300	6	3	NW	0	6	2	2	0	0
29/04/2021	1	MW	0800	1400	1	1	NE	0	4	2	2	0	0

Date	Survey visit	Observer	Survey start time	Survey finish time	Survey hour	Wind speed	Wind direction	Rain	Cloud cover	Cloud height	Visibility	Frost	Snow
29/04/2021	1	MW	0800	1400	2	2	NE	0	4	2	2	0	0
29/04/2021	1	MW	0800	1400	3	3	NE	0	4	2	2	0	0
29/04/2021	1	MW	0800	1400	4	4	NE	0	4	2	2	0	0
29/04/2021	1	MW	0800	1400	5	5	NE	0	4	2	2	0	0
29/04/2021	1	MW	0800	1400	6	5	NE	0	4	2	2	0	0
26/05/2021	2	MW	0800	1400	1	5	NW	0	8	2	2	0	0
26/05/2021	2	MW	0800	1400	2	5	NW	0	8	2	2	0	0
26/05/2021	2	MW	0800	1400	3	5	NW	0	8	2	2	0	0
26/05/2021	2	MW	0800	1400	4	6	NNW	0	8	2	2	0	0
26/05/2021	2	MW	0800	1400	5	5	NNW	0	7	2	2	0	0
26/05/2021	2	MW	0800	1400	6	5	NNW	0	7	2	2	0	0
29/06/2021	3	MW	0800	1400	1	5	NNW	0	8	2	2	0	0
29/06/2021	3	MW	0800	1400	2	5	NNW	0	8	2	2	0	0
29/06/2021	3	MW	0800	1400	3	6	NNW	0	7	2	2	0	0
29/06/2021	3	MW	0800	1400	4	6	NNW	0	5	2	2	0	0
29/06/2021	3	MW	0800	1400	5	6	NNW	0	4	2	2	0	0
29/06/2021	3	MW	0800	1400	6	7	NNW	0	4	2	2	0	0
28/07/2021	4	MW	0700	1300	1	3	NW	0	6	2	2	0	0
28/07/2021	4	MW	0700	1300	2	3	NW	0	5	2	2	0	0
28/07/2021	4	MW	0700	1300	3	3	NW	0	5	2	2	0	0
28/07/2021	4	MW	0700	1300	4	3	NW	0	5	2	2	0	0
28/07/2021	4	MW	0700	1300	5	3	NW	0	5	2	2	0	0
28/07/2021	4	MW	0700	1300	6	3	NW	0	6	2	2	0	0

C.3 Scarce Breeding Bird Surveys

Additional scarce breeding bird surveys were undertaken by MacArthur Green during the 2021 breeding season (refer to **Annex F** for those undertaken by AMEC between April and August 2013). **Table C-6** details survey dates and weather data recorded. Refer to **Annex B** for survey methodology and **Annex D** for survey results.

Table C-5 Meteorological conditions during scarce breeding bird surveys at Larbrax Wind Farm (sorted chronologically)

Date	Survey visit	Observer	Survey start time	Survey finish time	Survey hour	Wind speed	Wind direction	Rain	Cloud cover	Cloud height	Visibility	Frost	Snow
30/03/2021	1	MW	0730	1330	1	5	SW	0	8	2	2	0	0
30/03/2021	1	MW	0730	1330	2	5	SW	0	8	2	2	0	0
30/03/2021	1	MW	0730	1330	3	6	SW	0	8	2	2	0	0
30/03/2021	1	MW	0730	1330	4	6	SW	0	8	2	2	0	0
30/03/2021	1	MW	0730	1330	5	6	SW	0	7	2	2	0	0
30/03/2021	1	MW	0730	1330	6	6	SW	0	7	2	2	0	0
28/04/2021	2	MW	0800	1400	1	3	NE	0	4	2	2	0	0
28/04/2021	2	MW	0800	1400	2	4	NE	0	5	2	2	0	0
28/04/2021	2	MW	0800	1400	3	5	NE	0	5	2	2	0	0
28/04/2021	2	MW	0800	1400	4	5	NE	0	6	2	2	0	0
28/04/2021	2	MW	0800	1400	5	5	ENE	0	7	2	2	0	0
28/04/2021	2	MW	0800	1400	6	6	ENE	0	7	2	2	0	0
25/05/2021	3	MW	0600	1200	1	7	NNW	0	6	2	2	0	0
25/05/2021	3	MW	0600	1200	2	7	NNW	0	7	2	2	0	0
25/05/2021	3	MW	0600	1200	3	7	NNW	0	7	2	2	0	0
25/05/2021	3	MW	0600	1200	4	7	NNW	0	8	2	2	0	0
25/05/2021	3	MW	0600	1200	5	7	NNW	0	8	2	2	0	0
25/05/2021	3	MW	0600	1200	6	7	NNW	0	7	2	2	0	0
30/06/2021	4	MW	0800	1400	1	5	NNW	0	8	2	2	0	0
30/06/2021	4	MW	0800	1400	2	5	NNW	0	8	2	2	0	0
30/06/2021	4	MW	0800	1400	3	5	NNW	0	8	2	2	0	0
30/06/2021	4	MW	0800	1400	4	5	NNW	0	8	2	2	0	0

Date	Survey visit	Observer	Survey start time	Survey finish time	Survey hour	Wind speed	Wind direction	Rain	Cloud cover	Cloud height	Visibility	Frost	Snow
30/06/2021	4	MW	0800	1400	5	5	NNW	0	8	2	2	0	0
30/06/2021	4	MW	0800	1400	6	4	NNW	0	8	2	2	0	0
27/07/2021	5	MW	0800	1400	1	3	NNW	0	8	2	2	0	0
27/07/2021	5	MW	0800	1400	2	3	NNW	0	8	2	2	0	0
27/07/2021	5	MW	0800	1400	3	3	NW	0	5	2	2	0	0
27/07/2021	5	MW	0800	1400	4	3	NW	0	5	2	2	0	0
27/07/2021	5	MW	0800	1400	5	3	NW	0	4	2	2	0	0
27/07/2021	5	MW	0800	1400	6	3	NW	0	4	2	2	0	0
17/08/2021	6	MW	0730	1330	1	6	NW	0	8	2	2	0	0
17/08/2021	6	MW	0730	1330	2	7	NW	0	8	2	2	0	0
17/08/2021	6	MW	0730	1330	3	6	NW	0	8	2	2	0	0
17/08/2021	6	MW	0730	1330	4	7	NW	2	8	2	2	0	0
17/08/2021	6	MW	0730	1330	5	7	NW	0	8	2	2	0	0
17/08/2021	6	MW	0730	1330	6	7	NW	2	8	2	2	0	0

C.4 Black Grouse Surveys

Black surveys were undertaken during the 2021 breeding season. **Table C-7** details survey dates and weather data recorded. Refer to **Annex B** for survey methodology and **Annex D** for survey results.

Table C-6 Meteorological conditions during black grouse surveys at Larbrax Wind Farm (sorted chronologically)

Date	Survey visit	Observer	Survey start time	Survey finish time	Survey hour	Wind speed	Wind direction	Rain	Cloud cover	Cloud height	Visibility	Frost	Snow
27/05/2021	1	MW	0400	0700	1	1	SW	0	1	2	2	0	0
27/05/2021	1	MW	0400	0700	2	1	SW	0	1	2	2	0	0
27/05/2021	1	MW	0400	0700	3	1	SW	0	1	2	2	0	0
28/05/2021	1	MW	0400	0700	1	4	SW	4	8	2	2	0	0
28/05/2021	1	MW	0400	0700	2	4	SW	4	8	2	2	0	0
28/05/2021	1	MW	0400	0700	3	5	SW	4	8	2	2	0	0
27/05/2021	1	MW	0400	0700	1	1	SW	0	1	2	2	0	0
27/05/2021	1	MW	0400	0700	2	1	SW	0	1	2	2	0	0
27/05/2021	1	MW	0400	0700	3	1	SW	0	1	2	2	0	0
28/05/2021	1	MW	0400	0700	1	4	SW	4	8	2	2	0	0
28/05/2021	1	MW	0400	0700	2	4	SW	4	8	2	2	0	0
28/05/2021	1	MW	0400	0700	3	5	SW	4	8	2	2	0	0

ANNEX D. ORNITHOLOGICAL SURVEY RESULTS

D.1 Flight Activity Records: Target Species

Table D-1 and **Table D-2** provide all flights of target species recorded during flight activity surveys with a breakdown of the flight duration (seconds) established to be inside/outside the Collision Risk Analysis Area (CRAA). Refer to **Annex E** for detailed information relating to the collision modelling.

Table D-1 Details of target species recorded during flight activity surveys (sorted chronologically): 2012-2013

Date	VP	Observer	Flight start time	Species	No. of birds	Duration (s)	Inside CRAA (seconds)			Outside CRAA (seconds)		
							0-30m	31-130m	>130m	0-30m	31-130m	>130m
28/09/2012	3	A.D.Wood	1016	Curlew	5	47	47.00	0.00	0.00	0.00	0.00	0.00
28/09/2012	3	A.D.Wood	1039	Golden plover	1	51	0.00	51.00	0.00	0.00	0.00	0.00
28/09/2012	1	Jamie	1058	Curlew	2	8	7.83	0.00	0.00	0.17	0.00	0.00
28/09/2012	3	A.D.Wood	1100	Curlew	1	32	0.00	32.00	0.00	0.00	0.00	0.00
28/09/2012	3	A.D.Wood	1101	Curlew	2	14	14.00	0.00	0.00	0.00	0.00	0.00
28/09/2012	3	A.D.Wood	1105	Curlew	3	12	12.00	0.00	0.00	0.00	0.00	0.00
28/09/2012	3	A.D.Wood	1209	Curlew	7	28	28.00	0.00	0.00	0.00	0.00	0.00
28/09/2012	3	A.D.Wood	1357	Curlew	1	18	18.00	0.00	0.00	0.00	0.00	0.00
30/09/2012	2	Liz P	1012	Curlew	15	40	40.00	0.00	0.00	0.00	0.00	0.00
30/09/2012	2	Liz P	1015	Curlew	5	10	10.00	0.00	0.00	0.00	0.00	0.00
30/09/2012	2	Liz P	1132	Curlew	4	20	20.00	0.00	0.00	0.00	0.00	0.00
30/09/2012	2	Liz P	1214	Curlew	26	42	42.00	0.00	0.00	0.00	0.00	0.00
01/11/2012	2	A.D.Wood	1647	Merlin	1	18	18.00	0.00	0.00	0.00	0.00	0.00
02/11/2012	3	A.D.Wood	1031	Curlew	20	28	0.00	28.00	0.00	0.00	0.00	0.00
02/11/2012	3	A.D.Wood	1037	Curlew	1	35	15.00	20.00	0.00	0.00	0.00	0.00
02/11/2012	3	A.D.Wood	1057	Curlew	1	78	0.00	76.33	0.00	0.00	1.67	0.00
02/11/2012	2	Davy	1117	Curlew	1	16	16.00	0.00	0.00	0.00	0.00	0.00
02/11/2012	2	Davy	1125	Curlew	4	11	11.00	0.00	0.00	0.00	0.00	0.00
02/11/2012	1	Jamie	1130	Hen harrier	1	22	2.60	0.00	0.00	19.40	0.00	0.00
02/11/2012	1	Jamie	1136	Greylag goose	3	10	0.00	0.00	0.00	10.00	0.00	0.00
02/11/2012	3	A.D.Wood	1141	Curlew	1	16	0.00	16.00	0.00	0.00	0.00	0.00
02/11/2012	2	Davy	1152	Curlew	4	34	15.00	19.00	0.00	0.00	0.00	0.00
02/11/2012	3	A.D.Wood	1152	Lapwing	1	65	0.00	65.00	0.00	0.00	0.00	0.00
02/11/2012	3	A.D.Wood	1158	Lapwing	3	33	0.00	18.20	0.00	0.00	14.80	0.00
02/11/2012	2	Davy	1200	Lapwing	2	8	7.15	0.00	0.00	0.85	0.00	0.00
02/11/2012	1	Jamie	1211	Merlin	1	6	1.00	0.00	0.00	5.00	0.00	0.00
02/11/2012	3	A.D.Wood	1220	Curlew	31	18	11.83	0.00	0.00	6.17	0.00	0.00
02/11/2012	2	Davy	1252	Curlew	1	16	16.00	0.00	0.00	0.00	0.00	0.00
02/11/2012	2	Davy	1313	Curlew	5	18	18.00	0.00	0.00	0.00	0.00	0.00
02/11/2012	2	Davy	1316	Curlew	4	22	22.00	0.00	0.00	0.00	0.00	0.00
14/11/2012	1	Jamie	1151	Hen harrier	1	25	18.00	0.00	0.00	7.00	0.00	0.00
14/11/2012	3	Davy	1154	Hen harrier	1	65	65.00	0.00	0.00	0.00	0.00	0.00
14/11/2012	1	Jamie	1221	Hen harrier	1	4	4.00	0.00	0.00	0.00	0.00	0.00
14/11/2012	2	A.D.Wood	1222	Curlew	35	350	0.00	350.00	0.00	0.00	0.00	0.00
14/11/2012	2	A.D.Wood	1224	Lapwing	4	63	0.00	63.00	0.00	0.00	0.00	0.00
14/11/2012	2	A.D.Wood	1228	Hen harrier	1	35	21.91	0.00	0.00	13.09	0.00	0.00
14/11/2012	2	A.D.Wood	1309	Curlew	33	15	15.00	0.00	0.00	0.00	0.00	0.00
14/11/2012	3	Davy	1339	Curlew	11	34	34.00	0.00	0.00	0.00	0.00	0.00
14/11/2012	3	Davy	1445	Lapwing	6	56	0.00	56.00	0.00	0.00	0.00	0.00
14/11/2012	2	A.D.Wood	1622	Merlin	1	18	18.00	0.00	0.00	0.00	0.00	0.00
17/12/2012	1	Davy	1540	Hen harrier	1	135	30.37	0.00	0.00	104.63	0.00	0.00
18/12/2012	2	Davy	1024	Peregrine falcon	1	137	10.38	37.03	0.00	19.62	69.97	0.00
18/12/2012	2	Davy	1042	Curlew	8	26	26.00	0.00	0.00	0.00	0.00	0.00

Date	VP	Observer	Flight start time	Species	No. of birds	Duration (s)	Inside CRAA (seconds)			Outside CRAA (seconds)		
							0-30m	31-130m	>130m	0-30m	31-130m	>130m
18/12/2012	2	Davy	1052	Hen harrier	1	27	27.00	0.00	0.00	0.00	0.00	0.00
18/12/2012	2	Davy	1103	Curlew	1	48	48.00	0.00	0.00	0.00	0.00	0.00
18/12/2012	2	Davy	1140	Lapwing	1	123	45.00	78.00	0.00	0.00	0.00	0.00
18/12/2012	3	A.D.Wood	1144	Whooper swan	15	100	0.00	0.00	0.00	100.00	0.00	0.00
18/12/2012	3	A.D.Wood	1224	Whooper swan	2	85	0.00	78.18	0.00	0.00	6.82	0.00
18/12/2012	1	Davy	1305	Lapwing	1	60	34.81	0.00	0.00	25.19	0.00	0.00
18/12/2012	3	A.D.Wood	1305	Lapwing	1	29	0.00	29.00	0.00	0.00	0.00	0.00
18/12/2012	3	A.D.Wood	1333	Golden plover	1	35	0.00	33.13	0.00	0.00	1.87	0.00
18/12/2012	1	Davy	1340	Hen harrier	1	10	0.00	0.00	0.00	10.00	0.00	0.00
18/12/2012	3	A.D.Wood	1340	Hen harrier	1	79	75.58	0.00	0.00	3.42	0.00	0.00
18/12/2012	1	Davy	1342	Hen harrier	1	86	0.00	0.00	0.00	86.00	0.00	0.00
18/12/2012	1	Davy	1451	Greylag goose	9	51	0.00	0.00	0.00	0.00	51.00	0.00
18/12/2012	3	A.D.Wood	1459	Lapwing	1	36	0.00	36.00	0.00	0.00	0.00	0.00
18/12/2012	1	Davy	1519	Hen harrier	1	40	2.51	0.00	0.00	37.49	0.00	0.00
20/12/2012	2	A.D.Wood	1356	Curlew	1	25	0.00	25.00	0.00	0.00	0.00	0.00
20/12/2012	2	A.D.Wood	1526	Lapwing	1	22	22.00	0.00	0.00	0.00	0.00	0.00
23/01/2013	2	Davy	1610	Hen harrier	1	88	88.00	0.00	0.00	0.00	0.00	0.00
23/01/2013	1	Jamie	1613	Hen harrier	1	17	0.62	0.00	0.00	16.38	0.00	0.00
24/01/2013	2	Davy	1303	Lapwing	1	2	2.00	0.00	0.00	0.00	0.00	0.00
24/01/2013	2	Davy	1330	Lapwing	4	42	42.00	0.00	0.00	0.00	0.00	0.00
24/01/2013	3	A.D.Wood	1332	Lapwing	4	16	16.00	0.00	0.00	0.00	0.00	0.00
24/01/2013	3	A.D.Wood	1343	Lapwing	5	17	17.00	0.00	0.00	0.00	0.00	0.00
21/02/2013	1	Jamie	0716	Short-eared owl	1	28	0.00	0.00	0.00	28.00	0.00	0.00
21/02/2013	1	Jamie	0734	Barn owl	1	5	0.00	0.00	0.00	5.00	0.00	0.00
21/02/2013	1	Jamie	0754	Barn owl	1	12	12.00	0.00	0.00	0.00	0.00	0.00
21/02/2013	2	Davy	0855	Curlew	15	169	169.00	0.00	0.00	0.00	0.00	0.00
21/02/2013	2	Davy	0855	Curlew	15	70	10.00	60.00	0.00	0.00	0.00	0.00
21/02/2013	2	Davy	0856	Curlew	24	16	16.00	0.00	0.00	0.00	0.00	0.00
21/02/2013	2	Davy	0941	Golden plover	25	181	120.00	61.00	0.00	0.00	0.00	0.00
21/02/2013	3	A.D.Wood	0944	Golden plover	25	16	16.00	0.00	0.00	0.00	0.00	0.00
21/02/2013	3	A.D.Wood	1531	Lapwing	1	16	0.00	16.00	0.00	0.00	0.00	0.00
22/02/2013	3	A.D.Wood	0945	Hen harrier	1	38	38.00	0.00	0.00	0.00	0.00	0.00
22/02/2013	2	Davy	1009	Curlew	6	22	22.00	0.00	0.00	0.00	0.00	0.00
03/04/2013	2	Davy	1559	Curlew	1	42	42.00	0.00	0.00	0.00	0.00	0.00
03/04/2013	1	Jamie	1616	Peregrine falcon	1	69	0.00	15.00	54.00	0.00	0.00	0.00
03/04/2013	1	Jamie	1659	Curlew	17	14	0.00	0.00	0.00	14.00	0.00	0.00
03/04/2013	1	Jamie	1701	Curlew	2	4	2.98	0.00	0.00	1.02	0.00	0.00
03/04/2013	3	A.D.Wood	1701	Curlew	5	48	0.00	48.00	0.00	0.00	0.00	0.00
03/04/2013	3	A.D.Wood	1730	Curlew	1	46	0.00	46.00	0.00	0.00	0.00	0.00
03/04/2013	3	A.D.Wood	1733	Curlew	2	16	16.00	0.00	0.00	0.00	0.00	0.00
04/04/2013	3	Davy	1109	Curlew	1	43	43.00	0.00	0.00	0.00	0.00	0.00
04/04/2013	2	A.D.Wood	1111	Curlew	2	38	23.00	15.00	0.00	0.00	0.00	0.00
04/04/2013	3	Davy	1157	Merlin	1	19	19.00	0.00	0.00	0.00	0.00	0.00
04/04/2013	2	A.D.Wood	1207	Peregrine falcon	1	7	6.93	0.00	0.00	0.07	0.00	0.00
04/04/2013	3	Davy	1240	Curlew	1	17	6.21	0.00	0.00	10.79	0.00	0.00
04/04/2013	1	Jamie	1242	Curlew	1	8	0.00	0.00	0.00	8.00	0.00	0.00
04/04/2013	3	Davy	1445	Lapwing	27	14	0.00	0.00	0.00	14.00	0.00	0.00
04/04/2013	3	Davy	1447	Lapwing	1	16	16.00	0.00	0.00	0.00	0.00	0.00
04/04/2013	3	Davy	1448	Lapwing	1	25	25.00	0.00	0.00	0.00	0.00	0.00
04/04/2013	3	Davy	1453	Lapwing	1	30	12.76	12.76	0.00	2.24	2.24	0.00
04/04/2013	3	Davy	1454	Lapwing	8	53	3.29	0.00	0.00	49.71	0.00	0.00

Date	VP	Observer	Flight start time	Species	No. of birds	Duration (s)	Inside CRAA (seconds)			Outside CRAA (seconds)		
							0-30m	31-130m	>130m	0-30m	31-130m	>130m
04/04/2013	2	A.D.Wood	1547	Curlew	8	18	18.00	0.00	0.00	0.00	0.00	0.00
04/04/2013	2	A.D.Wood	1610	Curlew	8	18	18.00	0.00	0.00	0.00	0.00	0.00
04/04/2013	3	Davy	1618	Lapwing	1	41	41.00	0.00	0.00	0.00	0.00	0.00
04/04/2013	3	Davy	1624	Lapwing	1	51	24.79	0.00	0.00	26.21	0.00	0.00
04/04/2013	1	Jamie	1627	Lapwing	1	4	0.00	0.00	0.00	4.00	0.00	0.00
04/04/2013	2	A.D.Wood	1635	Curlew	8	19	19.00	0.00	0.00	0.00	0.00	0.00
24/04/2013	3a	Davy	1516	Lapwing	1	9	9.00	0.00	0.00	0.00	0.00	0.00
24/04/2013	2a	Jamie	1521	Lapwing	1	63	0.00	0.00	0.00	63.00	0.00	0.00
24/04/2013	2a	Jamie	1525	Curlew	1	3	0.00	0.00	0.00	3.00	0.00	0.00
24/04/2013	3a	Davy	1525	Curlew	1	27	27.00	0.00	0.00	0.00	0.00	0.00
24/04/2013	3a	Davy	1536	Greylag goose	3	27	16.92	0.00	0.00	10.08	0.00	0.00
24/04/2013	2a	Jamie	1541	Lapwing	1	3	3.00	0.00	0.00	0.00	0.00	0.00
24/04/2013	2a	Jamie	1602	Curlew	1	2	1.47	0.00	0.00	0.53	0.00	0.00
24/04/2013	2a	Jamie	1607	Curlew	1	23	11.06	0.00	0.00	11.94	0.00	0.00
24/04/2013	3a	Davy	1612	Lapwing	1	24	24.00	0.00	0.00	0.00	0.00	0.00
24/04/2013	1a	A.D.Wood	1623	Lapwing	1	8	6.66	0.00	0.00	1.34	0.00	0.00
24/04/2013	3a	Davy	1625	Curlew	1	4	3.07	0.00	0.00	0.93	0.00	0.00
24/04/2013	2a	Jamie	1630	Greylag goose	3	5	5.00	0.00	0.00	0.00	0.00	0.00
24/04/2013	3a	Davy	1657	Lapwing	1	100	100.00	0.00	0.00	0.00	0.00	0.00
24/04/2013	2a	Jamie	1703	Curlew	1	27	6.21	0.00	0.00	20.79	0.00	0.00
24/04/2013	2a	Jamie	1709	Lapwing	1	17	0.00	0.00	0.00	17.00	0.00	0.00
24/04/2013	3a	Davy	1711	Curlew	1	38	38.00	0.00	0.00	0.00	0.00	0.00
25/04/2013	1a	Jamie	1005	Lapwing	4	8	8.00	0.00	0.00	0.00	0.00	0.00
25/04/2013	1a	Jamie	1441	Lapwing	2	3	3.00	0.00	0.00	0.00	0.00	0.00
25/04/2013	2a	A.D.Wood	1509	Greylag goose	2	44	8.54	0.00	0.00	35.46	0.00	0.00
25/04/2013	3a	Davy	1529	Lapwing	1	9	7.99	0.00	0.00	1.01	0.00	0.00
25/04/2013	2a	A.D.Wood	1531	Lapwing	1	40	17.35	0.00	0.00	22.65	0.00	0.00
25/04/2013	2a	A.D.Wood	1535	Lapwing	2	56	56.00	0.00	0.00	0.00	0.00	0.00
25/04/2013	3a	Davy	1630	Lapwing	1	47	47.00	0.00	0.00	0.00	0.00	0.00
25/04/2013	3a	Davy	1643	Lapwing	1	21	21.00	0.00	0.00	0.00	0.00	0.00
25/04/2013	2a	A.D.Wood	1713	Curlew	2	29	19.50	0.00	0.00	9.50	0.00	0.00
25/04/2013	2a	A.D.Wood	1714	Curlew	1	7	4.80	0.00	0.00	2.20	0.00	0.00
25/04/2013	3a	Davy	1718	Hen harrier	1	166	71.53	84.71	0.00	4.47	5.29	0.00
25/04/2013	2a	A.D.Wood	1724	Lapwing	1	16	0.00	0.00	0.00	16.00	0.00	0.00
25/04/2013	1a	Jamie	1725	Lapwing	2	125	125.00	0.00	0.00	0.00	0.00	0.00
26/04/2013	3a	Davy	0953	Curlew	1	42	42.00	0.00	0.00	0.00	0.00	0.00
26/04/2013	2a	A.D.Wood	1014	Greylag goose	2	33	4.75	0.00	0.00	28.25	0.00	0.00
26/04/2013	2a	A.D.Wood	1044	Greylag goose	1	26	3.88	0.00	0.00	22.12	0.00	0.00
26/04/2013	3a	Davy	1110	Curlew	1	16	16.00	0.00	0.00	0.00	0.00	0.00
26/04/2013	3a	Davy	1130	Curlew	1	31	31.00	0.00	0.00	0.00	0.00	0.00
26/04/2013	3a	Davy	1130	Lapwing	1	12	12.00	0.00	0.00	0.00	0.00	0.00
26/04/2013	3a	Davy	1146	Lapwing	1	37	30.55	0.00	0.00	6.45	0.00	0.00
26/04/2013	3a	Davy	1149	Curlew	1	22	22.00	0.00	0.00	0.00	0.00	0.00
26/04/2013	2a	Jamie	1150	Lapwing	2	6	0.00	0.00	0.00	6.00	0.00	0.00
26/04/2013	3a	Davy	1156	Curlew	1	157	15.00	142.00	0.00	0.00	0.00	0.00
26/04/2013	2a	Jamie	1206	Lapwing	1	4	3.03	0.00	0.00	0.97	0.00	0.00
26/04/2013	2a	Jamie	1224	Lapwing	4	28	28.00	0.00	0.00	0.00	0.00	0.00
26/04/2013	2a	Jamie	1227	Greylag goose	2	5	0.00	0.00	0.00	5.00	0.00	0.00
26/04/2013	2a	Jamie	1227	Greylag goose	2	17	0.00	0.00	0.00	17.00	0.00	0.00
26/04/2013	3a	Davy	1233	Lapwing	1	98	98.00	0.00	0.00	0.00	0.00	0.00
26/04/2013	3a	Davy	1247	Curlew	1	17	12.48	0.00	0.00	4.52	0.00	0.00

Date	VP	Observer	Flight start time	Species	No. of birds	Duration (s)	Inside CRAA (seconds)			Outside CRAA (seconds)		
							0-30m	31-130m	>130m	0-30m	31-130m	>130m
26/04/2013	3a	Davy	1252	Curlew	1	21	18.83	0.00	0.00	2.17	0.00	0.00
14/05/2013	3a	Davy	0544	Curlew	1	1	1.00	0.00	0.00	0.00	0.00	0.00
14/05/2013	3a	Davy	0544	Greylag goose	2	28	23.43	0.00	0.00	4.57	0.00	0.00
14/05/2013	3a	Davy	0545	Lapwing	2	8	8.00	0.00	0.00	0.00	0.00	0.00
14/05/2013	3a	Davy	0547	Curlew	1	30	30.00	0.00	0.00	0.00	0.00	0.00
14/05/2013	3a	Davy	0556	Curlew	1	105	99.50	0.00	0.00	5.50	0.00	0.00
14/05/2013	1a	A.D.Wood	0558	Curlew	1	69	5.10	3.92	0.00	33.90	26.08	0.00
14/05/2013	2a	Jamie	0559	Curlew	1	8	0.00	0.00	0.00	8.00	0.00	0.00
14/05/2013	1a	A.D.Wood	0601	Curlew	1	31	0.00	24.98	0.00	0.00	6.02	0.00
14/05/2013	2a	Jamie	0602	Curlew	1	23	0.00	0.00	0.00	23.00	0.00	0.00
14/05/2013	3a	Davy	0604	Curlew	1	85	19.72	10.75	0.00	35.28	19.25	0.00
14/05/2013	3a	Davy	0608	Curlew	1	48	2.81	42.09	0.00	0.19	2.91	0.00
14/05/2013	2a	Jamie	0610	Curlew	1	14	13.50	0.00	0.00	0.50	0.00	0.00
14/05/2013	3a	Davy	0637	Curlew	1	33	33.00	0.00	0.00	0.00	0.00	0.00
14/05/2013	1a	A.D.Wood	0640	Curlew	1	16	0.00	0.00	0.00	16.00	0.00	0.00
14/05/2013	2a	Jamie	0640	Curlew	1	34	31.35	0.00	0.00	2.65	0.00	0.00
14/05/2013	3a	Davy	0641	Greylag goose	1	26	25.07	0.00	0.00	0.93	0.00	0.00
14/05/2013	2a	A.D.Wood	1022	Curlew	1	28	0.00	16.66	0.00	0.00	11.34	0.00
14/05/2013	2a	A.D.Wood	1022	Lapwing	1	79	27.26	20.60	0.00	17.74	13.40	0.00
14/05/2013	2a	Jamie	1023	Lapwing	1	21	0.00	0.00	0.00	21.00	0.00	0.00
14/05/2013	2a	A.D.Wood	1032	Curlew	1	17	0.00	6.58	0.00	0.00	10.42	0.00
14/05/2013	2a	Jamie	1036	Curlew	1	18	12.79	0.00	0.00	5.21	0.00	0.00
14/05/2013	3a	Davy	1044	Merlin	1	56	56.00	0.00	0.00	0.00	0.00	0.00
14/05/2013	2a	A.D.Wood	1059	Lapwing	3	72	0.00	33.44	0.00	0.00	38.56	0.00
14/05/2013	2a	Jamie	1100	Lapwing	1	3	0.00	0.00	0.00	3.00	0.00	0.00
14/05/2013	3a	Davy	1100	Lapwing	1	38	0.00	38.00	0.00	0.00	0.00	0.00
14/05/2013	2a	Jamie	1101	Lapwing	1	16	10.23	0.00	0.00	5.77	0.00	0.00
14/05/2013	2a	A.D.Wood	1102	Lapwing	1	305	87.50	193.42	0.00	7.50	16.58	0.00
14/05/2013	3a	Davy	1109	Lapwing	1	115	40.00	75.00	0.00	0.00	0.00	0.00
14/05/2013	2a	A.D.Wood	1110	Lapwing	2	175	158.80	0.00	0.00	16.20	0.00	0.00
14/05/2013	3a	Davy	1129	Lapwing	1	33	18.00	15.00	0.00	0.00	0.00	0.00
14/05/2013	2a	Jamie	1143	Lapwing	1	19	12.21	0.00	0.00	6.79	0.00	0.00
14/05/2013	2a	Jamie	1220	Curlew	1	28	16.59	0.00	0.00	11.41	0.00	0.00
14/05/2013	3a	Davy	1220	Curlew	1	10	10.00	0.00	0.00	0.00	0.00	0.00
14/05/2013	2a	A.D.Wood	1224	Curlew	1	62	47.00	15.00	0.00	0.00	0.00	0.00
14/05/2013	2a	Jamie	1228	Curlew	1	16	9.43	0.00	0.00	6.57	0.00	0.00
14/05/2013	3a	Davy	1235	Curlew	1	40	40.00	0.00	0.00	0.00	0.00	0.00
14/05/2013	3a	Davy	1324	Curlew	2	19	19.00	0.00	0.00	0.00	0.00	0.00
14/05/2013	3a	Davy	1330	Curlew	1	13	13.00	0.00	0.00	0.00	0.00	0.00
14/05/2013	2a	Jamie	1352	Curlew	1	3	1.50	0.00	0.00	1.50	0.00	0.00
14/05/2013	2a	Jamie	1355	Greylag goose	1	4	0.00	0.00	0.00	4.00	0.00	0.00
14/05/2013	1a	A.D.Wood	1400	Curlew	1	16	8.58	0.00	0.00	7.42	0.00	0.00
14/05/2013	2a	Jamie	1405	Curlew	1	15	14.86	0.00	0.00	0.14	0.00	0.00
14/05/2013	3a	Davy	1405	Lapwing	1	29	29.00	0.00	0.00	0.00	0.00	0.00
14/05/2013	2a	Jamie	1406	Lapwing	2	65	28.57	33.33	0.00	1.43	1.67	0.00
14/05/2013	3a	Davy	1407	Lapwing	2	73	73.00	0.00	0.00	0.00	0.00	0.00
14/05/2013	1a	A.D.Wood	1420	Curlew	1	7	7.00	0.00	0.00	0.00	0.00	0.00
14/05/2013	3a	Davy	1426	Curlew	2	58	58.00	0.00	0.00	0.00	0.00	0.00
14/05/2013	2a	Jamie	1427	Curlew	1	4	0.00	0.00	0.00	4.00	0.00	0.00
14/05/2013	1a	A.D.Wood	1429	Curlew	1	65	22.80	6.84	0.00	27.20	8.16	0.00
14/05/2013	2a	Jamie	1431	Curlew	2	48	0.00	0.00	0.00	33.00	15.00	0.00

Date	VP	Observer	Flight start time	Species	No. of birds	Duration (s)	Inside CRAA (seconds)			Outside CRAA (seconds)		
							0-30m	31-130m	>130m	0-30m	31-130m	>130m
14/05/2013	3a	Davy	1438	Curlew	1	28	28.00	0.00	0.00	0.00	0.00	0.00
14/05/2013	3a	Davy	1438	Curlew	1	7	7.00	0.00	0.00	0.00	0.00	0.00
14/05/2013	1a	A.D.Wood	1439	Curlew	1	76	0.00	0.00	0.00	31.00	45.00	0.00
14/05/2013	2a	Jamie	1442	Curlew	1	8	0.00	0.00	0.00	8.00	0.00	0.00
15/05/2013	2a	Jamie	0655	Lapwing	1	3	3.00	0.00	0.00	0.00	0.00	0.00
15/05/2013	1a	A.D.Wood	0710	Curlew	1	18	0.00	0.00	0.00	18.00	0.00	0.00
15/05/2013	2a	Jamie	0715	Lapwing	1	72	0.00	0.00	0.00	30.00	42.00	0.00
15/05/2013	1a	A.D.Wood	0728	Curlew	1	8	3.82	0.00	0.00	4.18	0.00	0.00
15/05/2013	2a	Jamie	0728	Curlew	1	28	13.69	0.00	0.00	14.31	0.00	0.00
15/05/2013	2a	Jamie	0742	Curlew	1	102	78.74	13.58	0.00	8.26	1.42	0.00
15/05/2013	1a	A.D.Wood	0800	Curlew	1	6	6.00	0.00	0.00	0.00	0.00	0.00
15/05/2013	1a	A.D.Wood	0809	Curlew	1	8	8.00	0.00	0.00	0.00	0.00	0.00
15/05/2013	2a	Jamie	0809	Curlew	1	26	2.61	0.00	0.00	23.39	0.00	0.00
15/05/2013	2a	Jamie	0836	Lapwing	1	16	16.00	0.00	0.00	0.00	0.00	0.00
15/05/2013	3a	Davy	0840	Curlew	1	11	11.00	0.00	0.00	0.00	0.00	0.00
15/05/2013	3a	Davy	0848	Curlew	1	12	12.00	0.00	0.00	0.00	0.00	0.00
15/05/2013	2a	Jamie	0849	Lapwing	1	3	0.00	0.00	0.00	3.00	0.00	0.00
15/05/2013	1a	A.D.Wood	0855	Curlew	1	22	13.14	0.00	0.00	8.86	0.00	0.00
15/05/2013	3a	Davy	0858	Curlew	1	65	35.00	30.00	0.00	0.00	0.00	0.00
15/05/2013	2a	Jamie	0906	Lapwing	1	22	11.88	0.00	0.00	10.12	0.00	0.00
15/05/2013	1a	A.D.Wood	0907	Curlew	1	18	18.00	0.00	0.00	0.00	0.00	0.00
15/05/2013	3a	Davy	0916	Curlew	1	37	37.00	0.00	0.00	0.00	0.00	0.00
15/05/2013	1a	A.D.Wood	0922	Curlew	1	16	16.00	0.00	0.00	0.00	0.00	0.00
15/05/2013	2a	Jamie	0937	Lapwing	1	23	16.74	0.00	0.00	6.26	0.00	0.00
20/05/2013	2a	Jamie	1346	Lapwing	1	166	166.00	0.00	0.00	0.00	0.00	0.00
20/05/2013	1a	Davy	1356	Curlew	1	13	1.31	0.00	0.00	11.69	0.00	0.00
20/05/2013	3a	A.D.Wood	1358	Lapwing	1	8	8.00	0.00	0.00	0.00	0.00	0.00
20/05/2013	2a	Jamie	1403	Lapwing	1	6	6.00	0.00	0.00	0.00	0.00	0.00
20/05/2013	1a	Davy	1405	Lapwing	1	37	0.00	0.00	0.00	37.00	0.00	0.00
20/05/2013	3a	A.D.Wood	1408	Curlew	1	21	21.00	0.00	0.00	0.00	0.00	0.00
20/05/2013	3a	A.D.Wood	1409	Greylag goose	2	16	16.00	0.00	0.00	0.00	0.00	0.00
20/05/2013	3a	A.D.Wood	1420	Curlew	1	17	7.25	0.00	0.00	9.75	0.00	0.00
20/05/2013	2a	Jamie	1441	Curlew	1	9	0.00	0.00	0.00	9.00	0.00	0.00
20/05/2013	2a	Jamie	1445	Lapwing	1	31	31.00	0.00	0.00	0.00	0.00	0.00
20/05/2013	3a	A.D.Wood	1451	Curlew	1	9	9.00	0.00	0.00	0.00	0.00	0.00
20/05/2013	1a	Davy	1451	Whimbrel	6	65	0.00	0.00	0.00	65.00	0.00	0.00
20/05/2013	3a	A.D.Wood	1451	Whimbrel	4	9	9.00	0.00	0.00	0.00	0.00	0.00
20/05/2013	3a	A.D.Wood	1453	Curlew	1	33	33.00	0.00	0.00	0.00	0.00	0.00
20/05/2013	3a	A.D.Wood	1459	Curlew	1	22	0.00	22.00	0.00	0.00	0.00	0.00
20/05/2013	1a	Davy	1459	Lapwing	1	18	0.00	0.00	0.00	18.00	0.00	0.00
20/05/2013	3a	A.D.Wood	1459	Whimbrel	4	22	0.00	22.00	0.00	0.00	0.00	0.00
20/05/2013	2a	Jamie	1509	Curlew	1	5	0.00	0.00	0.00	5.00	0.00	0.00
20/05/2013	3a	A.D.Wood	1512	Lapwing	1	48	48.00	0.00	0.00	0.00	0.00	0.00
20/05/2013	2a	Jamie	1513	Curlew	1	19	19.00	0.00	0.00	0.00	0.00	0.00
20/05/2013	3a	A.D.Wood	1513	Lapwing	3	51	0.00	41.64	0.00	0.00	9.36	0.00
20/05/2013	1a	Davy	1515	Lapwing	1	94	0.00	0.00	0.00	94.00	0.00	0.00
20/05/2013	1a	Davy	1519	Lapwing	1	52	23.34	9.46	0.00	13.66	5.54	0.00
20/05/2013	2a	Jamie	1523	Curlew	2	14	0.00	0.00	0.00	14.00	0.00	0.00
20/05/2013	2a	Jamie	1531	Greylag goose	2	17	0.00	0.00	0.00	17.00	0.00	0.00
20/05/2013	2a	Jamie	1533	Curlew	1	47	7.67	0.00	0.00	39.33	0.00	0.00
20/05/2013	2a	Jamie	1541	Lapwing	3	23	0.00	0.00	0.00	23.00	0.00	0.00

Date	VP	Observer	Flight start time	Species	No. of birds	Duration (s)	Inside CRAA (seconds)			Outside CRAA (seconds)		
							0-30m	31-130m	>130m	0-30m	31-130m	>130m
20/05/2013	2a	Jamie	1602	Curlew	1	27	0.00	0.00	0.00	27.00	0.00	0.00
20/05/2013	3a	A.D.Wood	1602	Lapwing	1	82	52.00	30.00	0.00	0.00	0.00	0.00
20/05/2013	1a	Davy	1612	Lapwing	1	24	0.00	0.00	0.00	0.00	24.00	0.00
20/05/2013	1a	Davy	1617	Lapwing	1	60	60.00	0.00	0.00	0.00	0.00	0.00
20/05/2013	1a	Davy	1940	Peregrine falcon	1	148	103.51	0.00	0.00	44.49	0.00	0.00
20/05/2013	3a	A.D.Wood	2005	Curlew	1	17	12.72	0.00	0.00	4.28	0.00	0.00
20/05/2013	2a	Jamie	2008	Curlew	2	17	13.07	0.00	0.00	3.93	0.00	0.00
20/05/2013	2a	Jamie	2022	Curlew	1	2	0.00	0.00	0.00	2.00	0.00	0.00
20/05/2013	2a	Jamie	2053	Curlew	1	6	0.00	0.00	0.00	6.00	0.00	0.00
20/05/2013	3a	A.D.Wood	2127	Curlew	1	21	21.00	0.00	0.00	0.00	0.00	0.00
20/05/2013	1a	Davy	2137	Whimbrel	1	85	0.00	58.83	0.00	0.00	26.17	0.00
21/05/2013	2a	Jamie	0909	Curlew	2	13	0.00	0.00	0.00	13.00	0.00	0.00
21/05/2013	1a	Davy	0912	Lapwing	1	43	0.00	0.00	0.00	13.00	30.00	0.00
21/05/2013	3a	A.D.Wood	0912	Lapwing	1	41	15.00	26.00	0.00	0.00	0.00	0.00
21/05/2013	2a	Jamie	0913	Greylag goose	2	11	0.00	0.00	0.00	11.00	0.00	0.00
21/05/2013	1a	Davy	0938	Whimbrel	7	16	0.00	0.00	0.00	0.00	16.00	0.00
21/05/2013	1a	Davy	0945	Lapwing	1	26	26.00	0.00	0.00	0.00	0.00	0.00
21/05/2013	2a	Jamie	0948	Lapwing	1	14	0.00	0.00	0.00	14.00	0.00	0.00
21/05/2013	1a	Davy	0949	Whimbrel	10	39	0.00	0.00	0.00	24.00	15.00	0.00
21/05/2013	1a	Davy	0953	Lapwing	1	38	38.00	0.00	0.00	0.00	0.00	0.00
21/05/2013	3a	A.D.Wood	1000	Greylag goose	2	6	6.00	0.00	0.00	0.00	0.00	0.00
21/05/2013	2a	Jamie	1008	Lapwing	1	17	0.00	0.00	0.00	17.00	0.00	0.00
21/05/2013	2a	Jamie	1110	Lapwing	1	10	0.00	0.00	0.00	10.00	0.00	0.00
21/05/2013	2a	Jamie	1112	Curlew	1	33	0.00	0.00	0.00	33.00	0.00	0.00
21/05/2013	3a	A.D.Wood	1117	Curlew	1	17	17.00	0.00	0.00	0.00	0.00	0.00
21/05/2013	1a	Davy	1128	Lapwing	1	194	0.00	0.00	0.00	194.00	0.00	0.00
21/05/2013	3a	A.D.Wood	1128	Lapwing	1	187	127.00	60.00	0.00	0.00	0.00	0.00
21/05/2013	1a	Davy	1135	Lapwing	1	164	0.00	0.00	0.00	149.00	15.00	0.00
21/05/2013	1a	Davy	1139	Curlew	1	53	29.10	0.00	0.00	23.90	0.00	0.00
21/05/2013	2a	Jamie	1145	Lapwing	1	6	1.22	0.00	0.00	4.78	0.00	0.00
21/05/2013	1a	Davy	1151	Lapwing	1	38	37.48	0.00	0.00	0.52	0.00	0.00
21/05/2013	2a	Jamie	1151	Whimbrel	7	29	0.00	0.00	0.00	29.00	0.00	0.00
21/05/2013	3a	A.D.Wood	1153	Curlew	1	31	31.00	0.00	0.00	0.00	0.00	0.00
21/05/2013	1a	Davy	1157	Lapwing	1	135	0.00	0.00	0.00	90.00	45.00	0.00
21/05/2013	3a	A.D.Wood	1158	Lapwing	1	35	0.00	0.00	0.00	35.00	0.00	0.00
21/05/2013	3a	A.D.Wood	1446	Lapwing	1	22	0.00	5.62	0.00	0.00	16.38	0.00
21/05/2013	3a	A.D.Wood	1448	Lapwing	4	46	0.00	46.00	0.00	0.00	0.00	0.00
21/05/2013	1a	Davy	1450	Lapwing	2	11	0.00	0.00	0.00	11.00	0.00	0.00
21/05/2013	1a	Davy	1451	Lapwing	1	53	53.00	0.00	0.00	0.00	0.00	0.00
21/05/2013	2a	Jamie	1453	Lapwing	2	35	2.48	0.00	0.00	32.52	0.00	0.00
21/05/2013	2a	Jamie	1500	Lapwing	1	108	0.00	0.00	0.00	108.00	0.00	0.00
21/05/2013	2a	Jamie	1507	Whimbrel	7	11	0.00	0.00	0.00	11.00	0.00	0.00
21/05/2013	2a	Jamie	1526	Lapwing	2	94	0.00	52.29	0.00	0.00	41.71	0.00
21/05/2013	1a	Davy	1530	Curlew	1	67	14.34	0.00	0.00	52.66	0.00	0.00
21/05/2013	3a	A.D.Wood	1531	Curlew	1	35	35.00	0.00	0.00	0.00	0.00	0.00
21/05/2013	2a	Jamie	1535	Whimbrel	8	16	0.00	0.00	0.00	16.00	0.00	0.00
21/05/2013	2a	Jamie	1540	Curlew	2	55	10.58	0.00	0.00	44.42	0.00	0.00
21/05/2013	3a	A.D.Wood	1551	Curlew	1	16	13.92	0.00	0.00	2.08	0.00	0.00
21/05/2013	3a	A.D.Wood	1551	Curlew	1	16	15.02	0.00	0.00	0.98	0.00	0.00
21/05/2013	2a	Jamie	1552	Curlew	2	62	0.00	0.00	0.00	62.00	0.00	0.00
21/05/2013	3a	A.D.Wood	1557	Lapwing	1	35	0.00	0.00	0.00	35.00	0.00	0.00

Date	VP	Observer	Flight start time	Species	No. of birds	Duration (s)	Inside CRAA (seconds)			Outside CRAA (seconds)		
							0-30m	31-130m	>130m	0-30m	31-130m	>130m
21/05/2013	3a	A.D.Wood	1557	Lapwing	1	35	11.59	0.00	0.00	23.41	0.00	0.00
21/05/2013	1a	Davy	1614	Lapwing	1	100	1.05	0.45	0.00	68.95	29.55	0.00
21/05/2013	1a	Davy	1623	Curlew	1	26	0.00	0.00	0.00	26.00	0.00	0.00
21/05/2013	3a	A.D.Wood	1623	Curlew	1	91	0.00	55.63	0.00	0.00	35.37	0.00
21/05/2013	3a	A.D.Wood	1623	Curlew	1	91	0.00	60.06	0.00	0.00	30.94	0.00
21/05/2013	3a	A.D.Wood	1630	Lapwing	1	35	12.64	0.00	0.00	22.36	0.00	0.00
21/05/2013	3a	A.D.Wood	1630	Lapwing	1	35	19.12	0.00	0.00	15.88	0.00	0.00
21/05/2013	2a	Jamie	1633	Lapwing	2	8	8.00	0.00	0.00	0.00	0.00	0.00
21/05/2013	1a	Davy	1643	Lapwing	1	84	0.00	0.00	0.00	54.00	30.00	0.00
21/05/2013	2a	Jamie	1644	Lapwing	1	68	25.53	0.00	0.00	42.47	0.00	0.00
21/05/2013	3a	A.D.Wood	1653	Curlew	1	125	105.45	0.00	0.00	19.55	0.00	0.00
21/05/2013	3a	A.D.Wood	1653	Curlew	1	125	113.27	0.00	0.00	11.73	0.00	0.00
21/05/2013	3a	A.D.Wood	1702	Curlew	1	11	0.00	8.04	0.00	0.00	2.96	0.00
21/05/2013	3a	A.D.Wood	1702	Curlew	1	11	0.00	8.54	0.00	0.00	2.46	0.00
21/05/2013	1a	Davy	1708	Curlew	1	29	18.91	0.00	0.00	10.09	0.00	0.00
21/05/2013	3a	A.D.Wood	1708	Curlew	1	35	35.00	0.00	0.00	0.00	0.00	0.00
21/05/2013	3a	A.D.Wood	1708	Curlew	1	35	35.00	0.00	0.00	0.00	0.00	0.00
21/05/2013	2a	Jamie	1712	Whimbrel	4	6	0.00	0.00	0.00	6.00	0.00	0.00
21/05/2013	1a	Davy	1726	Lapwing	1	60	0.55	1.64	0.00	14.45	43.36	0.00
21/05/2013	2a	Jamie	1728	Lapwing	2	59	0.00	0.00	0.00	59.00	0.00	0.00
21/05/2013	1a	Davy	1729	Lapwing	1	157	0.00	0.00	0.00	15.00	142.00	0.00
21/05/2013	1a	Davy	1732	Curlew	1	43	18.33	0.00	0.00	24.67	0.00	0.00
21/05/2013	2a	Jamie	1734	Curlew	1	14	0.00	0.00	0.00	14.00	0.00	0.00
21/05/2013	3a	A.D.Wood	1744	Curlew	1	65	35.00	30.00	0.00	0.00	0.00	0.00
22/05/2013	2a	Davy	0758	Lapwing	1	78	0.00	0.00	0.00	78.00	0.00	0.00
22/05/2013	3a	A.D.Wood	0809	Curlew	2	65	50.29	0.00	0.00	14.71	0.00	0.00
22/05/2013	2a	Davy	0810	Curlew	1	50	0.00	50.00	0.00	0.00	0.00	0.00
22/05/2013	2a	Davy	0818	Whimbrel	2	55	40.00	15.00	0.00	0.00	0.00	0.00
22/05/2013	2a	Davy	0819	Whimbrel	1	6	6.00	0.00	0.00	0.00	0.00	0.00
22/05/2013	3a	A.D.Wood	0824	Lapwing	4	127	55.50	0.00	0.00	71.50	0.00	0.00
22/05/2013	1a	Jamie	0840	Lapwing	1	44	7.10	0.00	0.00	36.90	0.00	0.00
22/05/2013	3a	A.D.Wood	0840	Lapwing	2	63	58.06	0.00	0.00	4.94	0.00	0.00
22/05/2013	2a	Davy	0843	Curlew	1	49	0.00	0.00	0.00	34.00	15.00	0.00
22/05/2013	1a	Jamie	0845	Lapwing	2	8	0.00	0.00	0.00	8.00	0.00	0.00
22/05/2013	2a	Davy	0849	Greylag goose	4	38	0.00	0.00	0.00	38.00	0.00	0.00
22/05/2013	3a	A.D.Wood	0853	Lapwing	2	6	0.00	6.00	0.00	0.00	0.00	0.00
22/05/2013	2a	Davy	0859	Greylag goose	3	74	0.00	0.00	0.00	0.00	74.00	0.00
22/05/2013	2a	Davy	0901	Lapwing	1	240	11.94	1.71	0.00	198.06	28.29	0.00
22/05/2013	2a	Davy	0907	Lapwing	9	81	0.00	0.00	0.00	81.00	0.00	0.00
22/05/2013	1a	Jamie	0912	Lapwing	1	36	0.00	0.00	0.00	36.00	0.00	0.00
22/05/2013	2a	Davy	0916	Whimbrel	10	93	0.00	0.00	0.00	78.00	15.00	0.00
22/05/2013	2a	Davy	0923	Lapwing	1	64	64.00	0.00	0.00	0.00	0.00	0.00
22/05/2013	1a	Jamie	0928	Lapwing	1	11	0.00	0.00	0.00	11.00	0.00	0.00
22/05/2013	2a	Davy	0935	Curlew	1	33	0.00	0.00	0.00	33.00	0.00	0.00
22/05/2013	2a	Davy	0938	Curlew	2	36	0.00	0.00	0.00	36.00	0.00	0.00
22/05/2013	2a	Davy	0942	Curlew	1	38	0.00	0.00	0.00	38.00	0.00	0.00
22/05/2013	2a	Davy	1013	Whimbrel	1	15	0.00	0.00	0.00	15.00	0.00	0.00
22/05/2013	3a	A.D.Wood	1014	Curlew	4	24	15.16	0.00	0.00	8.84	0.00	0.00
22/05/2013	1a	Jamie	1025	Curlew	1	14	4.19	0.00	0.00	9.81	0.00	0.00
22/05/2013	2a	Davy	1029	Lapwing	1	89	42.42	0.00	0.00	46.58	0.00	0.00
22/05/2013	2a	Davy	1039	Lapwing	1	7	0.00	0.00	0.00	7.00	0.00	0.00

Date	VP	Observer	Flight start time	Species	No. of birds	Duration (s)	Inside CRAA (seconds)			Outside CRAA (seconds)		
							0-30m	31-130m	>130m	0-30m	31-130m	>130m
22/05/2013	3a	A.D.Wood	1039	Lapwing	1	20	13.59	0.00	0.00	6.41	0.00	0.00
22/05/2013	3a	A.D.Wood	1057	Lapwing	4	48	43.08	0.00	0.00	4.92	0.00	0.00
12/06/2013	2a	Jamie	1438	Lapwing	1	8	0.00	8.00	0.00	0.00	0.00	0.00
12/06/2013	3a	A.D.Wood	1447	Curlew	1	56	41.54	0.00	0.00	14.46	0.00	0.00
12/06/2013	2a	Jamie	1452	Lapwing	2	24	13.18	0.00	0.00	10.82	0.00	0.00
12/06/2013	1a	Davy	1503	Curlew	1	84	82.02	0.00	0.00	1.98	0.00	0.00
12/06/2013	2a	Jamie	1505	Curlew	1	12	0.00	0.00	0.00	0.00	12.00	0.00
12/06/2013	2a	Jamie	1508	Curlew	1	16	5.38	0.00	0.00	10.62	0.00	0.00
12/06/2013	1a	Davy	1538	Curlew	1	24	0.00	0.00	0.00	9.00	15.00	0.00
12/06/2013	3a	A.D.Wood	1600	Curlew	3	22	0.00	15.81	0.00	0.00	6.19	0.00
12/06/2013	2a	Jamie	1638	Curlew	1	76	0.00	0.00	0.00	76.00	0.00	0.00
12/06/2013	2a	Jamie	1701	Curlew	2	63	0.00	0.68	0.00	0.00	62.32	0.00
12/06/2013	3a	A.D.Wood	1701	Curlew	1	69	0.00	61.53	0.00	0.00	7.47	0.00
12/06/2013	2a	Jamie	1712	Curlew	1	42	0.00	15.56	0.00	0.00	26.44	0.00
12/06/2013	3a	A.D.Wood	1713	Lapwing	15	75	4.76	19.02	0.00	10.24	40.98	0.00
12/06/2013	3a	A.D.Wood	1717	Lapwing	2	107	12.19	74.76	0.00	2.81	17.24	0.00
13/06/2013	2a	Jamie	1021	Curlew	1	16	7.37	0.00	0.00	8.63	0.00	0.00
13/06/2013	2a	Jamie	1026	Curlew	1	8	0.00	0.00	0.00	8.00	0.00	0.00
13/06/2013	2a	Jamie	1026	Curlew	1	5	2.36	0.00	0.00	2.64	0.00	0.00
13/06/2013	2a	Jamie	1038	Lapwing	1	18	18.00	0.00	0.00	0.00	0.00	0.00
13/06/2013	2a	Jamie	1055	Curlew	1	8	0.00	0.00	0.00	8.00	0.00	0.00
13/06/2013	2a	Jamie	1055	Curlew	1	3	1.39	0.00	0.00	1.61	0.00	0.00
13/06/2013	2a	Jamie	1055	Curlew	1	3	0.00	0.00	0.00	3.00	0.00	0.00
13/06/2013	2a	Jamie	1110	Curlew	1	27	19.18	0.00	0.00	7.82	0.00	0.00
13/06/2013	1a	A.D.Wood	1134	Lapwing	1	18	0.00	0.00	0.00	18.00	0.00	0.00
13/06/2013	2a	Jamie	1134	Lapwing	1	5	2.14	0.00	0.00	2.86	0.00	0.00
13/06/2013	1a	A.D.Wood	1134	Lapwing	1	18	0.00	0.00	0.00	18.00	0.00	0.00
13/06/2013	2a	Jamie	1134	Lapwing	1	5	2.14	0.00	0.00	2.86	0.00	0.00
13/06/2013	2a	Jamie	1201	Lapwing	1	31	0.00	0.00	0.00	31.00	0.00	0.00
13/06/2013	2a	Jamie	1208	Lapwing	1	47	37.82	0.00	0.00	9.18	0.00	0.00
13/06/2013	3a	Davy	1310	Curlew	2	17	15.74	0.00	0.00	1.26	0.00	0.00
13/06/2013	3a	Davy	1314	Curlew	2	23	23.00	0.00	0.00	0.00	0.00	0.00
13/06/2013	3a	Davy	1335	Curlew	2	26	25.92	0.00	0.00	0.08	0.00	0.00
13/06/2013	3a	Davy	1350	Curlew	1	20	20.00	0.00	0.00	0.00	0.00	0.00
20/06/2013	2a	A.D.Wood	1130	Curlew	2	61	0.00	0.00	0.00	61.00	0.00	0.00
20/06/2013	2a	A.D.Wood	1141	Curlew	2	19	0.00	0.00	0.00	19.00	0.00	0.00
20/06/2013	1a	Jamie	1144	Curlew	1	38	13.37	20.49	0.00	1.63	2.51	0.00
20/06/2013	2a	A.D.Wood	1215	Curlew	2	175	0.00	0.00	0.00	70.00	105.00	0.00
20/06/2013	2a	A.D.Wood	1220	Curlew	1	9	0.00	0.00	0.00	9.00	0.00	0.00
20/06/2013	3a	Davy	1241	Curlew	1	4	4.00	0.00	0.00	0.00	0.00	0.00
20/06/2013	3a	Davy	1242	Curlew	1	13	13.00	0.00	0.00	0.00	0.00	0.00
20/06/2013	3a	Davy	1245	Lapwing	43	14	14.00	0.00	0.00	0.00	0.00	0.00
20/06/2013	3a	Davy	1246	Curlew	1	34	34.00	0.00	0.00	0.00	0.00	0.00
20/06/2013	3a	Davy	1302	Curlew	7	69	50.09	13.92	0.00	3.91	1.08	0.00
20/06/2013	3a	Davy	1307	Lapwing	2	94	53.53	10.16	0.00	25.47	4.84	0.00
20/06/2013	3a	Davy	1318	Curlew	1	15	7.26	0.00	0.00	7.74	0.00	0.00
20/06/2013	3a	Davy	1348	Lapwing	12	174	144.00	30.00	0.00	0.00	0.00	0.00
20/06/2013	3a	Davy	1352	Lapwing	5	30	30.00	0.00	0.00	0.00	0.00	0.00
20/06/2013	2a	Jamie	1355	Curlew	9	16	0.00	0.00	0.00	16.00	0.00	0.00
20/06/2013	2a	Jamie	1355	Lapwing	39	362	170.33	120.52	0.00	41.67	29.48	0.00
20/06/2013	3a	Davy	1358	Lapwing	27	29	29.00	0.00	0.00	0.00	0.00	0.00
20/06/2013	2a	Jamie	1409	Curlew	2	126	114.47	0.00	0.00	11.53	0.00	0.00
20/06/2013	2a	Jamie	1412	Curlew	2	69	22.99	0.00	0.00	46.01	0.00	0.00

Date	VP	Observer	Flight start time	Species	No. of birds	Duration (s)	Inside CRAA (seconds)			Outside CRAA (seconds)		
							0-30m	31-130m	>130m	0-30m	31-130m	>130m
20/06/2013	3a	Davy	1412	Curlew	1	63	63.00	0.00	0.00	0.00	0.00	0.00
20/06/2013	3a	Davy	1431	Curlew	7	45	30.00	15.00	0.00	0.00	0.00	0.00
20/06/2013	3a	Davy	1447	Lapwing	34	149	113.48	28.61	0.00	5.52	1.39	0.00
20/06/2013	2a	Jamie	1502	Curlew	1	26	0.00	0.00	0.00	26.00	0.00	0.00
20/06/2013	2a	Jamie	1515	Curlew	1	6	0.00	0.00	0.00	6.00	0.00	0.00
17/07/2013	2a	Joe	1302	Lapwing	2	30	30.00	0.00	0.00	0.00	0.00	0.00
17/07/2013	3a	Davy	1357	Lapwing	1	20	0.00	0.00	0.00	20.00	0.00	0.00
17/07/2013	3a	Davy	1414	Lapwing	33	85	62.62	0.00	0.00	22.38	0.00	0.00
17/07/2013	3a	Davy	1429	Curlew	1	58	21.69	7.57	0.00	21.31	7.43	0.00
17/07/2013	3a	Davy	1429	Whimbrel	1	58	21.78	7.60	0.00	21.22	7.40	0.00
17/07/2013	3a	Davy	1431	Curlew	1	165	28.90	77.06	0.00	16.10	42.94	0.00
17/07/2013	3a	Davy	1431	Whimbrel	1	165	28.91	77.09	0.00	16.09	42.91	0.00
17/07/2013	1a	A.D.Wood	1432	Curlew	1	95	7.61	40.56	0.00	7.39	39.44	0.00
17/07/2013	1a	A.D.Wood	1432	Whimbrel	1	95	7.61	40.58	0.00	7.39	39.42	0.00
17/07/2013	2a	Joe	1448	Peregrine falcon	1	45	0.00	0.00	0.00	15.00	30.00	0.00
17/07/2013	3a	Davy	1458	Lapwing	52	50	50.00	0.00	0.00	0.00	0.00	0.00
17/07/2013	3a	Davy	1502	Lapwing	51	67	11.07	38.38	0.00	3.93	13.62	0.00
17/07/2013	3a	Davy	1606	Curlew	21	211	155.06	0.00	0.00	55.94	0.00	0.00
17/07/2013	3a	Davy	1645	Lapwing	1	50	20.08	0.00	0.00	29.92	0.00	0.00
17/07/2013	2a	Joe	1657	Lapwing	1	69	0.00	0.00	0.00	69.00	0.00	0.00
17/07/2013	2a	Joe	1659	Lapwing	1	65	0.00	0.00	0.00	65.00	0.00	0.00
17/07/2013	3a	Davy	1659	Lapwing	1	69	38.61	0.00	0.00	30.39	0.00	0.00
17/07/2013	3a	Davy	1702	Lapwing	1	8	0.00	0.52	0.00	0.00	7.48	0.00
17/07/2013	3a	Davy	1704	Curlew	22	64	36.87	0.00	0.00	27.13	0.00	0.00
17/07/2013	1a	A.D.Wood	1707	Curlew	21	34	0.00	0.00	0.00	19.00	15.00	0.00
17/07/2013	3a	Davy	1710	Lapwing	2	4	0.00	4.00	0.00	0.00	0.00	0.00
18/07/2013	3a	Joe	1253	Lapwing	7	32	16.96	0.00	0.00	15.04	0.00	0.00
18/07/2013	3a	Joe	1635	Curlew	1	61	61.00	0.00	0.00	0.00	0.00	0.00
18/07/2013	2a	A.D.Wood	1639	Curlew	1	12	12.00	0.00	0.00	0.00	0.00	0.00
19/07/2013	1a	A.D.Wood	1014	Curlew	8	16	11.32	0.00	0.00	4.68	0.00	0.00
19/07/2013	1a	A.D.Wood	1016	Curlew	9	89	12.03	12.30	0.00	31.97	32.70	0.00
19/07/2013	2a	Davy	1038	Lapwing	1	362	79.07	55.95	0.00	132.93	94.05	0.00
19/07/2013	2a	Davy	1135	Curlew	1	35	0.00	0.00	0.00	0.00	35.00	0.00
19/07/2013	2a	Davy	1246	Lapwing	59	177	31.53	66.39	0.00	25.47	53.61	0.00
19/07/2013	2a	Davy	1257	Curlew	1	95	0.00	0.00	0.00	95.00	0.00	0.00
15/08/2013	2a	A.D.Wood	1115	Lapwing	3	18	0.00	0.00	0.00	18.00	0.00	0.00
15/08/2013	2a	A.D.Wood	1130	Curlew	1	16	16.00	0.00	0.00	0.00	0.00	0.00
15/08/2013	2a	A.D.Wood	1136	Golden plover	6	32	0.00	0.00	0.00	0.00	32.00	0.00
15/08/2013	2a	A.D.Wood	1306	Curlew	1	46	45.95	0.00	0.00	0.05	0.00	0.00
16/08/2013	3a	A.D.Wood	1002	Curlew	18	16	2.95	0.00	0.00	13.05	0.00	0.00

Table D-2 Details of target species recorded during flight activity surveys (sorted chronologically): 2021

Date	VP	Observer	Flight start time	Species	No. of birds	Duration (s)	Inside CRAA (seconds)					Outside CRAA (seconds)				
							0-20m	21-40m	41-100m	101-150m	>150m	0-20m	21-40m	41-100m	101-150m	>150m
31/03/2021	3a	MW	1156	Golden plover	10	60	22.06	22.06	0.00	0.00	0.00	7.94	7.94	0.00	0.00	0.00
31/03/2021	3a	MW	1205	Herring gull	7	65	22.76	19.51	0.00	0.00	0.00	12.24	10.49	0.00	0.00	0.00
31/03/2021	3a	MW	1400	Golden plover	4	35	23.62	0.00	0.00	0.00	0.00	11.38	0.00	0.00	0.00	0.00
30/04/2021	3a	MW	0911	Herring gull	21	45	41.52	0.00	0.00	0.00	0.00	3.48	0.00	0.00	0.00	0.00
30/04/2021	3a	MW	1050	Curlew	1	60	56.38	0.00	0.00	0.00	0.00	3.62	0.00	0.00	0.00	0.00
30/04/2021	3a	MW	1213	Curlew	2	55	47.00	0.00	0.00	0.00	0.00	8.00	0.00	0.00	0.00	0.00
30/04/2021	3a	MW	1302	Lapwing	2	30	27.13	0.00	0.00	0.00	0.00	2.87	0.00	0.00	0.00	0.00
27/05/2021	3a	MW	0911	Herring gull	35	65	57.94	0.00	0.00	0.00	0.00	7.06	0.00	0.00	0.00	0.00
28/05/2021	3a	MW	0930	Herring gull	22	50	44.24	0.00	0.00	0.00	0.00	5.76	0.00	0.00	0.00	0.00
28/05/2021	3a	MW	0944	Herring gull	8	45	30.97	0.00	0.00	0.00	0.00	14.03	0.00	0.00	0.00	0.00
28/06/2021	3a	MW	0914	Herring gull	8	50	47.92	0.00	0.00	0.00	0.00	2.08	0.00	0.00	0.00	0.00
28/06/2021	3a	MW	1020	Herring gull	11	55	40.77	0.00	0.00	0.00	0.00	14.23	0.00	0.00	0.00	0.00
26/07/2021	3a	MW	0750	Lapwing	4	60	26.68	8.89	0.00	0.00	0.00	18.32	6.11	0.00	0.00	0.00
26/07/2021	3a	MW	1016	Herring gull	9	65	46.70	0.00	0.00	0.00	0.00	18.30	0.00	0.00	0.00	0.00
26/07/2021	3a	MW	1016	Herring gull	7	55	49.48	0.00	0.00	0.00	0.00	5.52	0.00	0.00	0.00	0.00
16/08/2021	3a	MW	1014	Curlew	18	40	36.86	0.00	0.00	0.00	0.00	3.14	0.00	0.00	0.00	0.00
16/08/2021	3a	MW	1202	Herring gull	8	42	29.76	0.00	0.00	0.00	0.00	12.24	0.00	0.00	0.00	0.00

D.2 Moorland Breeding Bird Records

Table D-3 details all wader activity recorded during the 2021 breeding season. Survey methodology is detailed in **Annex B** and survey timing/weather conditions in **Annex C.** Refer to **Annex F** for data relating to surveys undertaken by AMEC between May and June 2012.

Table D-3 Wader activity recorded during breeding season surveys

Date	Survey type	Survey visit	Observer	Species	Number recorded	Notes
30/03/2021	SBBS	1	MW	Curlew	1	Resting in field north of Drumwhisley
30/03/2021	SBBS	1	MW	Curlew	1	Resting in field north of Drumwhisley
30/03/2021	SBBS	1	MW	Lapwing	1	Resting in field north of Drumwhisley
30/03/2021	SBBS	1	MW	Oystercatcher	1	At Loch More
31/03/2021	VP 3a	-	MW	Curlew	2	Not flying - on Larbrax moor
31/03/2021	VP 3a	-	MW	Lapwing	1	Not flying - on Larbrax moor
31/03/2021	VP 3a	-	MW	Oystercatcher	-	Heard only
28/04/2021	SBBS	2	MW	Common sandpiper	2	At Loch More
28/04/2021	SBBS	2	MW	Curlew	2	Near Hind Hill
28/04/2021	SBBS	2	MW	Lapwing	1	Near Hind Hill
28/04/2021	SBBS	2	MW	Lapwing	1	In field on Larbrax Moor
29/04/2021	BBS	1	MW	Curlew	1	Stationary
29/04/2021	BBS	1	MW	Curlew	1	Flew and then landed
29/04/2021	BBS	1	MW	Curlew	1	Stationary
29/04/2021	BBS	1	MW	Curlew	2	Stationary
29/04/2021	BBS	1	MW	Curlew	1	Stationary
29/04/2021	BBS	1	MW	Lapwing	1	Stationary
29/04/2021	BBS	1	MW	Lapwing	1	Stationary
29/04/2021	BBS	1	MW	Lapwing	1	Stationary
29/04/2021	BBS	1	MW	Lapwing	1	Stationary
29/04/2021	BBS	1	MW	Snipe	1	Stationary
25/05/2021	SBBS	3	MW	Curlew	4	2 pairs, in field west of unnamed loch on Larbrax Moor
25/05/2021	SBBS	3	MW	Oystercatcher	2	At Loch More
26/05/2021	BBS	2	MW	Curlew	2	Pair
26/05/2021	BBS	2	MW	Curlew	2	Pair
26/05/2021	BBS	2	MW	Oystercatcher	2	Pair on Loch More
27/05/2021	BK	1	MW	Curlew	-	Heard only
28/05/2021	VP 3a	-	MW	Oystercatcher	-	Heard only
29/06/2021	BBS	3	MW	Curlew	2	In tall vegetation with young
29/06/2021	BBS	3	MW	Curlew	1	
29/06/2021	BBS	3	MW	Oystercatcher	2	On Loch More
30/06/2021	SBBS	4	MW	Common sandpiper	1	At unnamed loch on Larbrax Moor
30/06/2021	SBBS	4	MW	Curlew	10	In field south-east of Hind Hill
30/06/2021	SBBS	4	MW	Oystercatcher	8	At Loch More
28/07/2021	BBS	4	MW	Lapwing	4	
17/08/2021	SBBS	6	MW	Dunlin	1	Near pond on Larbrax Moor
17/08/2021	SBBS	6	MW	Snipe	2	Near pond on Larbrax Moor

D.3 Scarce Breeding Bird Records

Table D-4 details all records of raptors and owls recorded during the 2021 surveys, however only Annex 1[1] or Schedule 1[2] species are considered to be scarce breeding birds (i.e. target species). Refer to **Annex B** for survey methodology and **Annex C** for weather data. Refer to **Annex F** for data relating to surveys undertaken by AMEC between April and August 2013.

Table D-4 Raptor and owl records

Date	Species	Number recorded	Sex	Age	Notes
30/03/2021	Kestrel	-	-	-	
30/03/2021	Sparrowhawk	-	-	-	
31/03/2021	Buzzard	-	-	-	
31/03/2021	Kestrel	1	-	-	Flew inshore over Barny's Leap and then back offshore for 78s at height 1
28/04/2021	Buzzard	-	-	-	
28/04/2021	Kestrel	-	-	-	
28/04/2021	Peregrine falcon	1	Male	Adult	Flying south along coast from Scart Craig to Cranberry Point
29/04/2021	Kestrel	-	-	-	
30/04/2021	Buzzard	-	-	-	
30/04/2021	Kestrel	-	-	-	
25/05/2021	Peregrine falcon	1	-	Adult	Flying south over Larbrax Moor
27/05/2021	Buzzard	-	-	-	
27/05/2021	Tawny owl	-	-	-	
29/06/2021	Buzzard	-	-	-	
29/06/2021	Kestrel	1	-	-	By Drumwhisley forest
29/06/2021	Peregrine falcon	1	-	Adult	Looped flight to the South
30/06/2021	Buzzard	-	-	-	
30/06/2021	Kestrel	-	-	-	
30/06/2021	Sparrowhawk	-	-	-	
27/07/2021	Buzzard	-	-	-	
27/07/2021	Kestrel	-	-	-	
17/08/2021	Hen harrier	1	Female	Adult	Flying north-east over Larbrax Moor

D.4 Black Grouse Records

No black grouse were recorded during the 2021 breeding season. Refer to **Annex B** for survey methodology and **Annex C** for weather data.

[1] Annex 1 of the EU Bird Directive

[2] Schedule 1 of the Wildlife and Countryside Act 1981, as amended by the Nature Conservation Act (Scotland) 2004

ANNEX E. COLLISION RISK ASSESSMENTS

A 500 m buffer from the proposed turbine locations was used for the Collision Risk Analysis Area (CRAA) (**Figure 8.3**). Using the larger 500 m area around the turbines accounts for possible inaccuracies in the recording of flightlines and ensures the assessment is precautionary.

The ultimate aim is to have 100 % coverage of the turbines and associated CRAA by the viewsheds, however in practice this is often unachievable as a result of the topography of the Site and limited access outwith the Site. For the Proposed Development, although some small areas of the CRAA remain 'invisible' at 20 m above ground level (**Figure 8.3, Figure 8.4** and **Figure 8.5**), the habitat within these areas is of sufficient similarity such that the survey data collected and subsequently assessed are considered to be representative of the whole CRAA. In addition, there were no records made during any of the surveys which would suggest that this area was of any particular importance to target species. Furthermore, the flying time at risk height (secsHahr^{-1}) for each species is calculated as a single mean activity rate within the entirety of the CRAA.

Table E-1, **Table E-2** and **Table E-3** present the parameters which apply to each Collision Risk Model (CRM). Collision modelling was undertaken on both the data gathered by AMEC during the 2012/2013 non-breeding season and 2013 breeding season and the MacArthur Green data gathered during the 2021 breeding season.

Table E-1 Wind farm parameters

Size of wind farm envelope	229.72	hectares (ha)
Number of turbines	4	turbines
Rotor diameter	133	metres (m)
Hub height	83.4	m
Max. rotor depth	1.09	m (at 15° pitch angle)
Max. chord	4.2	m
Pitch	15	degrees (°)
Rotation period	4.8	seconds (secs)
Turbine operation time	0.85	percent (%)
Risk height: lowest	16.9	m
Risk height: highest	149.9	m
Flight risk volume	305531928	m^3

Table E-2 CRM parameters per species

Species	Length (m)	Wingspan (m)	Assumed flight speed, v (ms^{-1})	Avoidance rate	Probability of collision	Bird transit time (secs)
Barn owl	0.35	0.93	5	0.98	0.1236	0.2874
Curlew	0.6	1	13	0.98	0.0711	0.1298
Golden plover	0.28	0.72	17.9	0.98	0.0498	0.0764
Greylag goose	0.825	1.635	17.1	0.998	0.0716	0.1118
Hen harrier	0.48	1.1	12	0.99	0.0693	0.1306
Herring gull	0.64	1.5	12.8	0.98	0.0753	0.1349
Lapwing	0.31	0.87	11.9	0.98	0.0608	0.1174
Merlin	0.28	0.56	13	0.98	0.0555	0.1052
Peregrine falcon	0.48	1.1	12.1	0.98	0.0690	0.1295
Whimbrel	0.42	0.89	16.3	0.98	0.0565	0.0925
Whooper swan	1.525	2.305	17.3	0.995	0.0964	0.1510

Table E-3 Visible area within the CRAA per vantage point

VP	Area (ha)
1	75.95
2	150.33
3	161.47
1a	36.86
2a	122.78
3a	161.09

Birds are assumed to be active during all the daylight hours and this is estimated by calculating the number of hours per day between sunrise and sunset (adjusting for correct latitude) for the survey seasons as defined in **Table E-4** below.

Table E-4 Season definitions per species/species group

Species	Breeding season			Non-breeding season		
	Start date	End date	Hours presumed present	Start date	End date	Hours presumed present
Geese and swans	15th May	31st August	1,781	1st September	14th May	2,712
Raptors	15th March	31st August	2,631	1st September	14th March	1,862
Waders	1st April	31st July	1,957	1st August	31st March	2,536

Outputs for the CRM for the following species are presented in the following order below:

- Barn owl;
- Curlew;
- Golden plover;
- Greylag goose;
- Hen harrier;
- Herring gull;
- Lapwing;
- Merlin;
- Peregrine falcon;
- Whimbrel; and
- Whooper swan.

E.1 Barn Owl

Non-Breeding Season 2012/2013

Table E-5 Barn owl flight activity

VP	Seconds at risk height	Observation effort (HaHr)	Flying time at risk height (secsHahr^{-1})
1	5.24	2733.54	0.0000001

Table E-6 Barn owl mortality estimates

Mean activity in wind farm at rotor height	0.00002	hr^{-1}
Total Combined rotor swept volume	79859	m^3
Bird occupancy	0.0446	hrs/season
Bird occupancy of rotor swept volume	0.0419	bird-sec
No. of transits through rotors	0.1459	per season
Estimated collisions	0.0180	per season
Estimated collisions after correction for operation	0.0153	per season
Estimated collisions after avoidance factor	0.0003	per season
Equivalent to 1 bird every	3261.68	seasons

E.2 Curlew

Non-Breeding Season 2012/2013

Table E-7 Curlew flight activity

VP	Seconds at risk height	Observation effort (HaHr)	Flying time at risk height (secsHahr^{-1})
1	6.84	2733.5360	0.00000014
2	15909.43	5411.8973	0.00032
3	1258.28	5825.8755	0.00003

Table E-8 Curlew mortality estimates

Mean activity in wind farm at rotor height	0.0784	hr^{-1}
Total Combined rotor swept volume	93752	m^3
Bird occupancy	198.9251	hrs/season
Bird occupancy of rotor swept volume	219.7425	bird-sec
No. of transits through rotors	1693.2924	per season
Estimated collisions	120.4227	per season
Estimated collisions after correction for operation	102.3593	per season
Estimated collisions after avoidance factor	2.0472	per season
Equivalent to 1 bird every	0.49	seasons

Breeding Season 2013

Table E-9 Curlew flight activity

VP	Seconds at risk height	Observation effort (HaHr)	Flying time at risk height (secsHahr^{-1})
1	2.60	455.7159	0.00000004
2	260.56	901.9829	0.000004
3	321.46	968.8263	0.000005
1a	424.23	1637.1203	0.000007
2a	424.91	6137.5733	0.000007
3a	3648.29	7248.9968	0.00006

Table E-10 Curlew mortality estimates

Mean activity in wind farm at rotor height	0.0187	hr^{-1}
Total Combined rotor swept volume	93752	m^3
Bird occupancy	36.5801	hrs/season
Bird occupancy of rotor swept volume	40.4082	bird-sec
No. of transits through rotors	311.3774	per season
Estimated collisions	22.1444	per season
Estimated collisions after correction for operation	18.8227	per season
Estimated collisions after avoidance factor	0.3765	per season
Equivalent to 1 bird every	2.6564	seasons

Breeding Season 2021

Table E-11 Curlew flight activity

VP	Seconds at risk height	Observation effort (HaHr)	Flying time at risk height (secsHahr^{-1})
3a	126.14	8265.96	0.000004

Table E-12 Curlew mortality estimates

Mean activity in wind farm at rotor height	0.0010	hr^{-1}
Total Combined rotor swept volume	93752	m^3
Bird occupancy	2.3691	hrs/season
Bird occupancy of rotor swept volume	2.6183	bird-sec
No. of transits through rotors	20.1764	per season
Estimated collisions	1.4349	per season
Estimated collisions after correction for operation	1.2197	per season
Estimated collisions after avoidance factor	0.0244	per season
Equivalent to 1 bird every	40.99	seasons

E.3 Golden Plover

Non-Breeding Season 2012/2013

Table E-13 Golden plover flight activity

VP	Seconds at risk height	Observation effort (HaHr)	Flying time at risk height (secsHahr^{-1})
2	2835.00	5411.8973	0.00006
3	258.79	5825.8755	0.000005

Table E-14 Golden plover mortality estimates

Mean activity in wind farm at rotor height	0.0141	hr^{-1}
Total Combined rotor swept volume	75969	m^3
Bird occupancy	35.8340	hrs/season
Bird occupancy of rotor swept volume	32.0757	bird-sec
No. of transits through rotors	419.9986	per season
Estimated collisions	20.9178	per season
Estimated collisions after correction for operation	17.7801	per season
Estimated collisions after avoidance factor	0.3556	per season
Equivalent to 1 bird every	2.81	seasons

Breeding Season 2021

Table E-15 Golden plover flight activity

VP	Seconds at risk height	Observation effort (HaHr)	Flying time at risk height (secsHahr^{-1})
3a	269.43	8265.96	0.000009

Table E-16 Golden plover mortality estimates

Mean activity in wind farm at rotor height	0.0021	hr^{-1}
Total Combined rotor swept volume	75969	m^3
Bird occupancy	5.0605	hrs/season
Bird occupancy of rotor swept volume	4.5320	bird-sec
No. of transits through rotors	59.3414	per season
Estimated collisions	2.9555	per season
Estimated collisions after correction for operation	2.5121	per season
Estimated collisions after avoidance factor	0.0502	per season
Equivalent to 1 bird every	19.90	seasons

E.4 Greylag Goose

Non-Breeding Season 2012/2013

Table E-17 Greylag goose flight activity

VP	Seconds at risk height	Observation effort (HaHr)	Flying time at risk height (secsHahr^{-1})
2a	19.85	2208.7406	0.0000003
3a	53.57	2255.2434	0.0000007

Table E-18 Greylag goose mortality estimates

Mean activity in wind farm at rotor height	0.0002	hr^{-1}
Total Combined rotor swept volume	106255	m^3
Bird occupancy	0.5994	hrs/season
Bird occupancy of rotor swept volume	0.7504	bird-sec
No. of transits through rotors	6.7111	per season
Estimated collisions	0.4808	per season
Estimated collisions after correction for operation	0.4087	per season
Estimated collisions after avoidance factor	0.0008	per season
Equivalent to 1 bird every	1223.35	seasons

Breeding Season 2013

Table E-19 Greylag goose flight activity

VP	Seconds at risk height	Observation effort (HaHr)	Flying time at risk height (secsHahr^{-1})
3a	19.21	5960.2863	0.0000004

Table E-20 Greylag goose mortality estimates

Mean activity in wind farm at rotor height	0.0001	hr^{-1}
Total Combined rotor swept volume	106255	m^3
Bird occupancy	0.1796	hrs/season
Bird occupancy of rotor swept volume	0.2249	bird-sec
No. of transits through rotors	2.0112	per season
Estimated collisions	0.1441	per season
Estimated collisions after correction for operation	0.1225	per season
Estimated collisions after avoidance factor	0.0002	per season
Equivalent to 1 bird every	4082.05	seasons

E.5 Hen Harrier

Non-Breeding Season 2012/2013

Table E-21 Hen harrier flight activity

VP	Seconds at risk height	Observation effort (HaHr)	Flying time at risk height (secsHahr^{-1})
1	25.36	2733.5360	0.0000005
2	59.78	5411.8973	0.0000012
3	77.98	5825.8755	0.000002

Table E-22 Hen harrier mortality estimates

Mean activity in wind farm at rotor height	0.0007	hr^{-1}
Total Combined rotor swept volume	87083	m^3
Bird occupancy	1.3875	hrs/season
Bird occupancy of rotor swept volume	1.4237	bird-sec
No. of transits through rotors	10.9022	per season
Estimated collisions	0.7556	per season
Estimated collisions after correction for operation	0.6423	per season
Estimated collisions after avoidance factor	0.0064	per season
Equivalent to 1 bird every	155.70	seasons

Breeding Season 2013

Table E-23 Hen harrier flight activity

VP	Seconds at risk height	Observation effort (HaHr)	Flying time at risk height (secsHahr^{-1})
3a	115.94	8215.5297	0.000002

Table E-24 Hen harrier mortality estimates

Mean activity in wind farm at rotor height	0.0004	hr^{-1}
Total Combined rotor swept volume	87083	m^3
Bird occupancy	1.0040	hrs/season
Bird occupancy of rotor swept volume	1.0302	bird-sec
No. of transits through rotors	7.8892	per season
Estimated collisions	0.5468	per season
Estimated collisions after correction for operation	0.4648	per season
Estimated collisions after avoidance factor	0.0046	per season
Equivalent to 1 bird every	215.16	seasons

E.6 Herring Gull

Breeding Season 2021

Table E-25 Herring gull flight activity

VP	Seconds at risk height	Observation effort (HaHr)	Flying time at risk height (secsHahr^{-1})
3a	1084.64	8265.9600	0.00004

Table E-26 Herring gull mortality estimates

Mean activity in wind farm at rotor height	0.0084	hr^{-1}
Total Combined rotor swept volume	95974	m^3
Bird occupancy	20.3716	hrs/season
Bird occupancy of rotor swept volume	23.0484	bird-sec
No. of transits through rotors	170.8241	per season
Estimated collisions	12.8702	per season
Estimated collisions after correction for operation	10.9397	per season
Estimated collisions after avoidance factor	0.2188	per season
Equivalent to 1 bird every	4.57	seasons

E.7 Lapwing

Non-Breeding Season 2012/2013

Table E-27 Lapwing flight activity

VP	Seconds at risk height	Observation effort (HaHr)	Flying time at risk height (secsHahr^{-1})
1	15.20	2733.5360	0.0000003
2	439.73	5411.8973	0.000009
3	601.65	5825.8755	0.000012

Table E-28 Lapwing mortality estimates

Mean activity in wind farm at rotor height	0.0048	hr^{-1}
Total Combined rotor swept volume	77636	m^3
Bird occupancy	12.2379	hrs/season
Bird occupancy of rotor swept volume	11.1948	bird-sec
No. of transits through rotors	95.3572	per season
Estimated collisions	5.8001	per season
Estimated collisions after correction for operation	4.9300	per season
Estimated collisions after avoidance factor	0.0986	per season
Equivalent to 1 bird every	10.14	seasons

Breeding Season 2013

Table E-29 Lapwing flight activity

VP	Seconds at risk height	Observation effort (HaHr)	Flying time at risk height (secsHahr^{-1})
3	76.46	968.8263	0.0000012
1a	247.86	1637.1203	0.000004
2a	13492.37	6137.5733	0.0002
3a	10502.40	7248.9968	0.0002

Table E-30 Lapwing mortality estimates

Mean activity in wind farm at rotor height	0.0894	hr^{-1}
Total Combined rotor swept volume	77636	m^3
Bird occupancy	175.0461	hrs/season
Bird occupancy of rotor swept volume	160.1254	bird-sec
No. of transits through rotors	1363.9499	per season
Estimated collisions	82.9616	per season
Estimated collisions after correction for operation	70.5174	per season
Estimated collisions after avoidance factor	1.4103	per season
Equivalent to 1 bird every	0.71	seasons

Breeding Season 2021

Table E-31 Lapwing flight activity

VP	Seconds at risk height	Observation effort (HaHr)	Flying time at risk height (secsHahr^{-1})
3a	60.52	8265.96	0.000002

Table E-32 Lapwing mortality estimates

Mean activity in wind farm at rotor height	0.0005	hr^{-1}
Total Combined rotor swept volume	77636	m^3
Bird occupancy	1.1368	hrs/season
Bird occupancy of rotor swept volume	1.0404	bird-sec
No. of transits through rotors	8.8619	per season
Estimated collisions	0.5390	per season
Estimated collisions after correction for operation	0.4582	per season
Estimated collisions after avoidance factor	0.0092	per season
Equivalent to 1 bird every	109.13	seasons

E.8 Merlin

Non-Breeding Season 2012/2013

Table E-33 Merlin flight activity

VP	Seconds at risk height	Observation effort (HaHr)	Flying time at risk height (secsHahr^{-1})
1	0.44	2733.5360	0.000000009
2	15.72	5411.8973	0.0000003

Table E-34 Merlin mortality estimates

Mean activity in wind farm at rotor height	0.00007	hr^{-1}
Total Combined rotor swept volume	75969	m^3
Bird occupancy	0.1374	hrs/season
Bird occupancy of rotor swept volume	0.1230	bird-sec
No. of transits through rotors	1.1698	per season
Estimated collisions	0.0649	per season
Estimated collisions after correction for operation	0.0551	per season
Estimated collisions after avoidance factor	0.0011	per season
Equivalent to 1 bird every	906.63	seasons

Breeding Season 2013

Table E-35 Merlin flight activity

VP	Seconds at risk height	Observation effort (HaHr)	Flying time at risk height (secsHahr^{-1})
3	8.30	968.8263	0.00000012
3a	24.45	8215.5297	0.0000004

Table E-36 Merlin mortality estimates

Mean activity in wind farm at rotor height	0.0001	hr^{-1}
Total Combined rotor swept volume	75969	m^3
Bird occupancy	0.2836	hrs/season
Bird occupancy of rotor swept volume	0.2539	bird-sec
No. of transits through rotors	2.4142	per season
Estimated collisions	0.1339	per season
Estimated collisions after correction for operation	0.1138	per season
Estimated collisions after avoidance factor	0.0023	per season
Equivalent to 1 bird every	439.32	seasons

E.9 Peregrine Falcon

Non-Breeding Season 2012/2013

Table E-37 Peregrine falcon flight activity

VP	Seconds at risk height	Observation effort (HaHr)	Flying time at risk height (secsHahr^{-1})
2	41.57	5411.8973	0.0000008

Table E-38 Peregrine falcon mortality estimates

Mean activity in wind farm at rotor height	0.0002	hr^{-1}
Total Combined rotor swept volume	87083	m^3
Bird occupancy	0.3535	hrs/season
Bird occupancy of rotor swept volume	0.3628	bird-sec
No. of transits through rotors	2.8011	per season
Estimated collisions	0.1931	per season
Estimated collisions after correction for operation	0.1642	per season
Estimated collisions after avoidance factor	0.0033	per season
Equivalent to 1 bird every	304.55	seasons

Breeding Season 2013

Table E-39 Peregrine falcon flight activity

VP	Seconds at risk height	Observation effort (HaHr)	Flying time at risk height (secsHahr^{-1})
1	23.99	455.7159	0.0000003
2	3.03	901.9829	0.00000004
3a	45.20	1968.8943	0.0000006

Table E-40 Peregrine falcon mortality estimates

Mean activity in wind farm at rotor height	0.0002	hr^{-1}
Total Combined rotor swept volume	87083	m^3
Bird occupancy	0.6254	hrs/season
Bird occupancy of rotor swept volume	0.6417	bird-sec
No. of transits through rotors	4.9552	per season
Estimated collisions	0.3417	per season
Estimated collisions after correction for operation	0.2904	per season
Estimated collisions after avoidance factor	0.0058	per season
Equivalent to 1 bird every	172.16	seasons

E.10 Whimbrel

Breeding Season 2013

Table E-41 Whimbrel flight activity

VP	Seconds at risk height	Observation effort (HaHr)	Flying time at risk height (secsHahr^{-1})
1a	102.73	1637.1203	0.000002
2a	67.55	6137.5733	0.0000011
3a	210.54	7248.9968	0.000003

Table E-42 Whimbrel mortality estimates

Mean activity in wind farm at rotor height	0.0014	hr^{-1}
Total Combined rotor swept volume	83749	m^3
Bird occupancy	2.7411	hrs/season
Bird occupancy of rotor swept volume	2.7049	bird-sec
No. of transits through rotors	29.2556	per season
Estimated collisions	1.6522	per season
Estimated collisions after correction for operation	1.4044	per season
Estimated collisions after avoidance factor	0.0281	per season
Equivalent to 1 bird every	35.60	seasons

E.11 Whooper Swan

Non-Breeding Season 2012/2013

Table E-43 Whooper swan flight activity

VP	Seconds at risk height	Observation effort (HaHr)	Flying time at risk height (secsHahr^{-1})
3	156.37	6794.7018	0.000002

Table E-44 Whooper swan mortality estimates

Mean activity in wind farm at rotor height	0.0005	hr^{-1}
Total Combined rotor swept volume	145155	m^3
Bird occupancy	1.2765	hrs/season
Bird occupancy of rotor swept volume	2.1832	bird-sec
No. of transits through rotors	14.4595	per season
Estimated collisions	1.3945	per season
Estimated collisions after correction for operation	1.1853	per season
Estimated collisions after avoidance factor	0.0059	per season
Equivalent to 1 bird every	168.74	seasons

ANNEX F. ORNITHOLOGICAL BASELINE DATA AND METHODOLOGY (AMEC REPORTS)

Detailed on the pages below are the following baseline reports written by AMEC Environment & Infrastructure Ltd.:

- Breeding Bird Report 2012 (September 2012);
- Migration and Winter Season 2012/2013 (January 2014)
- Spring Migration & Breeding Season 2013 (January 2014).

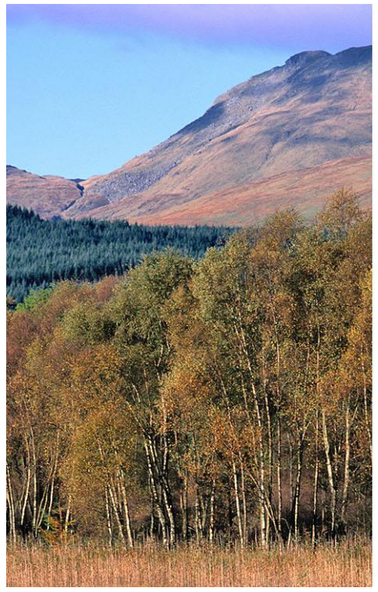
These reports provide the details of the surveys undertaken between May 2012 and August 2013 for the previous Larbrax Wind Farm submission. These reports are only presented for their survey methodologies/guidance followed and species recorded. Any preliminary assessment, measurements, recommendations or other conclusions in these reports have been superseded by the assessment undertaken in **Chapter 8: Ornithology**. The figures referenced in these reports have also not been included and the data included on them is represented in the figure suite that accompanies **Chapter 8: Ornithology**.

It should be noted that **Technical Appendix 8.1 Annexes C & D** present the flight activity survey hours and target species data respectively for the flight activity surveys undertaken by AMEC alongside the data gathered by MacArthur Green in 2021 and **Technical Appendix 8.1 Annex E** presents the collision modelling undertaken across the combined AMEC and MacArthur Green dataset.

PNE Wind UK Limited

Larbrax Wind Farm

Breeding Bird Report 2012



AMEC Environment & Infrastructure
UK Limited

September 2012

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Document Revisions

No.	Details	Date
01	Draft Breeding Bird Report	11 Sep. 12
02	Final Breeding Bird Report	21 Sep. 12
03	Final Breeding Bird Report	25 Sep 12

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Doc Reg No. 32186/D040/rr0013i3

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Certificate No. FS 13881 Certificate No. EMS 69090

1. Introduction

PNE Wind UK Limited (PNE) is investigating the feasibility of developing a wind farm at Larbrax (central National Grid Reference NW 97038 61887) situated in Dumfries and Galloway approximately 6.5 kilometres (km) west of Stranraer. PNE commissioned AMEC Environment & Infrastructure UK Limited (AMEC) to undertake a bird survey of the site during the 2012 breeding season.

1.1 Purpose of this Report

This report has been produced for the purpose of providing PNE with details of the methodology and results of breeding bird surveys undertaken by AMEC at Larbrax in May and June 2012. The information contained within this report can be used to inform the detailed assessment of predicted impacts and effects on birds that would be presented in the subsequent Environmental Statement. This report could also be used as a consultation document in any subsequent communication with Scottish Natural Heritage (SNH), Royal Society for the Protection of Birds (RSPB) and other key stakeholders.

1.2 Site Description

The proposed development area (the site) on which the report focuses covers an area of approximately 5km^2. The site considered in this report is located to the east of the B738 with access onto the site from a track leaving the B738 to Meikle Larbrax.

The current land use within the site is largely agricultural (pasture) with areas of open moorland. The surrounding land use is similar to that of the site. The western boundary of the site runs along the coastal habitat of the Irish Sea. The site boundary and study area are presented in Figure 3.1. There are no details regarding the locations of turbines and any associated infrastructure, including access tracks, at this time. The breeding bird survey will help to inform the turbine layout and infrastructure locations in order to minimise any potential environmental impact.

This report complements an Extended Phase 1 Habitat survey of the Larbrax site.

2. Methods

2.1 Desk Study

The presence of Special Protection Areas (SPAs), Ramsar sites and Sites of Special Scientific Interest (SSSIs) within 20km of Larbrax for which birds were a principle reason for notification or designation was determined by reference to the SNH Sitelink website[1]. This search radius is based upon the range of species that are most likely to use the site regularly during the breeding period.

[1] http://gateway.snh.gov.uk/sitelink/

September 2012
Doc Reg No. 32186/D040/rr0013i3

The key objective of the breeding bird surveys (in conjunction with the desk study) at Larbrax was to establish whether any species or population of nature conservation importance were likely to make use of the site and adjacent areas.

2.2 Breeding Bird Survey

Territory mapping surveys based on the BTO's Common Bird Census (CBC) methodology (Marchant, 1983, Bibby *et al*., 2000) were carried out across the site and, where access was possible, in areas of coastal habitat directly adjacent to the site. Transects (no further than 50m apart) were walked across all open habitats, while all field boundaries and woodland/shelter belt edges were also walked.

While eight to ten visits are the norm for CBC sites being monitored over the long-term, where territory mapping is being used for the purpose of assessing potential environmental impacts it is generally accepted that three to four visits are sufficient to determine the numbers and locations of breeding birds with reasonable accuracy.

A total of four visits were made to the site on 5th May, 18th May, 6th June and 22nd June 2012, with all surveys commencing between 0615 and 0630 am. On the final visit very heavy rain terminated the survey which, following improvements in the weather, recommenced later in the day. Each visit was conducted at a pace that ensured that most birds would be detected if calling, singing or visible.

There is an area in the west of the site where access was not possible due to a high deer fence. Surveyors were able to adequately view this area using binoculars.

3. Results

3.1 Desk Study

3.1.1 Designated Sites of Ornithological Importance

There are seven statutory sites designated for their bird interest within 20km of the proposed site. Glen App and Galloway Moors and Loch of Inch Torrs Warren include both international and national designations within their boundaries. The sites are listed below in order of highest International designation with their constituent National designated sites closest to the site going through to the closest National designation:

Glen App and Galloway Moors

- **Glen App and Galloway Moors SPA**, c. 11.5km north east and designated for its breeding population of hen harrier (an average of 10 breeding females annually between 1994 and 1998, 2% of British breeding population).
- **Glen App and Galloway Moors SSSI**, c. 11.5km north east and designated due to its breeding hen harrier population (regularly supporting 2% of the British breeding population).

Loch of Inch Torrs Warren

- **Loch of Inch and Torrs Warren SPA**, the closest compartment is 12.2km east of the site however the main body of the SPA is located 15km east and designated for supporting overwintering internationally important numbers of Greenland white fronted goose, (1991/92-95/96 winter peak mean of 534 representing 4% of the British wintering population and 2% of the World population) and a nationally important overwintering number of hen harrier (1991/92 to 1995/96 winter peak mean of 8 representing 1% of the British wintering population).

- **Loch of Inch and Torrs Warren Ramsar**, the closest compartment is 12.2km east of the site however the main body of the SPA is located 15km east and designated by regularly supporting overwintering internationally important numbers of Greenland white-fronted goose (1991/92-95/96 winter peak mean of 534 representing 4% of the British wintering population and 2% of the World population).

- **White Loch – Lochinch SSSI**, c. 12.2km east and designated for non-breeding greylag goose population. White Loch is internationally important for large numbers of overwintering wildfowl, supporting up to 2% of the Icelandic greylag goose population overwintering in the UK, and for overwintering Greenland white-fronted geese, but these are not a qualifying feature.

- **Torrs Warren – Luce Sands SSSI** , c. 15km south-east and designated for it's internationally important overwinting population of hen harrier which roost in areas of fen and tall heather.

Sites of Special Scientific Interest

- **Auchrochar Wetlands SSSI**, c. 11km east and designated for its large breeding population of sedge warbler. However, it also supports a diverse bird population of both breeding and wintering species characteristic of wetland. The site is used regularly as a hunting area by a number of raptor species.

3.1.2 Breeding Bird Territory Mapping

The status of birds has been assessed using the following categories. These categories were used to classify birds as target species and non-target species:

- Species listed on Annex 1 of the Directive 2009/147/EC on the Conservation of Wild Birds (often referred to as the Birds Directive)[2];

- Species protected under Schedule 1[3] of the Wildlife & Countryside Act 1981 (as amended);

- Red and amber-listed Birds of Conservation Concern (BoCC)[4]; and

- BAP species – species for which a UK Biodiversity Action Plan (UKBAP) has been developed in response to concerns about their conservation status.

In total, 55 species were recorded with 33 of those species showing evidence of breeding within the site. Of those breeding species seven were red-listed and nine amber-listed BoCC (see Table 3.1 for summary of conservation status). Figure 3.1 shows the target bird species and Figure 3.2 shows all non-target bird species identified on site. The only Schedule 1 species was whimbrel, with a flock moving through the site on migration. Two Annex 1 species were recorded; sandwich tern moving south close offshore and European golden plover, recorded on the first visit with no further visits recorded so likely also to have been moving through the area and returning to breeding grounds elsewhere.

There were a number of wader species breeding on and in the vicinity of the site which included two amber–listed BoCC – Eurasian curlew and Eurasian oystercatcher, plus at least four territories of the red-listed northern lapwing. In addition, post-breeding flocks of northern lapwing used the coastal strip and improved pasture at the bottom of Larbrax Moor.

Eurasian oystercatcher may have also bred along the shoreline however it was difficult to confirm nesting due to the inaccessibility of this area. The two Eurasian curlew territories were at Larbrax Moor and Galdenoch Moor and this species also occurred on the shoreline. Recent research has shown that Eurasian curlew appear to be particularly susceptible to wind farm developments, so it is likely applications affecting this species will be given greater scrutiny. Common snipe were also recorded drumming over the north-east of the site.

The species assemblage was indicative of the variety of habitats present and although skylark and meadow pipit predominated, other species, such as goldcrest, hedge accentor, willow warbler, chaffinch and the red-listed lesser redpoll were associated with blocks of coniferous woodland, woodland edge and scrub. Farmland birds, such as yellowhammer, reed bunting (both red-listed BoCC) and common whitethroat were also present. The rocky coastline held two pairs of nesting herring gull, a raven nest and three northern fulmar nests. The only raptors recorded were common buzzard and the amber-listed common kestrel and although it was suspected that kestrel may have nested on the cliffs no evidence of this was found.

Greylag and greater Canada geese were recorded around the moor and lochans and both species may have nested as common shelduck and mallard also may have done. The wetlands also brought in other species such as grey heron.

[2] Certain endangered, rare, or vulnerable bird species, which warrant special consideration, are included on Annex 1 of the European Communities Council Directive on the Conservation of Wild Birds (the codified version of 79/409/EEC, as amended).

[3] All species of wild birds are protected under the Wildlife and Countryside Act 1981 (as amended), though some species that are considered to be rare or vulnerable are listed on Schedule 1 of the Act and are afforded additional protection to deter disturbance when nesting.

[4] The background to the establishment of a 'traffic light system' of conservation concern for UK birds is discussed in Eaton *et al* (2009). 'Red-listed' species include those that are globally threatened have suffered an historical population decline (between 1800 and 1994) or which are perceived to have experienced rapid declines in their UK breeding population or contractions in their UK range of more than 50% over the past twenty-five years. Amber listed species may have suffered moderate declines or range contractions, have an unfavourable conservation status in Europe (and are therefore of European concern), breed in very low numbers (five year mean of 1-30 pairs breeding annually), breed at a limited number of sites, or occur in relatively high numbers in UK in comparison with other parts of Europe. Other species have 'green' status, as they do not fulfil these criteria. This implies that the population of a species is either stable or increasing (or that too little is known about the population to allow the species to be included on the red or amber list).

Table 3.1 Species recorded at Larbrax during territory mapping, their conservation status and breeding status on site where B = Breeding; PB = Possible Breeding; NB = Non-breeding

English Name	Scientific Name	BTO Code	Classification	Breeding Status	
Barn Swallow	***Hirundo rustica***	**SL**	**Amber**	**NB**	
Blackbird	*Turdus merula*	B		B	
Blue Tit	*Cyanistes caeruleus*	BT		NB	
Bullfinch	***Pyrrhula pyrrhula***	**BF**	**UKBAP, Amber**	**NB**	
Carrion Crow	*Corvus corone*	C		B	
Chaffinch	*Fringilla coelebs*	CH		PB	
Coal Tit	*Periparus ater*	CT		NB	
Common Buzzard	*Buteo buteo*	BZ		NB	
Common Eider	***Somateria mollissima***	**E**	**Amber**	**PB**	
Common Kestrel	***Falco tinnunculus***	**K**	**Amber**	**NB**	
Common Linnet	***Carduelis cannabina***	**LI**	**UKBAP, Red**	**B**	
Common Pheasant	***Phasianus colchicus***	PH		NB	
Common Raven	***Corvus corax***	RN		B	
Common Shelduck	***Tadorna tadorna***	**SU**	**Amber**	**NB**	
Common Snipe	***Gallinago gallinago***	**SN**	**Amber**	**PB**	
Common Whitethroat	***Sylvia communis***	**WH**	**Amber**	**PB**	
Common Wood Pigeon	*Columba palumbus*	WP		PB	
Eurasian Curlew	***Numenius arquata***	**CU**	**UKBAP, Amber**	**PB**	
European Goldfinch	*Carduelis carduelis*	GO		NB	
Eurasian Jackdaw	*Corvus monedula*	JD		NB	
Eurasian Oystercatcher	***Haematopus ostralegus***	**OC**	**Amber**	**B**	
European Golden Plover	***Pluvialis apricaria***	**GP**	**Annex 1, Amber**	**NB**	
European Robin	*Erithacus rubecula*	R		PB	
European Shag	***Phalacrocorax aristotelis***	**SA**	**Amber**	**NB**	
Eurasian Siskin	*Carduelis spinus*	SK		NB	
Eurasian Stonechat	*Saxicola torquata*	SC		B	
Goldcrest	*Regulus regulus*	GC		PB	
Great black-backed Gull	***Larus marinus***	**GB**	**Amber**	**NB**	
Great Cormorant	*Phalacrocorax carbo*	CA		NB	
Greater Canada Goose	***Branta canadensis***	**CG**		NB	
Grey Heron	*Ardea cinerea*	H		NB	
Greylag Goose	***Anser anser***	**GJ**	**Amber**	**NB**	
Hedge Accentor	***Prunella modularis***	**D**	**UKBAP, Amber**	**PB**	
Herring Gull	***Larus argentatus***	**HG**	**UKBAP, Red**	**B**	
Lesser Redpoll	***Carduelis cabaret***	**LR**	**UKBAP, Red**	**PB**	
Long-tailed Tit	*Aegithalos caudatus*	LT		B	
Mallard	***Anas platyrhynchos***	**MA**	**Amber**	**NB**	
Meadow Pipit	***Anthus pratensis***	**MP**	**Amber**	**PB**	
Mistle Thrush	***Turdus viscivorus***	**M**	**Amber**	**NB**	
Northern Fulmar	***Fulmarus glacialis***	**F**	**Amber**	**B**	
Northern Lapwing	***Vanellus vanellus***	**L**	**UKBAP, Red**	**PB**	
Northern Wheatear	***Oenanthe oenanthe***	**W**	**Amber**	**PB**	
Pied Wagtail	*Motacilla alba*	PW		B	
Reed Bunting	***Emberiza schoeniclus***	**RB**	**Amber**	**PB**	
Ringed Plover	***Charadrius hiaticula***	**RP**	**Amber**	**NB**	
Rook	*Corvus frugilegus*	RO		NB	
Sandwich Tern	***Sterna sandvicensis***	**TE**	**Annex 1, Amber**	**NB**	
Sedge Warbler	*Acrocephalus schoenobaenus*	SW		PB	
Skylark	***Alauda arvensis***	**S**	**UKBAP, Red**	**PB**	
Song Thrush	***Turdus philomelos***	**ST**	**UKBAP, Red**	**PB**	
Willow Warbler	***Phylloscopus trochilus***	**WW**	**Amber**	**PB**	
Whimbrel	***Numenius phaeopus***	**WM**	**Schedule 1, Red**	**NB**	
White Wagtail	*Moticilla alba*	WB		NB	
Winter Wren	*Troglodytes troglodytes*	WR		B	
Yellowhammer	***Emberiza citrinella***	**Y**	**UKBAP, Red**	**PB**	

3.1.3 Target Species recorded within the survey area

Target species, including those that are Schedule 1 or have conservation status of at least red-listing or UKBAP priority, are discussed in further detail below.

Waders

Whimbrel is a Schedule 1 species and is red-listed due to declines in both the breeding and non-breeding populations.

European golden plover numbers in Scotland have undergone substantial declines in some areas and the species is an Annex 1 species.

Northern lapwing is a UKBAP priority species and is red listed due to declines in both the breeding and non-breeding populations.

Eurasian Curlew is a UKBAP priority species and is amber-listed due to a widespread decline that is primarily attributed to agricultural change and afforestation (Forrester *et al*. 2007).

Gulls

Herring gull is red-listed due to declines in both the breeding and non-breeding populations. However, the species is a common resident breeding bird in coastal Scotland (Forrester *et al* 2007). Breeding herring gull were recorded along the coastal habitat adjacent to the site with little activity on the site.

Terns

Sandwich tern is listed on Annex 1 and is also amber-listed due to a widespread decline.

Passerines

Skylark is a UKBAP priority species and is red-listed due to a rapid decline in the breeding population in Britain during the period 1975 to 1994 (Donald, 2004). The main threats to skylark are changes in agricultural practices leading to the loss of winter stubbles and breeding habitat (Forrester *et al*, 2007).

Song thrush is a UKBAP priority species and is red-listed because the species has experienced a severe breeding population decline over the last 25 years. It breeds throughout mainland Scotland but is most common in the lowlands; except in coastal areas; most birds migrate in winter (Forrester *et al*, 2007).

Bullfinch, common linnet and yellowhammer are all UKBAP priority species. Common linnet and yellowhammer are red-listed due to severe long-term declines in the UK breeding populations, while bullfinch is amber-listed due to a moderate breeding population decline. All three species are resident and occur throughout much of Scotland.

4. Summary and Recommendations

The range of species breeding at Larbrax was typical of the habitats present, which was predominantly farmland and open moorland.

Many of the conservation notable species occurring on the site were passerines using the farmland, woodland and scrub and might not be significantly affected by wind farm development. However, given the relatively rich assemblage present, care would have to be taken during site design to ensure that habitat supporting these species was maintained.

A wind farm would have the potential to impact on breeding waders on the site, with two species present, northern lapwing and Eurasian curlew, which have both undergone notable population declines. The latter species has recently been shown to be very sensitive to wind farm developments, with evidence suggesting they will not return to territories within the wind farm footprint. It is recommended that turbines are positioned outside the territories of these species in order to help minimise any potential disturbance.

Further survey work is recommended in order to gain information on breeding waders and other species using the site. Winter and breeding bird vantage point surveys would help to further assess bird activity across the site and provide information to inform the best layout for the turbines in order to minimise disturbance to bird species.

5. References

Bibby, C.J., N.D. Burgess,. Hill, D.A & S.H. Mustoe. (2000): Bird Census Techniques (2nd Edition). London: Academic Press.

Donald, P.F. (2004). The Skylark. T. & A.D. Poyser, London.

Eaton, M.A., Brown, A.F., Noble, D.G., Musgrove, A.J., Hearn, R.D., Aebischer, N.J., Gibbons, D.W., Evans, A. & Gregory, R.D. (2009). Birds of Conservation Concern 3: the population status of birds in the United Kingdom, Channel Islands and Isle of Man. British Birds 102: 296-341. (BoCC3).

Forrester, R.W., Andrews, I.J., McInerny, C.J., Murray, R.D., McGowan, R.Y., Zonfrillo, B., Betts, M.W., Jardine, D.C. & Grundy D.S. (eds). 2007. The Birds of Scotland. The Scottish Ornithologists' Club, Aberlady.

Gilbert, G., Gibbons, D.W. and Evans, J. (1998) *Bird Monitoring Methods*. RSPB Sandy.

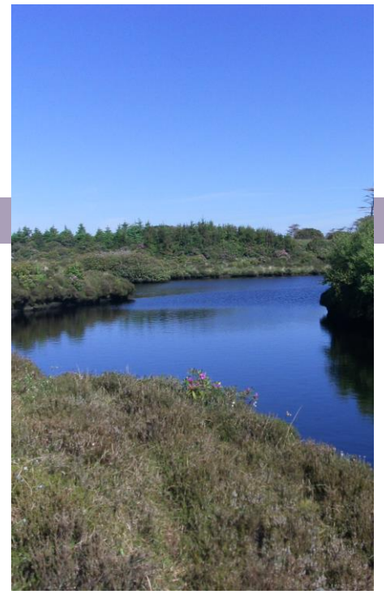
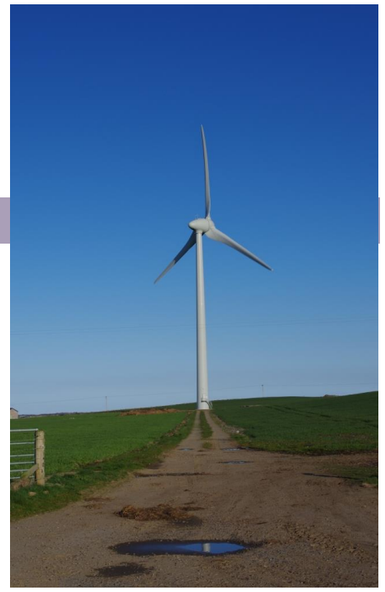
Marchant, J.H. (1983). *Common Birds Census instructions*. BTO, Tring.

O'Brien, M & Smith, K W 1992. Changes in the status of waders breeding on wet grasslands in England and Wales between 1982 and 1989. *Bird Study* 39: 165-176.

PNE WIND UK Ltd

Larbrax Wind Farm

Baseline Ornithology Report: Migration and Winter Season 2012/13

AMEC Environment & Infrastructure UK Limited

January 2014

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Document Revisions

No.	Details	Date
1	Draft report	January 2014
2	Final report	January 2014

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Doc Reg No. dedi0121r

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Executive Summary

- This report summarises the findings of migration and winter bird surveys carried out between September 2012 - March 2013 on the site of a proposed new wind farm at Larbrax, located south west of Leswalt on the North Rhins Peninsula, Dumfries and Galloway.
- A series of ornithological survey methodologies were undertaken including Vantage Point surveys from three observation points, evening Barn Owl *Tyto alba* and Hen Harrier *Circus cyaneus* surveys and site walkover surveys.
- The Site was used by a number of wader species throughout the winter, including both Eurasian Curlew *Numenius arquata* and Northern Lapwing *Vanellus vanellus*, which were regularly present on the Site although European Golden Plover *Pluvialis apricaria* were only recorded on three occasions.
- Sensitive raptors recorded on the site included Hen Harriers with at least three individuals recorded, although there was no evidence of Hen Harrier roosting on the site.
- Merlin *Falco columbarius* and Peregrine *Falco peregrinus* were also recorded on several occasions on/over the Site.
- Barn Owl surveys showed limited use of the Site, but potential roosting sites were identified in the local area although none were on site. There was also one sighting of a Short-eared Owl *Asio flammeus.*
- Small numbers (i.e. less than 20 birds) of Whooper Swan *Cygnus cygnus* were recorded on and over the Site in November and December. Small flocks of Greylag Geese Anser anser were also recorded although they may form part of a local feral population, rather than being migrant birds.

January 2014
Doc Reg No. dedi0121r

1. Introduction

AMEC Environment & Infrastructure UK Limited (AMEC) was commissioned by PNE Wind UK (PNE) to undertake bird surveys at the site of a proposed wind farm development at Larbrax, located south west of Leswalt on the North Rhins Peninsula, Dumfries and Galloway (approximate grid reference for Site centre NW 969 620).

The purpose of this report is to describe the methods and results of the autumn migration and winter surveys, i.e. those carried out between September 2012 – March 2013, which were designed to be suitable to inform the preparation of an Environmental Statement for the development. Surveys included vantage point surveys, Hen Harrier *Circus cyaneus* roost and Barn Owl *Tyto alba* surveys, and site walkover surveys.

The work followed on from an initial breeding bird survey which was carried out in April – June 2012 (Larbrax Wind Farm, Breeding Bird Report 2012).

1.1 Site Description

The Site is located at Larbrax, on the western boundary of the North Rhins Peninsula. The study area is a low-lying coastal Site and the highest part of the Site is 83 m. The Site is generally quite flat, but drops steeply down to the sea on the western side. There are several small water bodies within the study area including Loch Beg and Loch More with drainage channels flowing into the sea. There are some rough vehicle tracks allowing access to the Site from Meikle Galdenoch and Meikle Larbrax located on the north and south of the study area, respectively. Overall, the Site provides grazing for cattle and sheep and fencing is used to contain stock. Several small isolated strips of coniferous plantation are located mainly in the north of the Site. There are some wetland habitats (e.g. blanket bog) on the eastern section of the Site. The Site boundary and current proposed turbine layout is illustrated in Figure 1.1.

1.2 Background and Scope

The key issues relating to birds and wind farms are:

- The effects of direct habitat loss due to land take by wind turbine bases, tracks and ancillary structures;
- The effects of disturbance and displacement of birds from the proximity of the wind turbines. Such disturbance may occur as a consequence of construction work, or due to the presence of the wind farm close to nest or feeding sites or on habitual flight routes; and
- The effects of collision with rotating turbine blades (i.e. killing or injury of birds), which is of particular relevance for sites located in areas with high raptor activity or which support large concentrations of waterfowl.

With regard to the first issue, total land take by wind farm infrastructure generally represents a very small proportion of a site. Therefore the permanent loss of nesting and foraging habitat for birds tends to be very small and will generally have little effect on bird populations. At most wind farm sites it is the latter two issues, collision risk and displacement, which may potentially be more significant.

Ornithological work carried out at Larbrax was based primarily on Scottish Natural Heritage (SNH) guidance. A range of guidance documents have been produced relating to the assessment of bird/wind farm interactions and the following publications and guidelines in particular have been influential in determining the scope of the works at Larbrax:

- SNH (2005, revised 2010 and 2013). *Survey methods for use in assessment of the impacts of proposed onshore windfarms on bird communities*. http://www.snh.gov.uk/docs/C278917.pdf
- SNH (2006). *Assessing significance of impacts from onshore windfarms on birds outwith designated areas*. SNH, Battleby.

SNH guidance recommends that field surveys should be focussed on those species of high nature conservation value for which there is potential for an impact which might be judged significant and adverse. In most circumstances these "target species" tend to be limited to those protected species and other species of conservation concern which may be subject to impact from wind farms.

There are several overarching species lists which describe protected species and species of conservation concern:

- Special Protection Areas (SPA) designate species and those listed under Annex 1 within the Directive 2009/147/EC on the conservation of wild birds (Birds Directive).
- Species listed under Schedule 1 of the *Wildlife & Countryside Act 1981* (as amended) (WCA).
- Species listed under Scottish Biodiversity List (SBL) as required under Section 2(4) of the Nature Conservation (Scotland) Act 2004.
- Birds of Conservation Concern – a five yearly review (Eaton *et al* 2009[1]) which assesses British bird populations and identifies species where the population or range show long term or large negative trends – species are classified into three groups which can be described as:
  - Green – populations are considered to be relatively stable, with no threats identified;
  - Amber – evidence of moderate long term decline in either population or range; and
  - Red – evidence of severe long term decline in either population or range.

In addition, consideration should also be given to migratory species which are either rare or vulnerable, or warrant special consideration on account of the proximity of migration routes, or breeding, moulting, wintering or staging areas in relation to the proposed wind farm (SNH 2005/2013)[2].

1.3 Key species

The following key species of conservation concern (target species) were identified during the initial desk based study, a review of species range maps for the Site (Forrester and Andrews 2007[3]), consultation with SNH, and as a result of the findings of ongoing ornithology field work:

- Protected raptors and owls (particularly Hen Harrier *Circus cyaneus* and Peregrine *Peregrinus falconus*, also Barn Owl *Tyto alba*); and
- Waterfowl and waders (particularly grey geese *Anser spp.* which might migrate through or use the area, Whooper Swan *Cygnus cygnus*, European Golden Plover *Pluvialis apricaria* and Eurasian Curlew *Numenius arquata*).

2. Methodology

2.1 Desk Study & Consultation

The presence of Special Protection Areas (SPAs) and ornithological Sites of Special Scientific Interest (SSSI) within 20 km was determined by accessing the Multi-Agency Geographical Information for the Countryside (MAGIC) website[4].

SNH was consulted in a meeting on the 14th May 2013, although the purpose of this meeting was primarily to discuss the field work survey schedule and ensure that SNH were satisfied with the scope and scale of the surveys. This was confirmed by letter on the 5th of June 2013.

RSPB were consulted on the 8th of April 2013 and responded on the 15th of April 2013.

Dumfries Raptor Study Group were consulted on the 25th October 2013 and again on the 9th of December 2013. Data relating to the request for any breeding records of raptors or owls within 2 km of the site boundary was received on the 17th of January 2014.

The Dumfries and Galloway Environmental Records Centre (DGERC) requested to provide data on protected species, BAP (Biodiversity Action Plan)[5], LBAP (Local Biodiversity Action Plan) , Scottish Biodiversity List and rare, scarce and threatened species within 5 km of the Site boundary – this request included all taxa, not just birds, although only results specific to birds are presented here..

2.2 Wintering Bird Surveys

The key objective of the winter bird surveys at Larbrax was to establish whether any species or populations of nature conservation importance made regular use of the Site or adjacent areas. A variety of surveys were carried out from September 2012 to March 2013 inclusive, further details of which are provided below. In general, the surveys were carried out in line with the SNH 2010 guidelines, as this fieldwork preceded the 2013 revision of those guidelines. It is not considered that this represents a deficiency of the data gathered by these surveys.

2.2.1 Surveyors

All survey work was subcontracted to Starling Learning, and was carried out by experienced ornithologists competent in field survey techniques.

[1] Eaton, M.A., Brown, A.F., Noble, D.G., Musgrove, A.J., Hearn, R.D., Aebischer, N.J., Gibbons, D.W., Evans, A. & Gregory, R.D. 2009. Birds of Conservation Concern 3: the population status of birds in the United Kingdom, Channel Islands and Isle of Man. *British Birds*, **102**, pp 296-341
[2] SNH (2005, revised 2010 and 2013). *Survey methods for use in assessment of the impacts of proposed onshore windfarms on bird communities*. http://www.snh.gov.uk/docs/C278917.pdf
[3] Forrester R & Andrews I (eds) 2007 *The birds of Scotland* Scottish Ornithologists Club Aberlady.
[4] http://magic.defra.gov.uk
[5] The actual request was for BAP and LBAP species; this terminology/classification has now been superseded by the SBL list.

2.2.2 Vantage Point Survey

Vantage point (VP) watches were conducted in accordance with SNH (2010) guidance and undertaken throughout the survey period. This method focuses on identifying flight-paths of target species and allows any regularly used flight lines to be identified, and if necessary, allowing turbine locations to be altered where necessary to reduce collision risk to birds. The data generated can also be used to estimate the theoretical risk of collision with turbines by incorporation into a suitable model.

The SNH methodology guidance is that vantage points should be chosen parsimoniously to achieve maximum visibility from the minimum number of locations such that all parts of the survey area are within two kilometres of a VP. Three vantage points were identified (the locations of which are shown in Figure 2.2) as being sufficient to survey the development area during the autumn/winter period, the locations of which were:

- VP1 – NW 96981 62235 - view bearing 200º
- VP2 – NW 96483 62304 – view bearing 180º
- VP3 – NW 97115 61283 – view bearing 0º

Five height bands were used and when target species were located, their height was recorded at 15 second (s) intervals. The height bands assessed included:

- 1 – less than 10 m
- 2 - 10 m – 30 m
- 3 – 31 m - 80 m*
- 4 – 81 m – 130 m*
- 5 – greater than 130 m

Those marked with an * indicate collision risk height

2.2.3 Hen Harrier/Barn owl surveys

In addition to the standard VP surveys, additional surveys were undertaken over suitable Hen Harrier roost habitat and also to assess for Barn Owl use of the Site between January and March 2013. These involved additional dusk VP surveys carried out from a number of different points across the Site (more points were used because ability to detect birds reduced over distance with darkness), with VP watches undertaken in the hours around sunset.

2.2.4 Winter Walkover Survey

Winter walkover surveys were carried out on a monthly basis between November 2012 – March 2013 with all (land) areas within 1 km of the initial turbine layout being covered. All birds heard or seen were recorded on field maps using standard BTO two-letter codes.

2.2.5 Limitations

Winter 2012/13 was abnormally cold, particularly in the latter part of the season when the Mull of Galloway experienced heavy snow fall, making access to the Site difficult. Consequently some surveys were carried out at the first available opportunity when access could be obtained rather than strictly on schedule – this means that the surveys due in March for example, were carried out in the first week of April. Because of the unusual conditions, which may have reduced bird activity over the Site, scheduling the surveys for after the worst weather conditions was considered to ensure the survey results would be representative, and less affected by atypical weather conditions.

The cold weather which persisted during late winter and into spring meant that the breeding season commenced much later than would be expected, with many migrant species delayed onto breeding grounds due to lack of food availability. As such, surveys being carried out later than they would normally be , are considered in this instance, not to detract from the assessment of the ornithological interests and could actually make for a stronger assessment than if the surveys had been carried out strictly in accordance with the SNH guidelines.

3. Results

3.1 Desk Study and consultation

Table 3.1 provides details of statutory designated ornithological sites within the search area as outlined in section 2.1. There are other statutory sites present within the search area which are not designated for birds, which have been excluded from this assessment. Figure 2.1 shows the location of each designated site identified.

Table 3.1 Statutory ornithological sites within the search area

Site Name	Approximate distance from site (km)	Reasons for ornithological designation/notification
Glen App and Galloway Moors SPA / SSSI	12	10 breeding Hen Harrier females
Loch of Inch and Torrs Warren SPA	13	Greenland White-fronted Goose (534) and non-breeding Hen Harrier (8)
Auchrochar Wetlands SSSI	12	Breeding Sedge Warbler Acrocephalus schoenobaenus
White Loch – Lochinch SSSI	13	2% of Icelandic Greylag Goose Anser anser population
Torrs Warren – Luce Sands SSSI	16	Non-breeding Hen Harrier

Consultation with SNH has confirmed that the proposed development would not affect any of the populations of the designated sites because the designated sites lie further from the proposed development than the species will range. This makes it highly unlikely that any birds which form the protected population of the designated site would be present on or make use of Larbrax wind farm. It was therefore considered that an Appropriate Assessment would not be required.

In addition, SNH confirmed during the meeting in May 2013 and later by letter on the 5th of June that they were satisfied with the proposed field survey methodology, which was consistent with the then applicable 2010 guidelines.

RSPB, in responding to their consultation, did not have any pertinent data related to the site.

3.1.1 DGERC data

Approximately 80 records were received as a result of the data request. However to ensure results were applicable and meaningful to the Site the following filters were applied:

- Data limited to that which was recorded between 2007-2012 (the last five years for which data was available); and
- Sighting should have occurred within the OS grid squares NX 96 64 – NX 00 60.

The latter criteria created an approximately 1 km search area beyond the red line boundary of the Site. In addition, data was then reviewed for sensitive species which may roam more widely (e.g. raptors and owls). As a result of this search five records were included and are shown in Table 3.2.

Table 3.2 Results from DGERC data search

Species	Scientific Name	Date	Location	Grid reference	Recording Resolution (m)[1]	No.	Comments
Mallard	*Anas platyrhynchus*	28/06/2008	Lochnaw Loch	NX 99 63	1000	1	
Greater Canada Goose	*Branta canadensis*	28/06/2008	Lochnaw Loch	NX 99 63	1000	5	
Herring Gull	*Larus argentatus*	28/06/2008	Lochnaw Loch	NX 99 63	1000	20	
Barn Owl	*Tyto alba*	30/05/2008	Glenstockadale	NX001611	100	1	regularly seen hunting
Hen Harrier[2]	*Circus cyaneus*	January	withheld	withheld	100	1	being mobbed by Common Kestrel

[1] Indicates accuracy of recording of location i.e. whether to nearest grid square (1 km), 6 figure grid reference (100 m) or 8 figure reference (10 m)

[2] Record for Hen Harrier was considered sensitive by DGERC and not for release to the public; full details are therefore provided in the confidential annex.

Three of the five records relate to one day, and birds present on Lochnaw Loch. No records actually relate to birds on the proposed wind farm development Site. As such, the records are not believed to be an accurate representation of the background bird levels in the wider environment, although they do confirm presence of both Barn Owl and Hen Harrier in the wider environment and over a longer period than just the study period.

3.1.2 DGRSG data

The DGRSG provided information on breeding Peregrine within the search area. These results will be provided in a Confidential Annex to the Baseline Spring Migration and Breeding Season 2013 Report.

3.2 Field Survey

3.2.1 Vantage Point Results

Vantage point surveys were carried out between September 2012 – March 2013 (although as noted, snow in spring 2013 meant some surveys were re-timetabled. The March surveys were carried out in the first week of April). Table 3.3 shows the number of hours of survey from each VP during this period; date, time and conditions for each survey are provided in Appendix A.

Table 3.3 Hours of observation from each VP

	VP		
Month	**1**	**2**	**3**
September 2012	6	6	6
October 2012	6	6	6
November 2012	6	6	6
December 2012	6.5	6	6
January 2013	6	6	6
February 2013	6	6	6
March 2013	7.5	7.5	6.25
Total hours	44	43.5	42.25

Target Species

Table 3.4 shows the recorded target species together with their conservation status. This list of key species is not exhaustive and in addition to these key species any other protected raptors and owls or waterfowl and waders encountered during field work would have been considered as target species – e.g. Greenland White-fronted Goose *Anser albifrons flavirostris* which had been identified in the desk assessment as having the potential to be present, but which was ultimately not recorded.

Table 3.4 Conservation status of target species

Species Name	Scientific Name	Annex 1	Schedule 1	SBL	BoCC status
Hen Harrier	*Circus cyaneus*	X	X	X	Red
Eurasian Curlew	*Numenius arquata*			X	Amber
European Golden Plover	*Pluvialis apricaria*	X		X	Amber

Species Name	Scientific Name	Annex 1	Schedule 1	SBL	BoCC status
Common Kestrel	*Falco tinnunculus*			X	Amber
Whooper Swan	*Cygnus cygnus*	X	X	X	Amber
Peregrine	*Falco peregrinnus*	X	X	X	
Short-eared Owl	*Asio flammeus*	X		X	Amber
Barn Owl	*Tyto alba*		X	X	Amber
Merlin	*Falco columbarius*	X	X	X	Amber
Greylag Goose	*Anser anser*				Amber
Whimbrel	*Numenius phaeopus*		X		**Red**

Table 3.5 shows a summary of the results of the vantage point surveys, together with a brief analysis of the records – full results are shown in Appendix B. Full collision risk modelling will be carried out when all vantage point data on the Site has been collected, as part of the Environmental Impact Assessment, and reported in the Environmental Statement. Eurasian Curlew was the most commonly recorded species with birds present throughout much of the winter. A full discussion of each target species is provided in section 4. The flightline maps for the target species are illustrated in Figures 3.2.

- Figure 3.2 a: Flight activity of Hen Harrier
- Figure 3.2 b: Flight activity of Merlin
- Figure 3.2 c: Flight activity of Peregrine
- Figure 3.2 d: Flight activity of Whooper Swan
- Figure 3.2 e: Flight activity of European Golden Plover
- Figure 3.2 f: Flight activity of Eurasian Curlew
- Figure 3.2 g:Flight activity of Common Kestrel
- Figure 3.2 h: Flight activity of Greylag Goose

Table 3.5 Summary of observations of target species September 2012 – March 2013

Common Name	*Scientific Name*	*BTO Code*	*Number of birds recorded per month*							*Total no. Recorded*	*No. of observa-tions*	*Bird seconds at CRH*
			Sep	Oct	Nov	Dec	Jan	Feb	Mar			
Barn Owl	*Tyto alba*	BO		1				2		3	3	0
Eurasian Curlew	*Numenius arquata*	CU	161	157	88	10		45	76	537	54	3720
Greylag Goose	*Anser anser*	GJ		9		9			4	22	4	540
European Golden Plover	*Pluvialis apricaria*	GP	1			1		50		52	4	1215
Hen Harrier	*Circus cyaneus*	HH		1	4	6	2	1		14	14	0
Common Kestrel	*Falco tinnunculus*	K			2	5				7	7	195
Merlin	*Falco columbarius*	ML		2	1				1	4	4	0
Peregrine	*Falco peregrinnus*	PE				1			2	3	3	135
Short-eared Owl	*Asio flammea*	SE						1		1	1	0
Whooper Swan	*Cygnus cygnus*	WS				17				17	3	180

Secondary Species

A holistic approach was taken to secondary species recording on the Site, ensuring it didn't interfere with recording of target species, with all species recorded. In addition, target species which were heard calling but could not be located or which were on the ground were also recorded in this category. Because there was an element of birds being repetitively counted at times and some birds were likely recorded between VPs which were occurring simultaneously, a summary table is presented in Table 3.6, with a full breakdown of totals provided in Appendix C – the fact that the number recorded is likely to be an over-estimate of the number present should be remembered when reviewing this data.

Table 3.6 Secondary species recorded during VP surveys

Species	Scientific Name	Sep-12	Oct/Nov 2012	Dec-12	Jan-13	Feb-13
Blackbird	*Turdus merula*	X	X	X	X	X
Common Buzzard	*Buteo buteo*	X	X	X	X	
Carrion Crow	*Corvus corone*	X	X	X	X	X
Great Cormorant	*Phalacrocorax carbo*		X			
Eurasian Collared Dove	*Streptopelia decaocto*		X			
Greater Canada Goose	*Branta canadensis*					X
Chaffinch	*Fringilla coelebs*	X	X		X	X
Mixed corvids		X		X		X
Mew Gull	*Larus canus*		X			
Common Crossbill	*Loxia curvirostra*			X		
Eurasian Curlew	*Numenius arquata*	X	X	X		X

Species	Scientific Name	Sep-12	Oct/Nov 2012	Dec-12	Jan-13	Feb-13
Hedge Accentor	*Prunella modularis*		X	X		
Rock Dove/Feral Pigeon	*Columba livia*		X		X	
Common Eider	*Somateria mollissima*	X				
Fieldfare	*Turdus pilaris*		X	X	X	X
Great Black-backed Gull	*Larus marinus*	X	X	X		X
Goldcrest	*Regulus regulus*	X	X			
European Golden Plover	*Pluvialis apricaria*	X		X		X
Mixed Gulls			X			
Grey Heron	*Ardea cinerea*		X		X	
Hooded Crow	*Corvus cornix*		X		X	X
Herring Gull	*Larus argentatus*	X	X	X	X	X
House Martin	*Delichon urbica*	X				
Eurasian Jackdaw	*Corvus monedula*		X	X	X	X
Common Kestrel	*Falco tinnunculus*	X		X		
Northern Lapwing	*Vanellus vanellus*		X	X	X	X
Lesser Black-backed Gull	*Larus fuscus*	X	X			X
Common Linnet	*Carduelis cannabina*	X	X	X		
Lesser Redpoll	*Carduelis cabaret*	X	X			
Mistle Thrush	*Turdus viscivorus*		X	X		X
Mallard	*Anas platyrhynchos*	X	X	X	X	X
Eurasian Magpie	*Pica pica*		X	X		X
Meadow Pipit	*Anthus pratensis*	X	X	X	X	X
Manx Shearwater	*Puffinus puffinus*	X				
Eurasian Oystercatcher	*Haematopus ostralegus*					X
Common Pheasant	*Phasianus colchicus*		X	X		X
Pied Wagtail	*Motacilla alba*	X				
European Robin	*Erithacus rubecula*	X	X		X	
Common Reed Bunting	*Emberiza schoeniclus*		X	X		
Redwing	*Turdus iliacus*		X	X	X	
Red-legged Partridge	*Alectoris rufa*		X	X		
Common Raven	*Corvus corax*	X	X	X		X
Rook	*Corvus frugilegus*		X	X	X	X
Sky Lark	*Alauda arvensis*	X	X	X	X	
Eurasian Stonechat	*Saxicola torquata*	X	X	X		X
Stock Dove	*Columba oenas*			X		
Common Starling	*Sturnus vulgaris*		X	X	X	X
Eurasian Sparrowhawk	*Accipiter nisus*	X	X	X		

Species	Scientific Name	Sep-12	Oct/Nov 2012	Dec-12	Jan-13	Feb-13
Eurasian Siskin	*Carduelis spinus*	X				
Barn Swallow	*Hirundo rustica*	X				X
Common Shelduck	*Tadorna tadorna*					X
Common Wood Pigeon	*Columba palumbus*	X	X	X	X	X
Winter Wren	*Troglodytes troglodytes*	X	X	X		
Whooper Swan	*Cygnus cygnus*			X		

3.2.2 Walkover surveys

Table 3.7 shows the results of the walkover surveys carried out between November 2012 – March 2013 – dates and times of survey are shown in Appendix D. Numbers indicate the total recorded on each survey in that month. Species shown in bold are Schedule 1, Annex 1 or red listed on BoCC. In total, 59 species were observed, although five species (Red-throated Diver, Black-Throated Diver, Razorbill, Common Eider and Northern Gannet) were only recorded offshore

Table 3.7 Total number of birds recorded per monthly walkover survey

Species	Scientific name	November	December	January	February	March
Blackbird	*Turdus merula*	5	6		3	1
Black-throated Diver	***Gavia arctica***					**3**
Blue Tit	*Cyanistes caeruleus*		1			
Carrion Crow	*Corvus corone*	5	40	17	18	22
Chaffinch	*Fringilla coelebs*	6	3		1	8
Coal Tit	*Periparus ater*		1			
Common Buzzard	*Buteo buteo*	2	2	3	2	13
Common Eider	*Somateria mollissima*					2
Common Kestrel	*Falco tinnunculus*		1		1	
Common Pheasant	*Phasianus colchicus*		3	1	1	4
Common Raven	*Corvus corax*	1	1	2	1	11
Common Reed Bunting	*Emberiza schoeniclus*		12	3	6	
Common Shelduck	*Tadorna tadorna*				4	5
Common Snipe	*Gallinago gallinago*	2	29	1	3	3
Common Starling	*Sturnus vulgaris*		40		8	
Common Wood Pigeon	*Columba palumbus*		42	8		75
Eurasian Curlew	*Numenius arquata*		25		17	19
Eurasian Jackdaw	*Corvus monedula*	1	22	45	30	
Eurasian Oystercatcher	*Haematopus ostralegus*				1	10
Eurasian Siskin	*Carduelis spinus*					1

Species	Scientific name	November	December	January	February	March
Eurasian Sparrowhawk	*Accipiter nisus*		1			
Eurasian Stonechat	*Saxicola torquata*		11			
Eurasian Teal	*Anas crecca*		1			
Eurasian Woodcock	*Scolopax rusticola*			1		
European Robin	*Erithacus rubecula*	3		1	1	2
Feral Pigeon	*Columba livia*		45	16		1
Fieldfare	***Turdus pilaris***			**1**		**8**
Goldcrest	*Regulus regulus*			1		
Goosander	*Mergus merganser*	2	13			
Great Black-backed Gull	*Larus marinus*				1	2
Great Cormorant	*Phalacrocorax carbo*				1	3
Greater Canada Goose	*Branta canadensis*				2	18
Grey Heron	*Ardea cinerea*		1	1	4	2
Greylag Goose	*Anser anser*		24			36
Hedge Accentor	*Prunella modularis*	2		1		
Hen Harrier	***Circus cyaneus***		**3**			
Herring Gull	***Larus argentatus***		**27**	**3**	**3**	**7**
Hooded Crow	*Corvus cornix*				1	1
Lesser Black-backed Gull	*Larus fuscus*					1
Mallard	*Anas platyrhynchos*	23	10		78	14
Meadow Pipit	*Anthus pratensis*		11		7	35
Mistle Thrush	*Turdus viscivorus*			1		
Mixed corvids		400	350			
Mute Swan	*Cygnus olor*				1	
Northern Gannet	*Morus bassanus*				1	
Northern Lapwing	***Vanellus vanellus***	**15**			**56**	**60**
Peregrine Falcon	***Falco peregrinus***			**1**		**2**
Pied Wagtail	*Motacilla alba*	1				1
Razorbill	*Alca torda*					2
Red-legged Partridge	*Alectoris rufa*	7	3			
Red-throated Diver	***Gavia stellata***					**20**
Redwing	***Turdus iliacus***					**2**
Ringed Plover	*Charadrius hiaticula*					4
Rook	*Corvus frugilegus*		21	31	62	3
Sky Lark	***Alauda arvensis***	**28**	**36**	**25**	**11**	**14**
Song Thrush	***Turdus philomelos***		**2**		**2**	
Stock Dove	*Columba oenas*				2	
Water Rail	*Rallus aquaticus*		1			
Whooper Swan	***Cygnus cygnus***	**33**	**17**			
Winter Wren	*Troglodytes troglodytes*	6	8		2	

3.2.3 Barn Owl/Hen Harrier roost surveys

Barn Owl surveys, and Hen Harrier roost surveys were carried out to establish evening/night-time use of the Site by these species. Appendix E shows the dates and times of each survey. Results from the surveys are illustrated in Figure 3.3.

No Hen Harriers were recorded using any part of the Site as a roost, despite there being habitat identified as being potentially suitable north of Loch More.

One Barn Owl and two Short-eared Owls were recorded on Galdenoch Moor during the roost surveys. There were additional sightings of Barn Owls in Meikle Galdenoch and Little Galdenoch, and it is believed that Barn Owls were using buildings in these farm complexes to roost in.

4. Key Species accounts

Hen Harrier

Hen Harrier is a Schedule 1 and Annex 1 species, and a BoCC red-listed species. Within Scotland, the current population estimate for Hen Harrier is 505 pairs[6], with ten breeding pairs recorded in Dumfries and Galloway, and national breeding surveys have reported a decline in the population. Although Scandinavian birds do winter in Scotland, migration/ringing studies have highlighted that a large proportion of the Scottish population remain in Scotland, with Dumfries and Galloway being one of the preferred wintering locations[7]. Persecution of this species across Scotland is well-documented, and remains severe in particular areas, including Dumfries and Galloway. As a result of these factors, Hen Harrier is described as a scarce resident in the county.

Hen Harrier was seen on 14 occasions, with most sightings occurring in the vicinity of Hind Hill, with most sightings occurring in November and December. Activity could have been reduced on the Site in the early months of 2013 due to the snow on the Site in that period. All sightings were at low level, below collision risk height. At least three individuals used the site for foraging, with an adult male, an adult female and a first winter/immature recorded during the December walkover survey.

[6] Hayhow, D.B., Eaton, M.A., Bladwell, S., Etheridge, B., Ewing, S. Ruddock, M., Saunders, R., Sharpe, C., Sim, I.M.W. & Stevenson, A. (*2013*). The status of the Hen Harrier, *Circus cyaneus*, in the UK and Isle of Man in 2010. *Bird Study*
[7] Forrester R & Andrews I (eds) 2007 *The birds of Scotland* Scottish Ornithologists Club Aberlady.

Merlin

Merlin is an Annex I and Schedule 1 listed species and is a BoCC amber list species based on its unfavourable conservation status in Europe. Merlin is also listed on the Scottish Biodiversity List. The current UK population is estimated to be 1,160 pairs[8], with the population remaining relatively stable since 1993-4.

Merlin need open areas with a plentiful supply of birds to hunt, with most nests in heather and lesser numbers nesting in trees. As such, their distribution is closely linked to that of their prey, with the species tending to leave the uplands during late summer and autumn, moving to lower elevations, including both coastal and farmland areas. In 2012 a total of 369 home ranges were checked in Scotland, 211 of which were occupied by pairs, fledging a minimum of 287 young[9] . Eight home ranges were checked in Dumfries and Galloway, seven of which were occupied. It is described as a scarce resident in Dumfries & Galloway[10] although healthy populations exist in this region, and as a breeder with less than 25 pairs per annum and regular winter visitor in Ayrshire[11]. Merlin is considered 'a scarce resident' in Dumfries and Galloway.

Four Merlin were recorded on the Site during the vantage point surveys. Merlin breed on moorland areas, but will winter on coastal locations, generally following their prey species down to lower level. All birds were recorded below collision risk height. There was no obvious pattern to use of the site.

Peregrine

Peregrine is an Annex I and Schedule 1 listed species and is also a BoCC amber list species based on its unfavourable conservation status in Europe. Peregrine is also listed on the Scottish Biodiversity List. The current UK population is estimated to be 1,530 pairs, with 53 pairs found in Dumfries and Galloway (2002 survey; from Holling *et al.* 2012). Peregrines need open areas with a plentiful supply of birds to hunt and secure sites for breeding[12], with most eyries (nests) and roosts generally located on cliffs, crags or tall man-made structures.

Peregrine is considered a 'widespread, if scarce, resident' in Dumfries and Galloway.

Three Peregrine were observed during the vantage point surveys; one was offshore, and two were over the Site, with a further four sightings during walkover surveys. It is likely that this species breeds along the cliff to the west of the Site.

Whooper Swan

Whooper swan is a SBL priority species and is amber-listed due to its small UK breeding population (<300 breeding pairs) and localisation in winter (at least 50% of the UK non-breeding population found in 10 or fewer sites). It is also listed on Annex I of the Birds Directive and is Schedule 1 listed. The species is a common winter visitor and very rare breeder in Scotland. The most recent census in January 2010 found that Scotland held 2,659 birds, or 9.1% of the Icelandic population a reduction of 38.5% from the 2005 census count of 4,142 birds; however this reduction in numbers was probably caused by cold weather movements southwards as England and Wales saw a 40% increase in numbers for the same period.

[8] Holling, M. And the Rare Breeding Birds Panel. 2012. Rare breeding birds in the United Kingdom in 2010. British Birds, 105:352-416.
[9] Etheridge, B., Riley, H., Wernham, C., Holling, M. & Stevenson, A. (2013) Scottish Raptor Monitoring Scheme Annual Report 2011. *http://www.scottishraptorstudygroup.org/SRMS_Report11.pdf*.
[10] Irving, D. 2012. Birds in Dumfries and Galloway 2010. Scottish Ornithologists' Club.
[11] Simpson, F. 2012. Ayrshire Bird Report 2010. Scottish Ornithologists' Club.
[12] Ratcliffe, D. 1993. The Peregrine Falcon. T & A.D. Poyser.

Only three flights of Whooper Swan were recorded, with a combined total of 17 birds observed. All flights were observed moving in a northerly direction over the Site. All movements were on the same day, 18th December 2012.

The walkover surveys also recorded small numbers present, with 33 present or seen flying over in November and 17 recorded in December.

Barn Owl

Barn Owl is a Schedule 1 listed species, and a BoCC amber list species, as well as being listed on the Scottish Biodiversity List. The Barn Owl population for Dumfries and Galloway and Ayrshire combined is estimated at 500 pairs. In Scotland overall, two particularly severe winters in 2009/10 and 2010/11 were likely to be responsible for low nest occupancy rates during the springs which followed. In 2012, of the 702 nests checked, only 42% were occupied by pairs, showing no evidence of population recovery. Of those nests monitored for breeding activity, the lowest proportion since 2006 fledged young, and brood size was the smallest since 2003, and the first time this has fallen below two young per pair. Musgrove *et al*. (2013)[13] estimated the Great British population of Barn Owl to be 4,000 pairs.

Barn Owls were recorded particularly around the buildings of Meikle Galdenoch and Little Galdenoch, where there are roosting opportunities, and Barn Owl pellets were found in some barns/outbuildings that surveyors could gain access to with owner permission. However, records of activity on the Site were infrequent, with three observations during the general vantage point watches, and only two sightings during the dedicated Barn Owl vantage point surveys. All activity was on Galdenoch Moor, with two birds being seen along the shelterbelt edge.

Such low activity on the Site, when Barn Owls were known to be roosting in the vicinity of the Site, suggests that the site is of low suitability for Barn Owls, or that there is better habitat available for them elsewhere during the winter.

European Golden Plover

European Golden Plover is an Annex 1, Scottish Biodiversity List and BoCC amber-listed species. Musgrove *et al*. (2013) estimated a Great British wintering population of 400,000 individuals, and a breeding population of 38-59,000 pairs. Large numbers of European Golden Plover winter in Scotland, estimated at 25,000 - 35,000 individuals, with more passing through en route to wintering locations abroad.

Relatively small numbers of this Annex 1 species were recorded on site during the winter, with the largest flock sighted being 25 birds in February – the timing means this could have been the start of spring migration – with a total of 27 recorded throughout the winter period (there were two sightings of the flock of 25 to give an apparent total of 50, plus another two individual sightings).

Short-eared Owl

Short-eared owl is an Annex 1, Scottish Biodiversity List and BoCC amber-listed species.

One Short-eared Owl was recorded once during the vantage point surveys, with two additional sightings of this species noted during the Barn Owl/Hen Harrier roost surveys. All sightings were of birds on Hind Hill/Galdenoch Moor area of the Site. There was no evidence of a roost on or close to the Site, despite the late evening sightings.

[13] Musgrove, A., Aebischer, N., Eaton, M., Hearn, R., Newson, S., Noble, D., Parsons, M., Risely, K. and Stroud, S. 2013. 'Population estimates of birds in Great Britain and the United Kingdom.' In: *British Birds*, 106, pp 64-100.

Eurasian Curlew

The Eurasian Curlew is listed on the Scottish Biodiversity List, and is a BoCC amber-listed species. Within the UK, the population has been estimated at 68,000 breeding pairs and 150,000 wintering individuals (Musgrove *et al*. 2013), with the Scottish breeding population estimated at around 58,000 pairs. This equates to between 16% and 27% of the European breeding population estimated by Forrester *et al*. (2007). Within Dumfries and Galloway, curlew is described as a common resident.

Eurasian Curlew were frequently recorded on the Site, with a total of over 500 recorded through the winter period from the VPs, but with a maximum count of 25 from the walkover surveys. They were present in all months of the year, except January (snow may have hindered their use of the Site at this point; however Northern Lapwing which have similar habitat requirements were recorded at their greatest number in January), but with peak numbers recorded during September and October, suggesting that the Site may be used by migrant birds in these months. Most birds were recorded between Loch More and Scart Craig, a predominantly grassland area of the Site.

Common Kestrel

The Common Kestrel is a BoCC amber-listed species, and also appears on the Scottish Biodiversity List. According to Forrester and Andrews (2007), the Scottish wintering population of Common Kestrel is approximately 15,000 to 25,000 birds, compared to an estimated Great British breeding population of 45,000 pairs. The Scottish Raptor Study Group monitored 134 pairs in 2012, noting the lowest ever breeding success for the species. The Scottish Breeding Bird Survey recorded a decline of 64% in their numbers between 1994 and 2011, highlighting the status of kestrel as one of concern.

A total of seven Common Kestrel were recorded with two individuals/sightings in November and five recorded in December during the VP surveys. Birds were recorded hunting over grassland on the Site.

Northern Lapwing

Northern Lapwing appears on the Scottish Biodiversity List and is a BoCC red-listed species. The Scottish wintering population is between 65,000 – 69,000 birds (Forrester and Andrews, 2007)

A total of 158 Northern Lapwing were recorded through the winter months, with the greatest number, 66 recorded during the month of January. Birds were generally associated within the area around Loch More.

Greylag Goose

Greylag goose is BoCC amber-listed species based on non-breeding localisation within the UK and non-breeding international importance. The UK wintering population was estimated at 230,000 individuals in 2009-10 (Musgrove *et al*. 2013). The wintering population (as indicated by November peak counts) in Southwest Scotland/Northwest England was estimated at: 1,240 in 2011; 6,536 in 2010; and 3,230 in 2009[14]. The UK population also consists of 46,000 breeding pairs, the majority of which are an introduced feral population.

Only small numbers of Greylag Geese were observed on the site, with the largest flock recorded being nine. The species was also present during the summer months, suggesting that in addition to wintering migrant birds, there is also feral population in the area, which these birds could form part of, rather than being birds from the Arctic, wintering in the west of Scotland. If feral birds, their potential conservation status would be considerably lower than if they were migrant birds.

[14] Wildfowl and Wetlands Trust (2012). Goose and Swan Monitoring Programme: Icelandic Goose Census. Accessed on 16 August 2013:
http://monitoring.wwt.org.uk/species/2012/pinkfoot_latest2012.php#2011/12
http://monitoring.wwt.org.uk/species/2011/pinkfoot_latest2011.php
http://monitoring.wwt.org.uk/species/2010/pinkfoot_latest2010.php
http://monitoring.wwt.org.uk/species/2010/iceland_greylag_latest2010.php
http://monitoring.wwt.org.uk/species/2011/iceland_greylag_latest2011.php
http://monitoring.wwt.org.uk/species/2012/iceland_greylag_latest2012.php#2011/12

Appendix A
Dates and times of vantage point watches

Date	VP No.	Time	Duration	Daylight	Obs.	Weather
28/09/2012	1	09:35	3	Day	JM	5NW 7/8 good vis no rain
28/09/2012	1	12:35	3	Day	JM	5NW 7/8 good vis no rain
28/09/2012	3	12:40	3	Day	ADW	2W 5/8 good vis dry
29/09/2012	3	09:40	3	Day	ADW	5NW 7/8 good vis no rain
30/09/2012	2	12:40	3	Day	LP	5NW 3/8 excellent vis occasional heavy shower
30/09/2012	2	09:35	3	Day	LP	5NW 6/8 very good vis no rain
01/11/2012	1	15:50	1.5	Dusk	JM	
01/11/2012	2	16:00	1.5	Dusk	DG	
01/11/2012	3	15:45	1.75	Dusk	DG	W4 7/8 occasional/light rain fair
02/11/2012	1	09:30	4.5	Day	JM	
02/11/2012	2	09:35	3	Day	DG	W5-W4 8/8-7/8 showers fair
02/11/2012	2	12:35	1.5	Day	DG	
02/11/2012	3	09:30	4.5	Day	AW	SW5/6 - W3 8/8-7/8 showers - dry good
14/11/2012	1	11:00	3	Day	JM	E1 8/8 none-drizzle fair-poor
14/11/2012	1	14:00	3	Day	JM	NW 8/8 drizzle fair
14/11/2012	2	11:00	3	Day	AW	NE1 8/8 occasional rain good
14/11/2012	2	14:00	3	Day	AW	NE1 8/8 drizzle poor
14/11/2012	3	11:00	3	Day	DG	
14/11/2012	3	14:00	3	Day	DG	SSW-NE1-2 8/8 rain poor
17/12/2012	1	15:00	2	Dusk	DG	NE2 8/8 dry-occ rain fair
17/12/2012	2	15:00	2	Dusk	AW	0 8/8 dry good
18/12/2012	**3**	13:15	3	Day	ADW	
18/12/2012	1	12:50	2.5	Day	DG	
18/12/2012	1	12:30	3	Day	DG	E2 6/8 dry-occ/light good, cold
18/12/2012	2	10:12	2	Day	DG	SE2 7/8 Dry good cold
18/12/2012	3	10:15	3	Day	AW	SE2-3 4/8 dry, very good7.5-7.9 degrees
18/12/2012	3	13:15	3	Day	AW	SE2 6/8-4/8 dry very good-good 7.4 degrees
18/12/2012	3	10:15	3	Day	ADW	
20/12/2012	2	13:50	2	Day	ADW	
20/12/2012	1	16:05	1.5	Dusk	AW	SE3 3/8 dry very good 7.2 degrees
20/12/2012	1	16:05	1.25	Dusk	ADW	
20/12/2012	2	13:50	2	Day	AW	SE3 5/8 dry, very good 7.0-6.9 degrees
23/01/2013	3	14:00	2.5	Day	AW	2/3SE 6/8 Good vis dry/light snow
23/01/2013	2	13:56	3	Day	DG	2E 7/8 Good vis no rain
23/01/2013	1	13:50	2.75	Day	JM	
24/01/2013	3	09:40	2	Day	AW	2/3ESE 5/8 very good vis dry
24/01/2013	3	13:20	1.5	Day	AW	3ESE 8/8 Good vis dry
24/01/2013	2	10:40	3	Day	DG	2E 7/8 Fair vis no rain
24/01/2013	1	09:35	2	Day	JM	
24/01/2013	1	13:45	1.25	Day	JM	
21/02/2013	3	07:25	3	Dawn	AW	3SSE 7/8 Good vis no rain
21/02/2013	1	07:15	3	Dawn	JM	SSE3/4 7/8 Good vis dry
21/02/2013	1	13:00	2.5	Day	JM	SSE4 6/8 Good vis dry
21/02/2013	2	10:00	3	Day	JM	3E 6/8 Good vis no rain
21/02/2013	2	13:30	2	Day	DG	4E 4/8 fair vis no rain
21/02/2013	3	13:45	2	Day	AW	4SSE 6/8 very good vis no rain
22/02/2013	1	09:30	0.5	Day	JM	
22/02/2013	2	09:40	1	Day	DG	2E 8/8 good vis no rain
22/02/2013	3	09:40	1	Day	AW	2E 8/8 very good no rain
03/04/2013	1	15:15	2	day	JM	NE1 2/8 none good
03/04/2013	2	15:20	2	day	DG	NE2 2/8 none good dazzle from sea
03/04/2013	3	15:45	2	day	AW	NE2 1/8 dry very good, warm and sunny but still patches of snow
04/04/2013	1	11:35	3	day	JM	N2 4/8-7/8 none good
04/04/2013	1	16:10	1	day	JM	N2 5/8 none good
04/04/2013	2	10:45	2	day	AW	SE3 1/8-2/8 dry very good 8 degrees-10 degrees
04/04/2013	2	15:10	2	day	AW	ESE3 3/8 dry very good 12.6 degrees
04/04/2013	3	11:00	1.25	day	DG	E2-3 6/8-5/8none fair-good some haze
04/04/2013	3	14:40	1.5	day	DG	E2-E3 1/8-5/8 none fair slight haze

Appendix B
Target species detailed results

Date	VP No.	Species	Species code	No. of birds	Flight line No.	Duration (s)	Number of 15 s intervals:				
							1 < 10 m	2 10 - 30 m	3 31-80 m	4 81-130 m	5 - > 130 m
28/09/2012	1	Eurasian Curlew	CU	2	1	8	0	1	0	0	0
28/09/2012	3	Eurasian Curlew	CU	1	1	18	1	1	0	0	0
28/09/2012	3	Eurasian Curlew	CU	5	1	47	0	3	0	0	0
28/09/2012	3	Eurasian Curlew	CU	1	3	32	0	1	2	0	0
28/09/2012	3	Eurasian Curlew	CU	2	4	14	0	2	0	0	0
28/09/2012	3	Eurasian Curlew	CU	3	5	12	1	0	0	0	0
28/09/2012	3	Eurasian Curlew	CU	7	6	28	2	0	0	0	0
28/09/2012	3	European Golden Plover	GP	1	2	51	0	0	3	0	0
30/09/2012	2	Eurasian Curlew	CU	15	1	40	3	1	0	0	0
30/09/2012	2	Eurasian Curlew	CU	5	2	10	1	0	0	0	0
30/09/2012	2	Eurasian Curlew	CU	4	4	20	2	1	0	0	0
30/09/2012	2	Eurasian Curlew	CU	26	5	42	2	2	0	0	0
30/09/2012	2	Eurasian Curlew	CU	1	2	10	1	1	0	0	0
30/09/2012	2	Eurasian Curlew	CU	26	3	22	2	1	0	0	0
30/09/2012	2	Eurasian Curlew	CU	26	5	28	2	1	0	0	0
01/11/2012	2	Merlin	ML	1	1	18	2	0	0	0	0
02/11/2012	1	Greylag Goose	GJ	3	2	10	1	0	0	0	0
02/11/2012	2	Eurasian Curlew	CU	1	4	16	2	0	0	0	0
02/11/2012	2	Eurasian Curlew	CU	4	5	11	1	0	0	0	0
02/11/2012	2	Eurasian Curlew	CU	4	6	34	3	0	0	0	0
02/11/2012	2	Eurasian Curlew	CU	1	1	16	2	0	0	0	0
02/11/2012	2	Eurasian Curlew	CU	5	2	18	2	0	0	0	0
02/11/2012	2	Eurasian Curlew	CU	4	3	22	1	1	0	0	0
02/11/2012	3	Eurasian Curlew	CU	20	1	28	1	1	0	0	0
02/11/2012	3	Eurasian Curlew	CU	20	2	35	1	1	1	0	0
02/11/2012	3	Eurasian Curlew	CU	20	3	78	1	2	3	0	0
02/11/2012	3	Eurasian Curlew	CU	20	4	16	1	1	0	0	0
02/11/2012	3	Eurasian Curlew	CU	31	7	18	2	0	0	0	0
02/11/2012	1	Hen Harrier	HH	1	1	22	2	0	0	0	0
02/11/2012	1	Merlin	ML	1	6	6	1	0	0	0	0
14/11/2012	2	Eurasian Curlew	CU	9	3	35	0	0	0	0	0
14/11/2012	2	Eurasian Curlew	CU	35	4	350	14	3	0	0	0
14/11/2012	2	Eurasian Curlew	CU	33	10	15	2	0	0	0	0
14/11/2012	3	Eurasian Curlew	CU	11	10	34	1	2	0	0	0
14/11/2012	1	Hen Harrier	HH	1	3	25	2	0	0	0	0
14/11/2012	1	Hen Harrier	HH	1	5	4	0	0	0	0	0
14/11/2012	2	Hen Harrier	HH	1	7	35	2	1	0	0	0
14/11/2012	3	Hen Harrier	HH	1	3	65	0	5	0	0	0
14/11/2012	2	Common Kestrel	K	1	2	20	2	0	0	0	0
14/11/2012	2	Common Kestrel	K	1	5	147	0	8	2	0	0
14/11/2012	2	Merlin	ML	1	4	18	2	0	0	0	0
17/12/2012	1	Hen Harrier	HH	1	1	135	0	10	0	0	0
18/12/2012	2	Eurasian Curlew	CU	8	2	26	2	0	0	0	0
18/12/2012	2	Eurasian Curlew	CU	1	4	48	0	4	0	0	0
18/12/2012	1	Greylag Goose	GJ	9	5	51	0	0	4	0	0
18/12/2012	3	European Golden Plover	GP	1	2	35	0	0	3	0	0
18/12/2012	1	Hen Harrier	HH	1	2	10	1	0	0	0	0
18/12/2012	1	Hen Harrier	HH	1	3	86	6	0	0	0	0
18/12/2012	1	Hen Harrier	HH	1	6	40	3	0	0	0	0
18/12/2012	2	Hen Harrier	HH	1	3	27	0	2	0	0	0
18/12/2012	3	Hen Harrier	HH	1	3	79	6	0	0	0	0
18/12/2012	3	Common Kestrel	K	1	6	81	0	6	0	0	0
18/12/2012	3	Common Kestrel	K	1	1	16	2	0	0	0	0
18/12/2012	3	Common Kestrel	K	1	5	195	1	3	11	0	0
18/12/2012	3	Common Kestrel	K	1	6	62	0	5	0	0	0
18/12/2012	2	Peregrine Falcon	PE	1	1	137	0	2	3	4	0
18/12/2012	2	Whooper Swan	WS	14	7	31	0	3	0	0	0
18/12/2012	3	Whooper Swan	WS	1	2	100	2	6	0	0	0
18/12/2012	3	Whooper Swan	WS	2	4	55	0	0	6	0	0
20/12/2012	2	Eurasian Curlew	CU	1	1	25	0	0	3	0	0
20/12/2012	1	Common Kestrel	K	1	1	10	0	1	0	0	0
23/01/2013	1	Hen Harrier	HH	1	3	17	2	0	0	0	0
23/01/2013	2	Hen Harrier	HH	1	5	88	6	0	0	0	0

Date	VP No.	Species	Species code	No. of birds	Flight line No.	Duration (s)	Number of 15 s intervals:				
							1 < 10 m	2 10 - 30 m	3 31-80 m	4 81-130 m	5 - > 130 m
21/02/2013	1	Barn Owl	BO	1	2	5	1	0	0	0	0
21/02/2013	1	Barn Owl	BO	1	4	12	1	0	0	0	0
21/02/2013	2	Eurasian Curlew	CU	15	5	249	0	10	4	0	0
21/02/2013	2	Eurasian Curlew	CU	24	6	16	0	1	1	0	0
21/02/2013	2	European Golden Plover	GP	25	8	181	4	6	3	0	0
21/02/2013	3	European Golden Plover	GP	25	10	16	0	2	0	0	0
21/02/2013	1	Short eared owl	SE	1	1	28	2	0	0	0	0
22/02/2013	2	Eurasian Curlew	CU	6	1	22	2	0	0	0	0
22/02/2013	3	Hen Harrier	HH	1	9	38	3	0	0	0	0
03/04/2013	1	Eurasian Curlew	CU	17	9	14	1	0	0	0	0
03/04/2013	1	Eurasian Curlew	CU	2	10	4	1	0	0	0	0
03/04/2013	2	Eurasian Curlew	CU	1	12	42	0	3	0	0	0
03/04/2013	3	Eurasian Curlew	CU	17	9	31	0	0	3	0	0
03/04/2013	3	Eurasian Curlew	CU	5	10	48	0	0	4	0	0
03/04/2013	3	Eurasian Curlew	CU	1	16	46	0	0	4	0	0
03/04/2013	3	Eurasian Curlew	CU	2	17	16	0	2	0	0	0
03/04/2013	1	Peregrine Falcon	PE	1	6	69	0	0	0	2	3
04/04/2013	1	Eurasian Curlew	CU	1	2	8	1	0	0	0	0
04/04/2013	2	Eurasian Curlew	CU	2	3	38	0	1	2	0	0
04/04/2013	2	Eurasian Curlew	CU	8	4	18	0	2	0	0	0
04/04/2013	2	Eurasian Curlew	CU	8	6	18	1	1	0	0	0
04/04/2013	2	Eurasian Curlew	CU	8	7	19	1	1	0	0	0
04/04/2013	3	Eurasian Curlew	CU	1	2	43	0	3	0	0	0
04/04/2013	3	Eurasian Curlew	CU	1	6	17	2	0	0	0	0
04/04/2013	1	Greylag Goose	GJ	2	1	16	2	0	0	0	0
04/04/2013	2	Greylag Goose	GJ	2	4	8	1	0	0	0	0
04/04/2013	3	Merlin	ML	1	4	19	2	0	0	0	0
04/04/2013	2	Peregrine Falcon	PE	1	6	7	1	1	0	0	0

Appendix C
Secondary Species Counts

Species	Scientific Name	Sep-12	Oct/Nov 2012	Dec-12	Jan-13	Feb-13	Total recorded
Barn Swallow	*Hirundo rustica*	6	0	0		1	7
Blackbird	*Turdus merula*	2	5	24	7	12	50
Carrion Crow	*Corvus corone*	80	341	465	422	479	1787
Chaffinch	*Fringilla coelebs*	26	73	0	3	9	111
Common Buzzard	*Buteo buteo*	98	40	2	2	0	142
Common Crossbill	*Loxia curvirostra*		0	8			8
Common Eider	*Somateria mollissima*	2					2
Common Kestrel	*Falco tinnunculus*	7	0	1			8
Common Linnet	*Carduelis cannabina*	173	48	2			223
Common Pheasant	*Phasianus colchicus*		16	28		3	47
Common Raven	*Corvus corax*	34	13	8		5	60
Common Reed Bunting	*Emberiza schoeniclus*		7	2			9
Common Shelduck	*Tadorna tadorna*		0	0		13	13
Common Starling	*Sturnus vulgaris*		31	632	26	1	690
Common Wood Pigeon	*Columba palumbus*	7	377	14	15	7	420
Eurasian Collared Dove	*Streptopelia decaocto*		81	0			81
Eurasian Curlew	*Numenius arquata*	14	206	105		35	360
Eurasian Jackdaw	*Corvus monedula*		254	284	10	23	571
Eurasian Magpie	*Pica pica*		3	2		1	6
Eurasian Oystercatcher	*Haematopus ostralegus*		0	0		1	1
Eurasian Siskin	*Carduelis spinus*	3	0	0			3
Eurasian Sparrowhawk	*Accipiter nisus*	2	1	4			7
Eurasian Stonechat	*Saxicola torquata*	1	2	2		5	10
European Golden Plover	*Pluvialis apricaria*	1	0	2		73	76
European Robin	*Erithacus rubecula*	2	5	0	1		8
Fieldfare	*Turdus pilaris*		43	86	503	16	648
Goldcrest	*Regulus regulus*	2	65	0			67
Great Black-backed Gull	*Larus marinus*	3	6	0		6	15
Great Cormorant	*Phalacrocorax carbo*		1	0			1

Species	Scientific Name	Sep-12	Oct/Nov 2012	Dec-12	Jan-13	Feb-13	Total recorded
Greater Canada Goose	*Branta canadensis*		0	0		13	13
Grey Heron	*Ardea cinerea*		7	0	1		8
Hedge Accentor	*Prunella modularis*		198	54			252
Herring Gull	*Larus argentatus*	189	189	450	4	45	877
Hooded Crow	*Corvus cornix*		5	0	2	4	11
House Martin	*Delichon urbica*	4	0	0			4
Lesser Black-backed Gull	*Larus fuscus*	1	4	0		1	6
Lesser Redpoll	*Carduelis cabaret*	11	4	0			15
Mallard	*Anas platyrhynchos*	225	82	2250	44	62	2663
Manx Shearwater	*Puffinus puffinus*	1					1
Meadow Pipit	*Anthus pratensis*	76	9	35	13	9	142
Mew Gull	*Larus canus*		7	0			7
Mistle Thrush	*Turdus viscivorus*		1	32		10	43
Mixed corvids		73	0	1704		319	2096
Mixed Gulls		0	5	0			5
Northern Lapwing	*Vanellus vanellus*		16	27	66	49	158
Pied Wagtail	*Motacilla alba*	8	0	0			8
Red-legged Partridge	*Alectoris rufa*		1	2			3
Redwing	*Turdus iliacus*		215	24	11		250
Rock Dove/Feral Pigeon	*Columba livia*		25	0	1		26
Rook	*Corvus frugilegus*		323	550	11	149	1033
Sedge Warbler	*Acrocephalus schoenobaenus*		0	0			0
Sky Lark	*Alauda arvensis*	17	32	23	1		73
Stock Dove	*Columba oenas*		0	14			14
Whooper Swan	*Cygnus cygnus*		0	8			8
Winter Wren	*Troglodytes troglodytes*	3	10	9			22

Appendix D
Dates and times of Walkover Surveys

	Start time	End time
29/11/2013	14:30	16:30
20/12/2013[1]		
24/01/2013	09:33	13:35
21/02/2013	10:45	13:30
03/04/2013	17:20	19:20
04/04/2013	13:00	16:10

[1]Start and end time not recorded

Surveys could have more than one surveyor out on the same day, covering different parts of the site. The time shown is the maximum time spent surveying.

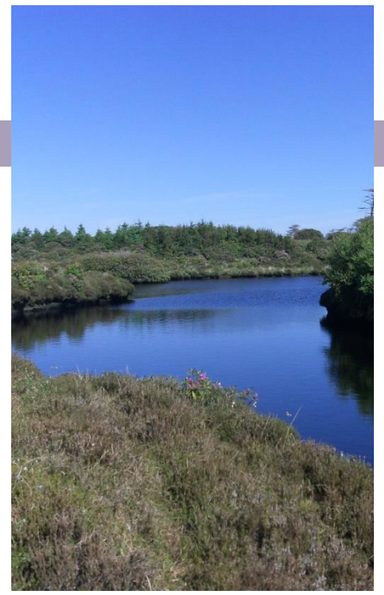
Appendix E
Barn Owl/Hen Harrier survey – Dates & Times

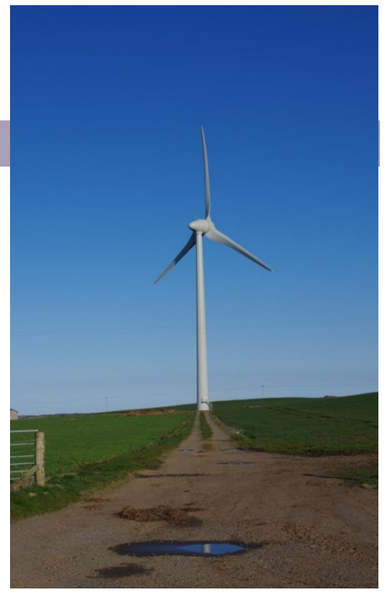
Date	Type	Surveyors	Start time	End time
23/01/2013	Hen Harrier roost survey	JM/DG/AW	16:45	17:45
24/01/2013	Barn Owl survey	JM/DG/AW	16:15	17:10
20/02/2013	Barn Owl survey	JM/DG/AW	17:40	18:25
21/02/2013	Hen Harrier roost survey	JM/DG/AW	16:10	18:10
03/04/2013	Barn Owl survey	JM/DG/AW	19:30	20:45
04/04/2013	Hen Harrier roost survey	JM/DG/AW	19:00	20:30

PNE Wind UK Ltd

Larbrax Wind Farm

Baseline Ornithology Report – Spring Migration & Breeding Season 2013





AMEC Environment & Infrastructure UK Limited

January 2014

Document Revisions

No.	Details	Date
1	Draft Report	January 2014
2	Final Report	January 2014

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Executive Summary

- The purpose of this report is to describe the bird populations on the proposed Larbrax Wind Farm site, with a view to informing an Ecological Impact Assessment as part of the EIA for the development.
- During the spring migration and breeding season 2013, a series of surveys were undertaken to determine the baseline of ornithological activity on the site of a proposed new wind farm at Larbrax, located south west of Leswalt on the North Rhins Peninsula, Dumfries and Galloway.
- Survey methods consisted of standard vantage points (VPs), along with raptor breeding surveys and specific breeding Barn Owl surveys.
- Flight activity of key target species was recorded, along with secondary species of interest.
- Seven target species were recorded during VP surveys: Hen Harrier, Merlin, Peregrine Falcon, Common Kestrel, Greylag Goose, Eurasian Curlew and European Golden Plover.
- During the study, Eurasian Curlew was the most recorded species, with a total of 358 individuals recorded in 177 VP observations.
- A total of 44 Whimbrel were also recorded on migration.
- Only three records of Barn Owl flight activity were made throughout the breeding season and nesting was confirmed offsite.
- No Merlin, Hen Harrier or any raptor of key conservation concern were found breeding within the site or within the 2 km survey buffer.
- Single Peregrine sightings were recorded on three occasions but there were no records of Merlin.
- Common Buzzard was the most frequent raptor recorded with 2 or 3 breeding pairs present in the local area although outwith the site boundary.
- Common Kestrel and Eurasian Sparrowhawk were recorded on site.

1. Introduction

1.1 About this Document

AMEC Environment & Infrastructure UK Limited (AMEC) was commissioned by PNE Wind UK Ltd (PNE) to undertake bird surveys during the breeding season of 2013 (April to August inclusive) at the site of a proposed wind farm development at Larbrax, located south west of Leswalt on the North Rhins Peninsula, Dumfries and Galloway. This report describes the methods and results of the surveys, which were designed to be suitable to inform an impact assessment and associated reporting in an Environmental Statement for the development. Surveys included vantage point surveys, as well as breeding raptor and Barn Owl *Tyto alba* surveys.

This work follows on from an initial breeding season, completed from April to June 2012 and the migration and winter season survey of 2012/13 (September 2012-March 2013). Further information on these surveys and their results can be found in the following reports:

- Larbrax Wind Farm, Breeding Bird Report 2012; and
- Larbrax Wind Farm, Baseline Ornithology Report: Migration and Winter Season 2012/13.

1.2 Site Description

The Site is located at Larbrax, on the western side of the North Rhins Peninsula, Dumfries and Galloway. The study area is a low-lying coastal site and the highest part of the Site is 83 m above mean sea level (AMSL). The Site is generally quite flat, but drops steeply down to the sea on the western side. There are several small water bodies within the study area including Loch Beg and Loch More with drainage channels flowing into the sea. There are some rough vehicle tracks allowing access to the Site from Meikle Galdenoch and Meikle Larbrax located on the north and south of the study area respectively. Overall, the Site provides grazing for cattle and sheep, and fencing is used to contain stock. Several small isolated strips of coniferous plantation are located mainly in the north of the Site. There are some wetland habitats (e.g. blanket bog) on the eastern section of the Site and the Site boundary is illustrated in Figure 1.1.

1.3 Background and Scope

The key issues relating to birds and wind farms are as follows:

- The effects of direct habitat loss due to land take by wind turbine bases, tracks and ancillary structures;
- The effects of disturbance and displacement of birds from the proximity of the wind turbines. Such disturbance may occur as a consequence of construction work, or due to the presence of the wind farm close to nest or feeding sites or on habitual flight routes; and
- The effects of collision with rotating turbine blades (i.e. killing or injury of birds), which is of particular relevance for sites located in areas with high raptor activity or which support large concentrations of waterfowl.

With regards to the first issue, total land take by wind farm infrastructure generally represents a very small proportion of a site. Therefore the permanent loss of nesting and foraging habitat for birds tends to be very small and will generally have little effect on bird populations. At most wind farm sites it is the latter two issues, collision risk and displacement, which may potentially be more significant.

Ornithological work carried out at Larbrax was based primarily on Scottish Natural Heritage (SNH) guidance. A range of guidance documents have been produced relating to the assessment of bird/wind farm interactions and the following publications and guidelines in particular have been influential in determining the scope of the works:

- SNH (2005, revised 2010 and 2013). *Survey methods for use in assessment of the impacts of proposed onshore windfarms on bird communities*. http://www.snh.gov.uk/docs/C278917.pdf; and
- SNH (2006). *Assessing significance of impacts from onshore windfarms on birds outwith designated areas*. SNH, Battleby.

SNH guidance recommends that field surveys should be focussed on those species of high nature conservation value for which there is potential for an impact which might be judged significant and adverse. In most circumstances these "target species" tend to be limited to those protected species and other species of conservation concern which may be subject to impact from wind farms.

There are five overarching species lists which describe protected species and species of conservation concern:

- Special Protection Areas (SPA) designate species and those listed under Annex 1 within the *Directive 2009/147/EC on the conservation of wild birds*, commonly referred to as the Birds Directive;
- species listed under Schedule 1 of the *Wildlife & Countryside Act 1981* (as amended);
- species listed under Scottish Biodiversity List (SBL) as required under Section 2(4) of the Nature Conservation (Scotland) Act 2004;
- Birds of Conservation Concern (BoCC) – a five-yearly review[1] which assesses British bird populations and identifies species where the population or range show long term or large negative trends – species are classified into three groups which can be described as:
  - Green – populations are considered to be relatively stable, with no threats identified;
  - Amber – evidence of moderate long-term decline in either population or range; and
  - Red – evidence of severe long-term decline in either population or range.

In addition, consideration should also be given to migratory species which are either rare or vulnerable, or warrant special consideration on account of the proximity of migration routes, or breeding, moulting, wintering or staging areas in relation to the proposed wind farm[2].

[1] Eaton, M.A., Brown, A.F., Noble, D.G., Musgrove, A.J., Hearn, R., Aebischer, N.J., Gibbons, D.W., Evans, A. and Gregory R,D. 2009. 'Birds of Conservation Concern 3: the population status of birds in the United Kingdom, Channel Islands and the Isle of Man.' *British Birds* **102**, pp296-341.

[2] Scottish Natural Heritage. (2005, revised 2010 and 2013). *Survey methods for use in assessment of the impacts of proposed onshore windfarms on bird communities*. http://www.snh.gov.uk/docs/C278917.pdf.

1.4 Key Species

The following key species of conservation concern (target species) were identified during the initial desk based study, a review of species range maps for the Site (Forrester *et al* 2007), consultation with SNH and as a result of the findings of ongoing ornithology field work:

- Protected raptors and owls (particularly Hen Harrier *Circus cyaneus*, Common Kestrel *Falco tinnunculus*, Merlin *Falco columbarius* and Peregrine Falcon *Falco peregrinus*, also Barn Owl and Short-Eared Owl *Asio flammeus*); and

Waterfowl and waders (particularly grey geese *Anser spp*. which might migrate through or use the area, Whooper Swan *Cygnus cygnus*, European Golden Plover *Pluvialis apricaria* and Eurasian Curlew *Numenius arquata*).

2. Methodology

2.1 Desk Study & Consultation

The presence of SPAs and ornithological Sites of Special Scientific Interest (SSSI) within 20 km was determined by accessing the Multi-Agency Geographical Information for the Countryside (MAGIC) website[3].

SNH was consulted in a meeting on the 14th May 2013, although the purpose of this meeting was primarily to discuss the field work survey schedule and ensure that SNH were satisfied with the scope and scale of the surveys. This was confirmed by letter on the 5th of June 2013.

RSPB were consulted on the 8th of April 2013 and responded on the 15th of April 2013.

Dumfries Raptor Study Group were consulted on the 25th October 2013 and again on the 9th of December 2013. Data relating to the request for any breeding records of raptors or owls within 2 km of the site boundary was received on the 17th of January 2014.

The Dumfries and Galloway Environmental Records Centre (DGERC) requested to provide data on protected species, BAP (Biodiversity Action Plan)[4], LBAP (Local Biodiversity Action Plan) , Scottish Biodiversity List and rare, scarce and threatened species within 5 km of the Site boundary – this request included all taxa, not just birds, although only results specific to birds are presented here.

2.2 Spring Passage & Breeding Season Surveys

The key objective of the breeding bird surveys at Larbrax was to establish whether any species or populations of nature conservation importance made regular use of the Site or adjacent areas, or the airspace above the proposed turbine layout. A variety of surveys were carried out from April to August 2013 inclusive, further details of which are provided below. In general, the surveys were carried out in line with the SNH 2010 guidelines, as this fieldwork preceded the 2013 revision of those guidelines.

[3] http://magic.defra.gov.uk
[4] The actual request was for BAP and LBAP species; this terminology/classification has now been superseded by the SBL list.

2.2.1 Surveyors

All survey work was subcontracted to Starling Learning, and was carried out by experienced ornithologists competent in the field survey techniques.

2.2.2 Vantage Point Survey (Spring Passage and Breeding Season)

Vantage-point (VP) watches were conducted in accordance with SNH (2010) guidance and undertaken throughout the survey period. This method focuses on identifying flight-paths of target species and allows any regularly used flight lines to be identified, allowing turbine locations to be altered where necessary to reduce collision risk to birds. The data generated can also be used to estimate the theoretical risk of collision with turbines by incorporation into a suitable model.

The SNH methodology guidance is that vantage-points should be chosen parsimoniously to achieve maximum visibility from the minimum number of locations such that all parts of the survey area are within two kilometre(s) of a VP. Three vantage points were identified (the locations of which are shown in Figure 1.1) as being sufficient to survey the turbine layout during the breeding season period, the locations of which were:

- VP1 – NW 96785 62161 – looking north
- VP2[5] – NW 96785 62161 – looking south; and
- VP3 – NW 97025 61317 – looking north.

Vantage point locations were amended from the winter survey to improve the viewshed in the northern part of the site and increase the robustness of the data for layout changes.

Five height bands were used and when target species were located, their height was recorded at 15 second (s) intervals. The height bands assessed included:

- 1 – less than 10 m;
- 2 - 10 m – 30 m;
- 3 – 31 m - 80 m*;
- 4 – 81 m – 130 m*; and
- 5 – greater than 130 m.

Those marked with an * indicate collision risk height

VP surveys were undertaken form April to cover the later part of spring migration (the March passage period was covered within the 2012/13 passage and winter season report) and continued throughout the breeding season.

[5] VPs 1 and 2 were at the same location, but the viewsheds completed a 360º arc, so were considered two separate VPs, as the maximum field of view for any one VP is 180º.

2.2.3 Barn Owl Surveys

In addition to the standard VP surveys, specific VPs were also undertaken to assess the potential for Barn Owl use of the Site. These involved additional dawn and dusk VP surveys carried out from a number of different points across the Site (more points were used because ability to detect birds reduced over distance with darkness), with VP watches undertaken in the two hours around sunrise/sunset. The Barn Owl VPs comprised of 14 hours per VP, at three VPs between the months of April to July, inclusive.

In addition to the Barn Owl VPS a site occupancy survey was undertaken with a single daytime visit by an appropriately licensed surveyor.

2.2.4 Breeding Raptor Surveys

A total of four breeding raptor walkover surveys were undertaken to determine the presence of breeding raptors, in particular Merlin and Hen Harrier. These walkover surveys were undertaken between April and early-August, inclusive. The area surveyed included all land within the site boundary and a 2 km buffer around this (as illustrated in Figure 1.1).

2.2.5 Limitations

Spring 2013 was late, with cold weather persisting in Dumfries and Galloway until well into May. As a result, migration movements were later than normal, although this may have been less marked at the coast and breeding was generally delayed.

The only breeding survey carried out was for raptors, and the timing of this was adjusted to take account of the weather (i.e. visits were carried out later than they would normally be scheduled in a season which is not badly delayed by adverse weather), the effects of the unseasonal weather is unlikely to be significant.

3. Results

3.1 Desk Study and Consultation

Consultation with SNH (during meeting of 14th May 2013) and subsequent electronic communication, confirmed that the proposed development would not affect any of the populations of the key designated sites identified during the desk study (Table 3.1 and illustrated in Figure 3.1) due to the distance of the proposed wind farm being further away than the foraging ranges of the key species associated with each of the designated sites. The distance of the designated sites and their designated species' foraging ranges makes it highly unlikely that any birds which form the protected population of the designated site would be present on or make use of the Site and immediate areas. It was therefore considered that an Appropriate Assessment would not be required. SNH also confirmed that they were satisfied with the proposed field survey methodology, which was consistent with the then applicable 2010 guidelines. It is not considered that this has resulted in a deficiency in the data gathered by these surveys.

Table 3.1 - Statutory ornithological sites within 20 km of the study area

Site Name	Approximate distance from site (km)	Reasons for ornithological designation/notification
Glen App and Galloway Moors SPA / SSSI	12	10 breeding Hen Harrier females
Loch of Inch and Torrs Warren SPA	13	Greenland White-fronted Goose (534) and non-breeding Hen Harrier (8)
Auchrochar Wetlands SSSI	12	Breeding Sedge Warbler Acrocephalus schoenobaenus
White Loch – Lochinch SSSI	13	2% of Icelandic Greylag Goose Anser anser population
Torrs Warren – Luce Sands SSSI	16	Non-breeding Hen Harrier

3.1.1 DGERC Data

Approximately 80 records were received as a result of the data request to DGERC. However to ensure results were applicable and meaningful to the Site the following filters were applied:

- Data limited to that which was recorded between 2007-2012 (the last five years for which data was available);
- Data related to Spring migration and breeding season; and
- Sightings should have occurred within the OS grid squares NX 96 64 – NX 00 60.

The latter criteria created an approximately 1 km search area beyond the red line boundary of the Site. In addition, data was then reviewed for sensitive species which may roam more widely (e.g. raptors and owls). As a result of this search, a single record relevant to the key species of this study was included and it is shown in Table 3.2.

Table 3.2 - Results from DGERC data search

Species	Scientific Name	Date	Location	Grid reference	Recording Resolution (m)1	No.	Comments
Barn Owl	*Tyto alba*	30/05/2008	Glenstockadale	NX001611	100	1	Regularly seen hunting

[1] Indicates accuracy of recording of location i.e. whether to nearest grid square (1 km), 6 figure grid reference (100 m) or 8 figure reference (10 m)

The single Barn Owl record relates to birds outwith the proposed development site however, it does confirm the historical presence of Barn Owl in the area.

3.2 Breeding Bird Surveys

3.2.1 Vantage Point Surveys

Across the three vantage points used, between 54 - 57 hours of observation was undertaken: 54 hours at VP1, 57 hours at VP2 and 56.75 hours at VP3. Dates and times of the VP watches are provided in Appendix Table A1. Surveys were conducted throughout a range of representative weather conditions, using standard methodology.

Table 3.3 shows the species regarded as target species together with their conservation status. These were the species which were actually recorded on the site. There were other potential target species identified in the desk assessment which were not recorded and which are not included here (e.g. Greenland White-fronted Goose).

Table 3.3 Conservation status of target species

Species Name	Scientific Name	Annex 1	Schedule 1	SBL	BoCC status
Hen Harrier	*Circus cyaneus*	X	X	X	Red
Eurasian Curlew	*Numenius arquata*			X	Amber
European Golden Plover	*Pluvialis apricaria*	X		X	Amber
Common Kestrel	*Falco tinnunculus*			X	Amber
Whooper Swan	*Cygnus cygnus*	X	X	X	Amber
Peregrine	*Falco peregrinnus*	X	X	X	
Short-eared Owl	*Asio flammeus*	X		X	Amber
Barn Owl	*Tyto alba*		X	X	Amber
Merlin	*Falco columbarius*	X	X	X	Amber
Greylag Goose	*Anser anser*				Amber
Whimbrel	*Numenius phaeopus*		X		Red

The following 7 target species were recorded during VP surveys: Hen Harrier, Merlin, Peregrine Falcon, Common Kestrel, Greylag Goose, Eurasian Curlew and European Golden Plover. Details of all target species flights are provided in Appendix Table B1. The flight lines are illustrated in the following figures:

- Figure 3.2: Flight activity of Hen Harrier, Merlin and Peregrine Falcon;
- Figure 3.3: Flight activity of Common Kestrel;
- Figure 3.4: Flight activity of Greylag Goose;
- Figure 3.5: Flight activity of Eurasian Curlew and European Golden Plover;
- Figure 3.6: Flight activity of Barn Owl; and
- Figure 3.7 Flight activity of Whimbrel.

Table 3.4 presents a summary of target species' flights recorded during the vantage point surveys, and the time spent at collision risk height.

Table 3.4 - Summary of target species' flight activity from VP surveys

Common Name	Number of birds recorded per month					Total No. recorded	No. of observations	Bird seconds at CRH
	Apr	May	Jun	Jul	Aug			
Eurasian Curlew	94	103	70	88	3	358	177	4,410
Greylag Goose	22	17				39	19	270
European Golden Plover					6	6	1	270
Hen Harrier	1					1	1	90
Common Kestrel	16	25	7	7	12	67	67	1,890
Merlin	1	1				2	2	0
Peregrine Falcon	2	1		1		4	4	75
Whimbrel		41		3		44	12	795

Secondary Species

In addition to the target species, a number of secondary species were also recorded during the vantage point surveys. These species, and their presence / absence for each month of the breeding season, are shown in Table 3.5.

Table 3.5 - Secondary species recorded during the VP surveys

Common Name	Scientific Name	Number of birds recorded per month					Total No. Recorded	No. of observations
		Apr	May	Jun	Jul	Aug		
Common Buzzard	*Buteo buteo*	39	52	20	2	10	125	112
Great Cormorant	*Phalacrocorax carbo*	7	11				18	18
Grey Heron	*Ardea cinerea*	1		1			2	2
Northern Lapwing	*Vanellus vanellus*	276	125	187	213	3	804	158
Mallard	*Anas platyrhynchos*	21	12		2		35	15
Eurasian Oystercatcher	*Haematopus ostralegus*	16	26	15	12	2	71	40
Common Raven	*Corvus corax*	111	12	2	4	7	136	53
Eurasian Sparrowhawk	*Accipiter nisus*	1			2	2	5	5
Common Shelduck	*Tadorna tadorna*	4	47	42			91	35
Eurasian Teal	*Anas crecca*			3			3	1

3.2.2 Barn Owl Surveys

Three records of Barn Owl flight activity were made throughout the breeding season; these are illustrated on Figure 3.6. Barn Owl was recorded nesting in a nest-box near Little Galdenoch, outwith and c. 300 m to the north-east of the Site boundary.

3.2.3 Breeding Raptor Surveys

No Merlin, Hen Harrier or any raptor of key conservation concern were found breeding within the site or 2 km survey buffer. Single Peregrine sightings were recorded on 3 occasions but there were no records of Merlin. Common Buzzard was the most frequent raptor recorded, with 2 or 3 breeding pairs present in the local area although outwith the site boundary. Common Kestrel and Eurasian Sparrowhawk were also recorded on site.

4. Species Accounts

Hen Harrier

Hen Harrier is a Schedule 1 and Annex 1 species, and a BoCC red-listed species and is also listed on the Scottish Biodiversity List. Within Scotland, the current population estimate for Hen Harrier is 505 pairs[6], with ten breeding pairs recorded in Dumfries and Galloway, and national breeding surveys have reported a decline in the population. Although Scandinavian birds do winter in Scotland, migration/ringing studies have highlighted that a large proportion of the Scottish population remain in Scotland, with Dumfries and Galloway being one of the preferred wintering locations[7]. Persecution of this species across Scotland is well-documented, and remains severe in particular areas, including Dumfries and Galloway. As a result of these factors, Hen Harrier is described as a scarce resident in the county.

During the spring migration VP surveys, a single individual was recorded on the 25th April 2013, spending approximately 90 seconds at collision risk height.

Barn Owl

Barn Owl is a Schedule 1 listed species, and a BoCC amber list species, as well as being listed on the Scottish Biodiversity List. The Barn Owl population for Dumfries and Galloway and Ayrshire combined is estimated at 500 pairs[5]. In Scotland overall, two particularly severe winters in 2009/10 and 2010/11 were likely to be responsible for low nest occupancy rates during the springs which followed. In 2012, of the 702 potential nests checked, only 42% were occupied by pairs, showing no evidence of population recovery[8]. Of those nests monitored for breeding activity, the lowest proportion since 2006 fledged young, and brood size was the smallest since 2003, and the first time this has fallen below two young per pair.

During the standard breeding VP surveys, no Barn Owls were recorded; however, three sightings were recorded during the species-specific surveys and an occupied nest was located off site.

Merlin

Merlin is an Annex I and Schedule 1 listed species and is a BoCC amber list species based on its unfavourable conservation status in Europe (Eaton *et al*. 2009). Merlin is also listed on the Scottish Biodiversity List. The current UK population is estimated to be 1,160 pairs[9], with the population remaining relatively stable since 1993-4. The Scottish breeding population is estimated at 800 pairs[5].

Merlin need open areas with a plentiful supply of birds to hunt, with most nests in heather and lesser numbers nesting in trees. As such, their distribution is closely linked to that of their prey, with the species tending to leave the uplands during late summer and autumn, moving to lower elevations, including both coastal and farmland areas. Merlin is considered 'a scarce resident' in Dumfries and Galloway (Irving, 2012). In 2012 eight home ranges were checked in Dumfries and Galloway, seven of which were occupied (Etheridge *et al* 2013). It is described as a scarce resident in Dumfries & Galloway[10] although healthy populations exist in this region (Forrester *et al* 2007), and as a breeder with less than 25 pairs per annum and regular winter visitor in Ayrshire[11]. They are not known to breed on the Mull of Galloway.

Two sightings of Merlin were recorded during the spring migration/early breeding season VP surveys, with a single male and single female recorded on each occasion (4th April and 14th May 2013), both outwith collision risk height.

Peregrine Falcon

Peregrine is an Annex I and Schedule 1 listed species and is also a BoCC amber list species based on its unfavourable conservation status in Europe (Eaton *et al*. 2009). Peregrine is also listed on the Scottish Biodiversity List. The current UK population is estimated to be 1,530 pairs, with 53 pairs found in Dumfries and Galloway (2002 survey; from Holling *et al.* 2012). Peregrines need open areas with a plentiful supply of birds to hunt and secure sites for breeding[12], with most eyries (nests) and roosts generally located on cliffs, crags or tall man-made structures.

Peregrine is considered a 'widespread, if scarce, resident' in Dumfries and Galloway (Irving, 2012).

A total of four Peregrine Falcons were recorded during the VP surveys, on the 3rd and 4th April, 20th May and 17th July 2013. Birds spent approximately 75 seconds at collision risk height; however, this was only around 30% of the overall flight time recorded. Breeding raptor surveys found no evidence of breeding within the site or 2 km buffer and only recorded 4 individual records over the survey period.

Data from the DGRSG identified two nesting locations within the search area. Full details of these are provided in the Confidential Annexe. There were no breeding attempts at either location in 2013.

Whimbrel

Whimbrel is a Schedule 1 breeding species, as well as being red-listed on BoCC. The majority of the UK breeding population (400 – 500 pairs (Andrew and Forrester 2007)) occurs on Shetland with smaller populations on Orkney and the Outer Hebrides. In addition to the breeding population larger numbers migrate through Scotland. Migration is strongest on the west coast in spring, with autumn birds being found more commonly on the east coast – this is reflected in the records for the Site, where no birds were seen during autumn, but small flocks of between 1-10 birds were recorded during VP surveys between May – July. In total, there were twelve records from the VP surveys, totalling 44 birds.

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[6] Hayhow, D.B., Eaton, M.A., Bladwell, S., Etheridge, B., Ewing, S. Ruddock, M., Saunders, R., Sharpe, C., Sim, I.M.W. & Stevenson, A. (*2013*). The status of the Hen Harrier, *Circus cyaneus*, in the UK and Isle of Man in 2010. *Bird Study*

[7] Forrester R & Andrews I (eds) 2007 *The birds of Scotland* Scottish Ornithologists Club Aberlady.

[8] Etheridge, B, Riley, H, Wernham, C, Holling, M, Stevenson, A, Roos, S, & Stirling-Aird, P (2013) Scottish Raptor Monitoring Scheme 2012 http://www.scottishraptorstudygroup.org/SRMS_Report12.pdf accessed 13/12/13

[9] Holling, M. And the Rare Breeding Birds Panel. 2012. Rare breeding birds in the United Kingdom in 2010. British Birds, 105:352-416.

[10] Irving, D. 2012. Birds in Dumfries and Galloway 2010. Scottish Ornithologists' Club.

[11] Simpson, F. 2012. Ayrshire Bird Report 2010. Scottish Ornithologists' Club.

[12] Ratcliffe, D. 1993. The Peregrine Falcon. T & A.D. Poyser.

Common Kestrel

The Common Kestrel is a BoCC amber-listed species, and also appears on the Scottish Biodiversity List. According to Forrester and Andrews (2007), the Scottish wintering population of Common Kestrel is approximately 15,000 to 25,000 birds, compared to an estimated Great British breeding population of 45,000 pairs. The Scottish Raptor Study Group monitored 134 pairs in 2012, noting the lowest ever breeding success for the species. The Scottish Breeding Bird Survey recorded a decline of 64% in their numbers between 1994 and 2011, highlighting the status of kestrel as one of concern.

During the VP surveys, a total of 67 Kestrels were recorded, each as individual birds. The birds observed spent approximately 30% of recorded flight time at collision risk height.

Greylag Goose

Greylag goose is a BoCC amber-listed species, based on non-breeding localisation within the UK and non-breeding international importance (Eaton *et al*. 2009). The UK wintering population was estimated at 230,000 individuals in 2009-10 (Musgrove *et al.* 2013). The wintering population (as indicated by November peak counts) in Southwest Scotland/Northwest England was estimated at: 1,240 in 2011; 6,536 in 2010; and 3,230 in 2009[13]. The UK population also consists of 46,000 breeding pairs, the majority of which are an introduced feral population.

A total of 39 individuals were recorded during the breeding season VP surveys on 19 occasions. On only one occasion were birds recorded flying at collision risk height, on the 22nd May 2013, when a flock of three individuals spent the entire observed flight time at 31-130m. It is likely that these birds form part of the feral breeding population.

European Golden Plover

The European Golden Plover is an Annex 1, Scottish Biodiversity List and BoCC amber-listed species. Musgrove *et al*. (2013) estimated a Great British wintering population of 400,000 individuals, and a breeding population of 38,000-59,000 pairs. Large numbers of European Golden Plover winter in Scotland, an estimated 25,000-35,000 individuals, with more passing through en route to wintering locations abroad.

During the VP surveys, a single flock of six birds was recorded on the 15th August 2013, with the birds spending the duration of the observation at collision risk height. However, the low numbers recorded on the site would suggest the area is of low importance for the species.

Eurasian Curlew

The Eurasian Curlew is listed on the Scottish Biodiversity List, and is a BoCC amber-listed species. Within the UK, the population has been estimated at 68,000 breeding pairs and 150,000 wintering individuals (Musgrove *et al*. 2013), with the Scottish breeding population estimated at around 58,000 pairs. This equates to between 16% and 27% of the European breeding population estimated by Forrester *et al*. (2007). Within Dumfries and Galloway, curlew is described as a common resident (Irving, 2012).

During the migration and breeding season study, Curlew was the most recorded species, with a total of 358 individuals in 177 VP observations.

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[13] Wildfowl and Wetlands Trust (2012). Goose and Swan Monitoring Programme: Icelandic Goose Census. Accessed on 16 August 2013:
http://monitoring.wwt.org.uk/species/2012/pinkfoot_latest2012.php#2011/12
http://monitoring.wwt.org.uk/species/2011/pinkfoot_latest2011.php
http://monitoring.wwt.org.uk/species/2010/pinkfoot_latest2010.php
http://monitoring.wwt.org.uk/species/2010/iceland_greylag_latest2010.php
http://monitoring.wwt.org.uk/species/2011/iceland_greylag_latest2011.php
http://monitoring.wwt.org.uk/species/2012/iceland_greylag_latest2012.php#2011/12

Appendix A
Survey Methods

Vantage Point Survey Dates

Table A.1 Dates, times and weather conditions during vantage point surveys

Date	Survey period	Duration (hours)	Sunset/sunrise time (where applicable)	Wind force (Beaufort scale) and direction	Cloud cover (eighths)	Precipitation (rain / snow / hail, heavy / moderate / light, showers)	Temp. (Degrees Celsius)	Visibility (<100m, 100-500m, 500m-2km, >2km)	Snow cover (depth and percentage coverage across site)	Notes (e.g. disturbance events)
VP1										
03/04/13	1515	2		NE 1	2	None		Good		
04/04/13	1135	3		N 4	4-7	None		Good		
04/04/13	1610	1		N 2	5	None		Good		
24/04/13	1530	2		NW 4-3	5-4	None		Very good		
25/04/13	1000	1.5		W-SW 0-1	7	Showers		Very good		
25/04/13	1400	3.5		W	8	Brief shower		Good		
26/04/13	0945	1.5		N 5-6	7	Occasional showers		Good		
14/05/13	0500	2		W 5-2	5-2	None		Good – Very good		
15/05/13	0655	3		N 4	3	None		Very good		Sunny
20/05/13	1940	2		NW 4	8	None		Fair		
20/05/13	1338	3			8	Mist		Poor - Fair		
21/05/13	0900	3		NW 4	8-7	None		Good		
21/05/13	1545	2		NWN	5	None		Good		
22/05/13	0800	3		N 2-3	5-6	None – Rain		Good		Rain in last 15mins
12/06/13	1415	3		NW 0-1	7	None		Good		
13/06/13	1040	1		NNW 1-3	8	None		Very good		
20/06/13	1100	2.5		Weather details unrecorded						
17/07/13	1320	3		SW 0-2	1-6	None		Good		
17/07/13	1620	1		SW 1-2	5	None		Very good		
18/07/13	1450	2		WNW	2	None		Good		
19/07/13	0950	3		NW 0-1	0	None		Very good		
15/08/13	1425	3		SE 2	8	None – Rain		Good – Poor		
16/08/13	0955	3		S 2	7-8	None		Good		
Total		**54**								
VP2										
03/04/13	1520	2		NE 2	2	None		Good		Dazzle from sea
04/04/13	1045	2		SE 3	1-2	None	8-10	Very good		
04/04/13	1510	2		ESE 3	3	None	12.6	Very good		

Date	Survey period	Duration (hours)	Sunset/sunrise time (where applicable)	Wind force (Beaufort scale) and direction	Cloud cover (eighths)	Precipitation (rain / snow / hail, heavy / moderate / light, showers)	Temp. (Degrees Celsius)	Visibility (<100m, 100-500m, 500m-2km, >2km)	Snow cover (depth and percentage coverage across site)	Notes (e.g. disturbance events)
24/04/13	1515	2.5		NW 3	6	None		Fair – Good		
25/04/13	1015	0.5		SW 1-2	8	Light rain		Fair		
25/04/13	1350	3		W 1-2	2-6	Dry / Showers		Very good		
25/04/13	1650	1		WNW 2	5	Showers		Very good		
26/04/13	0930	1.5		NW 4-5	7	Showers		Good		
26/04/13	1140	2		NW 4-5	7	Showers		Good		
14/05/13	0500	2		W 4-5	4	None		Good		
14/05/13	1000	3		W 4	3-8	None – Rain		Very good		
14/05/13	1015	3		W 4	6	None – Heavy rain		Good		
14/05/13	1345	1		SW 2-3	6	None – Heavy rain		Good		
15/05/13	0655	3		N 4	3	None		Very good		Sunny
20/05/13	1355	3			8	None		Poor		
21/05/13	1545	2		Weather details unrecorded						
22/05/13	0750	3		NW 3	6	None		Good – Fair		
12/06/13	1425	3		1-0	7-8	None		Good		
13/06/13	1015	1		1	8	None		Good		
20/06/13	1100	2		SW 3	8	None		Very good		
20/06/13	1355	1.5		2	3	None		Good		
17/07/13	1300	3		1-2	2	None		Good		Hazy / hot
17/07/13	1605	1		2	2	None		Good		
18/07/13	1450	2		NW 1	1	None		Very good		
19/07/13	1005	1		NE-SW 1	2	None		Good – Fair		
15/08/13	1115	3		SE 3	8	Showers – Heavy rain		Good – Very poor		
16/08/13	1310	3		SE 2	4-7	None – Showers		Good		
Total		**57**								
VP3										
03/04/13	1545	2		NE 2	1	None		Very good	Some patches of snow	
04/04/13	1100	1.25		E 2-3	6-5	None		Fair – Good		Some haze
04/04/13	1440	1.5		E 2-3	1-5	None		Fair		Slight haze
24/04/13	1807	2.5		NW 3	6	None		Fair – Good		
25/04/13	1422	0		SW-W 2	4-6	Brief period of rain		Good		
26/04/13	0930	3		NW 4	8-5	Occasional rain		Good		
26/04/13	1230	0.5		NW 4	3	None		Good		
14/05/13	0505	2		SW 5	7	None – Showers		Fair – Good		
14/05/13	1145	3		SW 4	8-2	Rain – Dry		Fair – Good		

Date	Survey period	Duration (hours)	Sunset/sunrise time (where applicable)	Wind force (Beaufort scale) and direction	Cloud cover (eighths)	Precipitation (rain / snow / hail, heavy / moderate / light, showers)	Temp. (Degrees Celsius)	Visibility (<100m, 100-500m, 500m-2km, >2km)	Snow cover (depth and percentage coverage across site)	Notes (e.g. disturbance events)
15/05/13	0705	3		4-5	4	None		Very good		
20/05/13	1335	3		NW 3	8	None		Poor		
20/05/13	1945	2		NWN 4	8	None		Moderate		
21/05/13	0900	3		NW 3-4	8-8	None		Very good		
21/05/13	1445	1		NW 3-4	4-6	None		Very good		
21/05/13	1545	2		NW 2-3	6	None		Very good		
22/05/13	0800	3		NW 3	6	None		Good – Fair		
12/06/13	1420	3		N-NW 1	6-7	None		Very good		
13/06/13	1115	1		NNW 2	8	None		Very good		
13/06/13	1300	1		NW 2	8	None		Good		
20/06/13	1215	3		S 2	5	None		Good		
17/07/13	1315	3		S 1-2	6	None		Fair		
17/07/13	1620	1		S 1-2	6	None		Fair		Hazy
18/07/13	1345	3		3-4	0	None		Excellent		
19/07/13	1050	2		1-2	0	None		Excellent		
15/08/13	1415	3		S 3	8	Shower – Heavy rain		Good – Very poor		
16/08/13	0955	2.5		2-3	6	None		Very good		
16/08/13	1435	1.5		S-SSW 2-1	7	None		Very good		
Total		**56.75**								

Hen Harrier / Barn Owl Survey Dates

Table A.2 Dates, times and weather conditions for hen harrier / barn owl surveys

Date	Survey period	Duration (hours)	Sunset/sunrise time (where applicable)	Wind force (Beaufort scale) and direction	Cloud cover (eighths)	Precipitation (rain / snow / hail, heavy / moderate / light, showers)	Temp. (Degrees Celsius)	Visibility (<100m, 100-500m, 500m-2km, >2km)	Snow cover (depth and percentage coverage across site)	Notes (e.g. disturbance events)
03/04/13	1930	1.25		E 2	2	None		Good		
03/04/13	1930	1.25		Calm	2	None				
04/04/13 (VP1)	1900	1.5		NE 4	1	None		Good		
04/04/13 (VP2)	1900	1.5		NE 4	1	None		Very good	Patches	Recent heavy snow still lying in patches where deep drifts
04/04/13 (VP3)	1900	1.5		E 2-3	2	None		Good	Recent heavy snow	
24/04/13	1950	2		NW 2-1	8	None				
24/04/13	1950	2		NW 2-1	8	None				
24/04/13	1940	2		Calm	8	None		Fair		

Date	Survey period	Duration (hours)	Sunset/sunrise time (where applicable)	Wind force (Beaufort scale) and direction	Cloud cover (eighths)	Precipitation (rain / snow / hail, heavy / moderate / light, showers)	Temp. (Degrees Celsius)	Visibility (<100m, 100-500m, 500m-2km, >2km)	Snow cover (depth and percentage coverage across site)	Notes (e.g. disturbance events)
25/04/13	1950	2		NWN 0-1	3	None		Very good		
25/04/13	1950	2		NWN 0-1	3	None		Very good		
25/04/13	1950	2		NWN 0-1	3	None		Very good		
12/06/13	2145	1.75		Weather details unrecorded						
12/06/13	2130	2		Weather details unrecorded						
13/06/13	2130	1		Weather details unrecorded						
13/06/13	2130	2		Weather details unrecorded						
13/06/13 (VP3)	2320	2		Weather details unrecorded						
19/06/13	2130	2		Weather details unrecorded						
19/06/13	2130	1.5		0	2	None		Very good		
20/06/13	2135	2		SW 1	8	None		Good		
20/06/13	2135	2		Weather details unrecorded						
20/06/13	2135	2		Weather details unrecorded						
17/07/13	2120	2		NW 1-2	6	None				
17/07/13	2129	2		NW 1-2	6	None		See note		Visibility obscured to extent by smoke
18/07/13	1000	1.5		Weather details unrecorded						

Raptor Survey Dates

Table A.3 Dates, times and weather conditions for raptor surveys

Date	Survey period	Duration (hours)	Sunset/sunrise time (where applicable)	Wind force (Beaufort scale) and direction	Cloud cover (eighths)	Precipitation (rain / snow / hail, heavy / moderate / light, showers)	Temp. (Degrees Celsius)	Visibility (<100m, 100-500m, 500m-2km, >2km)	Snow cover (depth and percentage coverage across site)	Notes (e.g. disturbance events)
25/04/2013	11:25	2.5		SW 2	4	None		Good		
25/04/2013	11:35	2		SW 2	4	None		Good		
25/04/2013	10:00	1.25		SW 2	4	None		Good		
25/04/2013	13:50	1		SW 2	4	None		Good		
13/06/13	1215	3		Weather details unrecorded						
20/06/2013	12:45	4.75		S 2	3	None		Very good		
20/06/2013	15:35	1		Weather details unrecorded						

Breeding Raptor Survey Dates

Table A.4 Dates, times and weather conditions for breeding raptor surveys

Date	Survey period	Duration (hours)	Sunset/sunrise time (where applicable)	Wind force (Beaufort scale) and direction	Cloud cover (eighths)	Precipitation (rain / snow / hail, heavy / moderate / light, showers)	Temp. (Degrees Celsius)	Visibility (<100m, 100-500m, 500m-2km, >2km)	Snow cover (depth and percentage coverage across site)	Notes (e.g. disturbance events)
13/06/2013	09:52	3		Weather details unrecorded						
13/06/2013	12:50	3		W 2	7	None		Very good		
18/07/2013	11:40	3		NW 1	1	None		Very good		
18/07/2013	11:45	3		Calm	2	None		Good		
19/07/2013	09:45	2.75		1-2	0	None		Excellent		
16/08/2013	11:30	3		Calm	8	None		Very good		
15/08/2013	10:50	3		S 2	8	None		Good		
20/06/2013	10:30	1.5			2	None		Good		
20/06/2013	15:30	1		S 2	4	None		Fair		

Appendix B
Survey Results

Vantage Point Survey Results

Table B1 Target species flight data

Number of flight line number	VP Number	Date	Number of birds	Total flight duration (seconds)	Number of 15-sec intervals in each height band					Notes
					<10m	10m-30m	31m-80m	81m-130m	>130m	
Hen Harrier										
9	3	25/04/2013	1	166	0	5	6	0	0	
Merlin										
4	3	04/04/2013	1	19	2	0	0	0	0	Female
16	3	14/05/2013	1	56	3	1	0	0	0	Male
Peregrine Falcon										
6	1	03/04/2013	1	69	0	0	0	2	3	
6	2	04/04/2013	1	7	1	1	0	0	0	Female
1	1	20/05/2013	1	148	1	9	0	0	0	
3	2	17/07/2013	1	45	0	1	3	0	0	
Common Kestrel										
7	1	24/04/2013	1	192	0	13	0	0	0	Male
3	2	24/04/2013	1	23	0	2	0	0	0	
7	2	24/04/2013	1	112	0	1	7	0	0	
14	2	24/04/2013	1	171	0	4	8	0	0	
4	3	24/04/2013	1	10	0	1	0	0	0	
5	3	24/04/2013	1	118	0	8	0	0	0	
9	3	24/04/2013	1	99	0	4	4	0	0	CU seen briefly; L flight; several short CU flights
12	3	24/04/2013	1	272	1	14	4	0	0	
17	3	24/04/2013	1	253	0	0	17	0	0	
10	2	25/04/2013	1	99	0	0	7	0	0	Male
3	3	25/04/2013	1	164	0	11	0	0	0	
4	3	25/04/2013	1	34	0	3	0	0	0	
7	3	25/04/2013	1	52	0	4	0	0	0	2 RN displaying beneath
9	2	26/04/2013	1	4	0	1	0	0	0	
13	2	26/04/2013	1	3	0	1	0	0	0	
6	3	26/04/2013	1	64	0	2	3	0	0	
1	1	14/05/2013	1	215	4	11	0	0	0	

Number of flight line number	VP Number	Date	Number of birds	Total flight duration (seconds)	Number of 15-sec intervals in each height band					Notes
					<10m	10m-30m	31m-80m	81m-130m	>130m	
4	1	14/05/2013	1	51	4	0	0	0	0	
5	1	14/05/2013	1	219	7	8	0	0	0	
6	1	14/05/2013	1	119	5	3	0	0	0	
13	1	14/05/2013	1	155	4	7	0	0	0	
16	1	14/05/2013	1	98	0	4	3	0	0	
18	1	14/05/2013	1	41	0	1	2	0	0	
4	2	14/05/2013	1	210	3	12	0	0	0	
9	2	14/05/2013	1	102	0	6	1	0	0	
10	2	14/05/2013	1	54	0	2	1	0	0	
11	2	14/05/2013	1	46	2	1	0	0	0	
5	2	14/05/2013	1	18	1	1	0	0	0	
8	2	14/05/2013	1	6	1	0	0	0	0	
3	3	14/05/2013	1	80	2	4	0	0	0	
9	3	14/05/2013	1	130	2	5	0	0	0	
15	3	14/05/2013	1	94	1	6	0	0	0	
19	3	14/05/2013	1	139	0	5	5	0	0	
15	3	14/05/2013	1	218	0	2	13	0	0	
4	3	15/05/2013	1	34	2	1	0	0	0	
12	3	20/05/2013	1	47	4	0	0	0	0	
14	3	21/05/2013	1	16	0	2	0	0	0	
6	3	21/05/2013	1	16	0	2	0	0	0	
21	2	22/05/2013	1	153	1	4	6	0	0	
22	2	22/05/2013	1	53	0	0	2	2	0	
10	3	22/05/2013	1	62	1	4	0	0	0	
3	2	12/06/2013	1	5	1	0	0	0	0	
7	2	12/06/2013	1	n/a	n/a	n/a	n/a	n/a	n/a	Perched from 14:58-15:08. Marked on map
9	2	12/06/2013	1	87	n/a	n/a	n/a	n/a	n/a	No height data
2	1	13/06/2013	1	40	0	3	0	0	0	
11	3	13/06/2013	1	144	0	4	4	2	0	
3	1	20/06/2013	1	4	1	0	0	0	0	
5	2	20/06/2013	1	239	15	1	0	0	0	
5	1	17/07/2013	1	35	0	2	1	0	0	Landed on met mast guy wires
4	2	17/07/2013	1	30	1	1	1	0	0	
5	2	17/07/2013	1	241	0	8	9	0	0	
12	3	17/07/2013	1	12	0	0	1	0	0	

Number of flight line number	VP Number	Date	Number of birds	Total flight duration (seconds)	Number of 15-sec intervals in each height band					Notes
					<10m	10m-30m	31m-80m	81m-130m	>130m	
1	2	18/07/2013	1	214	0	0	15	0	0	
4	1	19/07/2013	1	5	1	0	0	0	0	Sitting on post
4	2	19/07/2013	1	3	1	0	0	0	0	
1	1	15/08/2013	1	352	0	19	5	0		
5	2	15/08/2013	1	n/a	1	0	0	0	0	12:50 - 13:15 - perched on met mast wires
2	1	16/08/2013	1	288	19	2	0	0	0	Male
3	1	16/08/2013	1	148	10	0	0	0	0	Female
5	1	16/08/2013	1	155	8	0	0	0	0	Male
6	1	16/08/2013	1	n/a	n/a	n/a	n/a	n/a	n/a	Perched for 7 mins 15 sec, male
7	1	16/08/2013	1	8	1	0	0	0	0	Male
8	1	16/08/2013	1	273	19	0	0	0	0	Female
10	1	16/08/2013	1	73	4	1	0	0	0	
3	3	16/08/2013	1	92	0	4	3	0	0	
5	3	16/08/2013	1	55	0	4	0	0	0	
2	3	16/08/2013	1	37	0	3	0	0	0	
Greylag Goose										
1	1	04/04/2013	2	16	2	0	0	0	0	
4	2	04/04/2013	2	8	1	0	0	0	0	
13	2	24/04/2013	3	5	1	0	0	0	0	
6	3	24/04/2013	3	27	0	2	0	0	0	
4	2	24/04/2013	2	9	1	0	0	0	0	
3	2	25/04/2013	2	n/a	n/a	n/a	n/a	n/a	n/a	Sitting in field
5	2	25/04/2013	1	44	1	2	0	0	0	
3	2	26/04/2013	2	33	0	3	0	0	0	Landed at pond
4	2	26/04/2013	1	26	0	2	0	0	0	Landed at pond
11	2	26/04/2013	2	5	1	0	0	0	0	
12	2	26/04/2013	2	17	2	0	0	0	0	
2	2	14/05/2013	1	4	1	0	0	0	0	
5	3	14/05/2013	2	28	1	1	0	0	0	
13	3	14/05/2013	1	26	1	1	0	0	0	
9	2	20/05/2013	2	17	2	0	0	0	0	
3	3	20/05/2013	2	16	1	1	0	0	0	Landed
5	3	21/05/2013	2	6	1	0	0	0	0	
12	2	22/05/2013	4	38	0	3	0	0	0	
13	2	22/05/2013	3	74	0	0	3	3	0	

Number of flight line number	VP Number	Date	Number of birds	Total flight duration (seconds)	Number of 15-sec intervals in each height band					Notes
					<10m	10m-30m	31m-80m	81m-130m	>130m	
European Golden Plover										
3	2	15/08/2013	6	32	0	0	3	0	0	
Eurasian Curlew										
9	1	03/04/2013	17	14	1	0	0	0	0	
10	1	03/04/2013	2	4	1	0	0	0	0	
12	2	03/04/2013	1	42	0	3	0	0	0	
9	3	03/04/2013	17	31	0	0	3	0	0	
10	3	03/04/2013	5	48	0	0	4	0	0	
16	3	03/04/2013	1	46	0	0	4	0	0	
17	3	03/04/2013	2	16	0	2	0	0	0	
2	1	04/04/2013	1	8	1	0	0	0	0	
3	1	04/04/2013	2	n/a	n/a	n/a	n/a	n/a	n/a	On ground feeding
3	2	04/04/2013	2	38	0	1	2	0	0	
4	2	04/04/2013	8	18	0	2	0	0	0	
6	2	04/04/2013	8	18	1	1	0	0	0	
7	2	04/04/2013	8	19	1	1	0	0	0	
2	3	04/04/2013	1	43	0	3	0	0	0	
6	3	04/04/2013	1	17	2	0	0	0	0	
2	2	24/04/2013	1	3	1	0	0	0	0	
10	2	24/04/2013	1	2	1	0	0	0	0	
11	2	24/04/2013	1	23	2	0	0	0	0	
17	2	24/04/2013	1	27	2	0	0	0	0	
2	3	24/04/2013	1	27	0	2	0	0	0	
11	3	24/04/2013	1	4	1	0	0	0	0	
15	3	24/04/2013	1	38	0	3	0	0	0	CU chases another CU south
9	2	25/04/2013	1	10	1	0	0	0	0	Landed
2	2	25/04/2013	2	29	0	2	0	0	0	
3	2	25/04/2013	1	7	1	0	0	0	0	Landed
2	3	26/04/2013	1	42	0	3	0	0	0	
8	3	26/04/2013	1	16	2	0	0	0	0	
10	3	26/04/2013	1	31	1	2	0	0	0	
13	3	26/04/2013	1	22	2	0	0	0	0	
14	3	26/04/2013	1	157	0	2	9	0	0	2 buzzards seen during no.14 flight - the BZ flight are shown on maps; SU at small pond again
2	3	26/04/2013	1	17	1	1	0	0	0	
3	3	26/04/2013	1	21	0	2	0	0	0	Also flying at this time were BZ, 5GJ and 1 other CU

Number of flight line number	VP Number	Date	Number of birds	Total flight duration (seconds)	Number of 15-sec intervals in each height band					Notes
					<10m	10m-30m	31m-80m	81m-130m	>130m	
8	1	14/05/2013	1	69	1	1	3	0	0	
9	1	14/05/2013	2	37	0	0	3	0	0	
10	1	14/05/2013	1	31	0	0	3	0	0	
11	1	14/05/2013	1	16	0	2	0	0	0	
14	1	14/05/2013	1	16	2	0	0	0	0	
15	1	14/05/2013	1	7	1	0	0	0	0	
17	1	14/05/2013	1	65	1	3	1	0	0	
19	1	14/05/2013	1	76	0	1	1	3	0	
4	2	14/05/2013	1	8	1	0	0	0	0	
5	2	14/05/2013	1	23	2	0	0	0	0	
6	2	14/05/2013	1	14	1	0	0	0	0	
7	2	14/05/2013	1	34	3	0	0	0	0	
1	2	14/05/2013	1	28	0	1	1	0	0	
5	2	14/05/2013	1	17	0	0	2	0	0	
19	2	14/05/2013	1	62	1	2	1	0	0	
4	2	14/05/2013	1	18	2	0	0	0	0	
7	2	14/05/2013	1	5	1	0	0	0	0	
1	2	14/05/2013	1	3	1	0	0	0	0	
3	2	14/05/2013	1	15	1	0	0	0	0	
6	2	14/05/2013	1	4	0	1	0	0	0	
7	2	14/05/2013	2	48	1	2	1	0	0	
9	2	14/05/2013	1	8	1	0	0	0	0	
4	3	14/05/2013	1	1	1	0	0	0	0	
7	3	14/05/2013	1	30	2	1	0	0	0	
8	3	14/05/2013	1	105	1	7	0	0	0	
10	3	14/05/2013	1	85	1	3	2	0	0	
11	3	14/05/2013	1	48	0	1	3	0	0	
12	3	14/05/2013	1	33	1	1	1	0	0	
2	3	14/05/2013	1	10	1	0	0	0	0	
4	3	14/05/2013	1	40	1	2	0	0	0	
6	3	14/05/2013	2	19	2	0	0	0	0	
8	3	14/05/2013	1	13	1	0	0	0	0	
12	3	14/05/2013	2	58	3	1	0	0	0	
13	3	14/05/2013	1	28	1	1	0	0	0	
14	3	14/05/2013	1	7	1	0	0	0	0	

Number of flight line number	VP Number	Date	Number of birds	Total flight duration (seconds)	Number of 15-sec intervals in each height band					Notes
					<10m	10m-30m	31m-80m	81m-130m	>130m	
1	1	15/05/2013	1	18	2	0	0	0	0	Landed
2	1	15/05/2013	1	8	1	0	0	0	0	
3	1	15/05/2013	1	6	1	0	0	0	0	
4	1	15/05/2013	1	8	1	0	0	0	0	
5	1	15/05/2013	1	22	2	0	0	0	0	
6	1	15/05/2013	1	18	2	0	0	0	0	
7	1	15/05/2013	1	16	2	0	0	0	0	Landed at VP1
3	2	15/05/2013	1	28	1	1	0	0	0	
4	2	15/05/2013	1	102	2	4	1	0	0	
6	2	15/05/2013	1	26	2	0	0	0	0	
6	3	15/05/2013	1	11	0	1	0	0	0	
7	3	15/05/2013	1	12	0	1	0	0	0	
8	3	15/05/2013	1	65	0	3	2	0	0	
10	3	15/05/2013	1	37	0	3	0	0	0	
1	1	20/05/2013	1	13	0	1	0	0	0	
4	2	20/05/2013	1	9	1	0	0	0	0	
6	2	20/05/2013	1	5	1	0	0	0	0	
7	2	20/05/2013	1	19	2	0	0	0	0	
8	2	20/05/2013	2	14	1	0	0	0	0	
10	2	20/05/2013	1	47	3	1	0	0	0	
12	2	20/05/2013	1	27	1	1	0	0	0	
2	3	20/05/2013	1	21	1	1	0	0	0	
4	3	20/05/2013	1	17	2	0	0	0	0	
6	3	20/05/2013	1	33	1	2	0	0	0	
7	3	20/05/2013	1	9	0	1	0	0	0	
8	3	20/05/2013	1	22	0	0	2	0	0	
3	3	20/05/2013	1	17	0	2	0	0	0	
9	3	20/05/2013	1	21	0	2	0	0	0	
12	1	21/05/2013	1	53	0	4	0	0	0	
3	1	21/05/2013	1	26	0	2	0	0	0	
8	1	21/05/2013	1	29	2	0	0	0	0	
12	1	21/05/2013	1	43	0	4	0	0	0	
2	2	21/05/2013	2	62	3	2	0	0	0	
8	2	21/05/2013	1	14	1	1	0	0	0	
9	3	21/05/2013	1	17	2	0	0	0	0	

Number of flight line number	VP Number	Date	Number of birds	Total flight duration (seconds)	Number of 15-sec intervals in each height band					Notes
					<10m	10m-30m	31m-80m	81m-130m	>130m	
11	3	21/05/2013	1	31	31	3	0	0	0	
8	3	21/05/2013	1	35	3	0	0	0	0	
9	3	21/05/2013	1	16	2	0	0	0	0	
12	3	21/05/2013	1	91	0	0	7	0	0	
15	3	21/05/2013	1	125	0	9	0	0	0	
17	3	21/05/2013	1	11	0	0	3	0	0	
18	3	21/05/2013	1	35	0	3	0	0	0	
22	3	21/05/2013	1	65	0	3	2	0	0	
1	3	21/05/2013	1	16	2	0	0	0	0	
4	3	21/05/2013	1	91	0	0	7	0	0	
7	3	21/05/2013	1	125	0	9	0	0	0	
9	3	21/05/2013	1	11	0	0	1	0	0	
10	3	21/05/2013	1	35	0	3	0	0	0	
14	3	22/05/2013	1	65	0	3	2	0	0	
12	1	22/05/2013	1	14	1	0	0	0	0	
3	2	22/05/2013	1	50	0	1	3	0	0	
10	2	22/05/2013	1	49	1	2	1	0	0	
18	2	22/05/2013	1	33	2	1	0	0	0	
19	2	22/05/2013	2	36	1	2	0	0	0	
20	2	22/05/2013	1	38	1	2	0	0	0	
1	3	22/05/2013	2	65	5	0	0	0	0	Pair of Curlew and a lapwing displaying beside VP 3, several low short flights none of which at turbine height
12	3	22/05/2013	4	24	1	1	0	0	0	
3	1	12/06/2013	1	84	0	6	0	0	0	
5	1	12/06/2013	1	24	0	1	1	0	0	
5	2	12/06/2013	1	12	1	0	0	0	0	
6	2	12/06/2013	1	16	1	1	0	0	0	
10	2	12/06/2013	1	76	4	2	0	0	0	
14	2	12/06/2013	2	63	0	1	4	0	0	
16	2	12/06/2013	1	42	0	0	3	0	0	
4	3	12/06/2013	1	56	4	0	0	0	0	
7	3	12/06/2013	3	22	0	0	2	0	0	
10	3	12/06/2013	1	69	0	0	5	0	0	
1	2	13/06/2013	1	16	2	0	0	0	0	
2	2	13/06/2013	1	8	1	0	0	0	0	
3	2	13/06/2013	1	5	1	0	0	0	0	

Number of flight line number	VP Number	Date	Number of birds	Total flight duration (seconds)	Number of 15-sec intervals in each height band					Notes
					<10m	10m-30m	31m-80m	81m-130m	>130m	
5	2	13/06/2013	1	8	0	1	0	0	0	
6	2	13/06/2013	1	3	1	0	0	0	0	
7	2	13/06/2013	1	3	1	0	0	0	0	
9	2	13/06/2013	1	27	0	2	0	0	0	
1	3	13/06/2013	2	17	0	2	0	0	0	
3	3	13/06/2013	2	26	1	1	0	0	0	
4	3	13/06/2013	1	20	0	2	0	0	0	
4	1	20/06/2013	1	38	0	2	1	0	0	
2	2	20/06/2013	2	61	1	4	0	0	0	Landed
4	2	20/06/2013	2	19	0	2	0	0	0	
6	2	20/06/2013	2	175	0	5	4	3	0	
7	2	20/06/2013	1	9	1	0	0	0	0	Mobbing crow
2	2	20/06/2013	9	16	0	2	0	0	0	
3	2	20/06/2013	2	126	0	9	0	0	0	
4	2	20/06/2013	2	69	1	4	0	0	0	
5	2	20/06/2013	3	24	1	1	0	0	0	
8	2	20/06/2013	1	26	0	2	0	0	0	
11	2	20/06/2013	1	6	0	1	0	0	0	
1	3	20/06/2013	1	4	1	0	0	0	0	
2	3	20/06/2013	1	13	1	0	0	0	0	
4	3	20/06/2013	1	34	0	4	0	0	0	
5	3	20/06/2013	7	69	0	4	1	0	0	Small groups of GX flying over close to shore
8	3	20/06/2013	1	15	2	0	0	0	0	
14	3	20/06/2013	1	63	2	3	0	0	0	
16	3	20/06/2013	7	45	0	2	2	0	0	
1	1	17/07/2013	21	0	1	0	2	0	0	Landed in salt pan bay
14	3	17/07/2013	21	211	0	4	0	0	0	
4	3	17/07/2013	22	64	0	5	0	0	0	
3	1	17/07/2013	1	95	0	2	1	4	0	
5	3	17/07/2013	1	58	0	2	2	0	0	WM&CU flying together, landing on slopes west of Drumwhisley
6	3	17/07/2013	1	165	0	4	8	0	0	
2	2	18/07/2013	1	12	12	0	1	0	0	
1	3	18/07/2013	1	61	1	4	0	0	0	
1	1	19/07/2013	8	16	0	2	0	0	0	
2	1	19/07/2013	9	89	0	3	3	0	0	

Number of flight line number	VP Number	Date	Number of birds	Total flight duration (seconds)	Number of 15-sec intervals in each height band					Notes
					<10m	10m-30m	31m-80m	81m-130m	>130m	
2	2	19/07/2013	1	35	1	1	0	0	0	CU mobbing RN flight 3; BZ flights occasional but outside buffer to south and
6	2	19/07/2013	1	95	1	6	0	0	0	
2	2	15/08/2013	1	16	2	0	0	0	0	
6	2	15/08/2013	1	46	2	2	1	1	1	
2	3	16/08/2013	1	16	0	2	0	0	0	
Whimbrel										
7	2	22/05/2013	2	55	1	1	2	0	0	
8	2	22/05/2013	1	6	1	0	0	0	0	
16	2	22/05/2013	10	93	1	4	1	0	0	
23	2	22/05/2013	1	15	1	1	0	0	0	
4	1	21/05/2013	7	16	0	0	2	0	0	Probably disturbed by BZ
7	1	21/05/2013	10	39	0	2	1	0	0	
6	2	21/05/2013	4	6	1	0	0	0	0	
12	1	20/05/2013		85	0	0	4	2	0	
4	1	20/05/2013	6	65	0	5	0	0	0	
2	1	17/07/2013	1	95	0	2	1	4	0	
5	3	17/07/2013	1	58	0	2	2	0	0	WM & CU flying together
6	3	17/07/2013	1	165	0	4	8	0	0	

NB: No flights recorded for: Barn Owl; Short-eared Owl; Whooper Swan