



## **DOUGLAS WEST WIND FARM**

ORNITHOLOGY

Appendix 8.1

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## 1 INTRODUCTION

MacArthur Green was commissioned by Douglas West Wind Farm Ltd to complete ornithological assessments at the revised Douglas West Wind Farm, Douglas in South Lanarkshire (hereafter referred to as 'the Revised Development site'). Baseline surveys were conducted between September 2014 and August 2015 to inform an assessment of the potential ornithological effects of the Revised Development on the species assemblage present.

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 (Confidential); and
- Annex E: Collision Risk Assessments.

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 Annex D.

A range of surveys were employed to accurately record baseline conditions within the Revised Development site and appropriate survey buffers (detailed in Annex B and shown on **Figure 8.2** and **Figure 8.3**). In this Technical Appendix, associated Annexes (A – E) and Chapter 8 (Ornithology) of the Environmental Statement (ES).

## 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 METHODS

### 3.1 Consultations and Desk-Based Study

The following organisations and resources were consulted regarding the ornithological interests on and adjacent to the Revised Development site:

- Various ornithological surveys that were carried out on the site of the Revised Development during 2009 and 2010 on behalf of Community Windpower Ltd for the proposed Douglas West Community Windfarm (DWCW) project;
- Survey data collated from other local wind farm developments;
- Scottish Natural Heritage, including Sitelink (<http://gateway.snh.gov.uk/sitelink/index.jsp>);
- South Lanarkshire Council; and
- South Strathclyde Raptor Study Group (SSRSG).

### 3.2 Field Surveys

The following additional surveys were undertaken within the site between September 2014 and August 2015:

- Flight activity surveys (one breeding season and one non-breeding season);
- Breeding bird surveys (one breeding season);
- Scarce breeding bird surveys (one breeding season); and
- Black grouse surveys (one breeding season).

Survey methods followed the recommended SNH (2014<sup>i</sup>) guidelines available at the time and methods are described in detail within Annex B. 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, **Figure 8.2** and **Figure 8.3**.

The relative importance of the data collected was determined by the specific level of protection assigned to those species recorded, coupled with their perceived susceptibility to potential impacts resulting from the Revised Development. The resulting ‘target species’ and ‘secondary species’ lists are a standard assessment tool for wind farm ornithological studies (see Annex B).

## 4 RESULTS

### 4.1 Consultations and Desk-Based Study

#### 4.1.1 Designated Sites

Information gathered from the consultation exercise revealed that the site is within 20 km of one Special Protection Area (SPA) (**Figure 8.1**):

- Muirkirk and North Lowther Uplands SPA<sup>ii</sup> (underpinned by North Lowther Uplands SSSI<sup>iii</sup> and Muirkirk Uplands SSSI<sup>iv</sup>), 5.5 km to the south west.

**Table 8-1 Summary of qualifying features of Muirkirk and North Lowther Uplands SPA (underpinned by North Lowther Uplands SSSI and Muirkirk Uplands SSSI)**

Feature	Qualifying feature category	Status	Description
Golden plover <i>Pluvialis apricaria</i> Breeding	SPA	June 2015: unfavourable declining	Breeding population of European importance: minimum of 154 pairs (1999), 0.7% of the UK population.
Hen harrier <i>Circus cyaneus</i> Breeding	SPA, SSSI	July 2008: unfavourable declining	Breeding population of European importance: average of 29.2 breeding females (1994-96), 6% of the UK population. This is one of the largest hen harrier populations in the UK.
Hen harrier <i>Circus cyaneus</i> Non-breeding	SPA, SSSI	December 2004: unfavourable declining	Wintering population of European importance: average of 12 individuals (1991-95), 2% of the UK population.

Feature	Qualifying feature category	Status	Description
Merlin <i>Falco columbarius</i> Breeding	SPA	July 2009: unfavourable no change	Breeding population of European importance: average of 9 breeding pairs (1989-98), 0.7% of the UK population.
Peregrine <i>Falco peregrinus</i> Breeding	SPA	August 2004: unfavourable no change	Breeding population of European importance: average of 6 breeding pairs (1992-96), 0.5% of the UK population.
Short-eared owl <i>Asio flammeus</i> Breeding	SPA, SSSI	July 1998: favourable maintained	Breeding population of European importance: average of 26 breeding pairs (1997-98), 3% of the UK population
Breeding bird assemblage (Muirkirk Uplands)	SSSI	August 2008: favourable maintained	Upland moorland assemblage of national importance including buzzard <i>Buteo buteo</i> , curlew <i>Numenius arquata</i> , dunlin <i>Calidris alpina</i> , golden plover <i>Pluvialis apricaria</i> , merlin <i>Falco columbarius</i> , peregrine <i>Falco peregrinus</i> , red grouse <i>Lagopus lagopus scotica</i> , redshank <i>Tringa totanus</i> , ring ouzel <i>Turdus torquatus</i> , snipe <i>Gallinago gallinago</i> , stonechat <i>Saxicola torquatus</i> , teal <i>Anas crecca</i> , wheatear <i>Oenanthe oenanthe</i> and whinchat <i>Saxicola rubetra</i> .
Breeding bird assemblage (North Lowther Uplands)	SSSI	May 2015: unfavourable no change	Upland moorland assemblage of national importance including curlew <i>Numenius arquata</i> , dunlin <i>Calidris alpina</i> , golden plover <i>Pluvialis apricaria</i> , merlin <i>Falco columbarius</i> , peregrine <i>Falco peregrinus</i> , raven <i>Corvus corax</i> , red grouse <i>Lagopus lagopus scotica</i> , redshank <i>Tringa totanus</i> , snipe <i>Gallinago gallinago</i> , teal <i>Anas crecca</i> , wheatear <i>Oenanthe oenanthe</i> and whinchat <i>Saxicola rubetra</i> .

In addition, one National Nature Reserve (NNR) (Clyde Valley Woodlands NNR<sup>v</sup>) is within 20km of the site (**Figure 8.1**). Key species at this reserve are: spotted flycatcher, bullfinch, song thrush, treecreeper, great-spotted woodpecker, dipper, kingfisher and willow tit.

#### 4.1.2 Barn Owl

The barn owl desk based nest data are summarised in Table D-1 of **Confidential Annex D**, and shown in **Confidential Figure C8.2**.

#### 4.1.3 Black Grouse

Detailed data on black grouse were obtained from four sources:

- A report commissioned by Scottish Natural Heritage (SNH) on black grouse lek distribution in East Ayrshire (Zisman *et al.*, 2009<sup>vi</sup>);
- Information for the Douglas West Community Wind Farm (DWCW) from 2009 to 2010; and

- A data request from Scottish Power Renewables for the Hagshaw Hill Extension Wind Farm, which lies partly within the 1.5 km southern buffer of the site.

Zisman *et al.* (2009<sup>vi</sup>) identified four leks and a casual record within the site 1.5 km buffer zone (Table 8-2 below and **Confidential Figure C8.1**).

**Table 8-2 Black grouse desk study data for Douglas West and the surrounding 1.5 km buffer**

Locality	Grid reference	Date	Type of record	Males	Females	Source
Douglas West	NS 813 313	13/05/2003	lek	3	-	SNH
Douglas West	NS 813 313	13/04/2004	lek	1	-	SNH
Douglas West	NS 813 314	17/05/2004	lek	1	-	SNH
Over Arkney Hill	NS 810 315	04-05/2013	flight	1	-	SPR
Blackwood Hill	NS 809 309	10/12/2003	casual	3	-	SNH
West of Blackwood Hill	NS 809 309	2010	lek	2	-	DWCW
Wind farm spine road west of Blackwood Hill	NS 803 309	23/04/2015	casual	1	-	SPR
Rob's Hill	NS 812 307	17/05/2004	lek	1	-	SNH
Rob's Hill	NS 812 305	04-05/2011	casual	1	-	SPR
West of Robshill Burn	NS 808 301	04-05/2009	casual	1	-	SPR
West of Robshill Burn	NS 809 303	04-05/2009	casual	1	-	SPR
South-east of Robshill Burn	NS 813 301	04-05/2010	casual	1	-	SPR
South-east of Robshill Burn	NS 809 300	04-05/2011	casual	1	-	SPR
Over Robshill Burn	NS 810 305	04-05/2013	flight	1	-	SPR
East of Burnt Rig	NS 803 310	winter 2013/14	casual	3	1	SPR
Windrow Hill	NS 804 303	13/04/2004	lek	1	2	SNH

Information made available from the DWCW project states that 'a known lek site' (confirmed as the Blackwood Hill lek site in **Table 8-2** in e-mail correspondence from Starling Learning to 3R Energy), as well as the site were surveyed on 2nd May, 16th May and 5th June 2010. Two lekking males were recorded at the Blackwood Hill lek but no black grouse were recorded elsewhere in the surveyed area during any surveys.

Scottish Power Renewables (SPR) provided a map showing black grouse records in the site 1.5 km buffer zone to the south-west from targeted black grouse monitoring for the Hagshaw Hill Extension Wind Farm between 2009 and 2014 (**Confidential Figure C8.1**). These included records of mainly single, non-lekking males, as follows: two records to the west of the Robshill Burn from 2009, one record to the south-east of the Robshill Burn from 2010, one record at Rob's Hill and one to the south-east of the Robshill Burn from 2011, one flight record north-east over an area planted for black grouse along the Robshill Burn and one flight record from the planted area adjacent to the western boundary of the site heading south towards Arkney Hill, both from 2013. In addition, there was a casual record of three males and one female from the winter of 2013/14 east of Burnt Rig to the south of the coniferous plantation adjacent to the north of the Hagshaw Hill Extension Wind Farm and a casual record of a single male on the wind farm spine road slightly east of the latter location (west of Blackwood Hill) from April 2015. Despite the above sightings no active leks were known to SPR, although a lek was suspected nearby (Peter Robson, pers. comm., 24th April 2015).

#### 4.1.4 *Breeding Raptors*

A desk study was carried out within a radius of up to 15 km surrounding the site. Information on raptors was sought from the following sources:

- The South Strathclyde Raptor Study Group (SSRSG) which was contacted on 12th December 2014 (and throughout the survey period);
- The citations for the Muirkirk and North Lowther Uplands SPA and the Muirkirk Uplands SSSI;
- Information from the DWCW development surveys in 2009 and 2010;
- Information from Environmental Statements and Technical Reports from other local wind farm developments;
- Records from other ornithological surveys carried out for the Revised Development;
- Surveyor knowledge of the local area gained over several years of carrying out ecological and ornithological survey work in the site and in the wider area; and
- Habitats present on site and in the surrounding area.

The secretary of the SSRSG stated in e-mails of 21st December 2014 and 25th March 2015 that the SSRSG held no breeding records for Schedule 1 raptors (except for goshawk) within the site or the 2 km boundary. However, there have been regular sightings of hen harrier within the site and in the 2 km buffer zone and occasional sightings of red kite, goshawk, osprey, merlin, peregrine and short-eared owl in the 2 km buffer zone. Goshawk have very probably bred within the 2 km buffer zone or nearby during the preceding five years, most likely in the Long Plantation to the east/south-east of the site but the species was not recorded on a regular basis.

The DWCW information made available included data obtained from the SSRSG, data obtained through a scoping visit in 2009 and collected during breeding season surveys in 2010. This is summarised below:

- Red kite - nearest nest site at 6 km to the north. There were increasing sightings in the area but no nests sites were known to be present.
- Hen harrier breeding at distances of ca. 4 km and 7-8 km; no suitable nesting habitat present within the site. Two female birds had been recorded hunting through the site prior to the study and a bird was also recorded during a scoping visit in September 2009. A male was recorded in July 2010 hunting between Arkney Hill and the edge of the former opencast site at a time when birds breeding locally still had young in the nest. VP watches conducted during 2010 recorded one flight of a foraging bird during the breeding season.
- Goshawk - breeding at 2-3 km.
- Osprey - breeding at 15 km to the south-east. Two birds were recorded during VP watches in April 2010.
- Merlin possibly nesting 4 km away and recorded hunting along the edge of a woodland; also recorded during a scoping visit in September 2009. Recorded once during an April 2010 VP watch.
- Peregrine - breeding at 5 km and 6 km; also recorded during a scoping visit in September 2009.

- Short-eared owl - possibly nesting 4 km away; no suitable nesting habitat present within the site.

From fieldwork carried out by surveyors in the general area over several years, it is also known that during the mid- to late 2000s:

- Hen harriers bred in the Glespin area at Weston Hill at ca. 3 km to the south of the site and on a restored area of the former Glentaggart Opencast Coal Site at ca. 4.5 km to the south;
- Short-eared owl were active in the restored Opencast Coal Site; and
- Peregrine bred at the former Spireslack Opencast Coal Site, ca. 5.5 km to the west.

#### 4.1.5 *Waders*

A desk study was carried out within a radius of up to approximately 10 km surrounding the site. Information on waders was sought from the following sources:

- Information from the DWCW development surveys in 2009 and 2010;
- Information from Environmental Statements and Technical Reports from other local wind farm developments;
- Records from other ornithological surveys carried out for the Revised Development;
- Surveyor knowledge of the local area gained over several years of carrying out ecological and ornithological survey work within the site and in the wider area; and
- Habitats present on site and in the surrounding area.

A three-visit moorland birds (MBS) survey was carried out during May and July 2010 for the DWCW project. Altogether seven wader species were recorded holding territories within the site and surrounding 500 m buffer, as follows:

- Common sandpiper - four territories included two at the ponds, one on the lower stretch of the Poniel Water and another one at the former coal processing area. Sightings suggested that breeding was unsuccessful.
- Curlew - six territories were recorded within the site and surrounding 500 m buffer zone. Of these, four were on the damp grassland areas to the south-west of the former Dalquhandy Opencast Coal Site and one on the Opencast Site itself. In addition, a large number of curlew flights were recorded during VP watches.
- Lapwing - there was one pair at the pond adjacent to the tarmac road in the north-western section of the site. A pair recorded at the main pond in the centre of the site on the same day was thought to be the same pair. In addition, ten flights were recorded during VP watches.
- Oystercatcher - of two pairs, one was recorded in a fenced compound at Douglas West and one at the main pond in the centre of the site and the coal processing area. In addition, seven flights were recorded during VP watches.
- Redshank - two territories were located at the main pond on the May visit only.

- Ringed plover - four territories were recorded, two at the main pond in the centre of the site and two on the former coal processing area. Two territories on the second visit and none on the last visit led to the conclusion that breeding had been unsuccessful.
- Snipe - six territories were recorded within the site and surrounding 500 m buffer zone. Snipe showed a similar distribution to curlew. The single territory that was on former Opencast Coal land was associated with adjacent improved grassland. In addition, two flights were also recorded during VP watches.

In addition to the above sightings a golden plover was recorded during a scoping visit in September 2009.

A synopsis carried out in 2007 by Dunnock Environmental Services (DES) staff of records collected at the Dalquhandy site identified six species of waders: breeding lapwing, ringed plover and curlew as well as oystercatcher, woodcock and snipe, the latter in good numbers in winter at a then recently restored pond in the northern section of the Dalquhandy site.

## 4.2 Field Survey

All valid surveys were undertaken during suitable weather conditions (as described within Annex B – Survey Methodologies). Where weather conditions deteriorated below acceptable conditions (Annex B), surveys were either suspended or additional surveys were undertaken. All surveys in 2014 to 2015 were undertaken by DES and Schedule 1/Annex 1 surveys were carried out by appropriately licensed surveyors. Survey effort and results of the field surveys are detailed within Annexes C and D; survey results and information collected through the desk study are also illustrated within **Figures 8.5 to 8.25** and **Confidential Figures C8.1 to C8.3**. All survey data were reviewed, inputted, and analysed by MacArthur Green.

The following sections summarise the results from each survey undertaken.

### 4.2.1 Flight Activity

The flight activity surveys recorded all target species flight activity within the Revised Development 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 250 m buffer).

Flight activity surveys across the 2015 breeding season and 2014/2015 non-breeding season were undertaken across two Vantage Points (VPs) (**Figure 8.3**). The locations of the two VPs have remained constant throughout the 2014 to 2015 survey period, and are the same as those used during the 2009-10 baseline surveys for the DWCW project (this project used a third VP, which was considered unnecessary for coverage of the final turbine layout in 2014 to 2015). Valid survey effort<sup>1</sup> is detailed in **Table 8-3** and full details of flight activity surveys are contained in Annex C with methodology in Annex B.

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<sup>1</sup> 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 8-3 Summary of total hours of valid survey per VP in each season**

Period	VP1	VP2	VP3
2009/2010 non-breeding season	28	26	27
2010 breeding season	61	61	58
2010/2011 non-breeding season	26	28	30
2014/2015 non-breeding season	N/A	83.5	83.82
2015 breeding season	N/A	59	54

A total of 16 target species were recorded during the flight activity surveys<sup>2</sup>. For each species across the whole flight activity survey period, **Table 8-5** and **Table 8-4** show the number of flights recorded and the number of birds recorded<sup>3</sup>. 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 8-4 Target species recorded and total number of flights recorded during flight activity surveys, 2009-2010**

Species	Total number of flightlines recorded	Total number of birds recorded	Total bird seconds recorded
Curlew	46	69	2,990
Greylag goose	2	3	225
Hen harrier	8	8	856
Lapwing	5	26	3,225
Merlin	2	2	120
Osprey	1	2	480
Oystercatcher	4	7	10,110
Peregrine	1	1	120
Snipe	2	2	65

<sup>2</sup> Please note this includes the 2009-2010 surveys undertaken for the DWCW project.

<sup>3</sup> This includes flights that would not technically be 'at-risk' of collision (e.g. recorded outwith the CRAA and/or not at rotor height).

**Table 8-5 Target species recorded and total number of flights recorded during flight activity surveys, 2014-2015**

Species	Total number of flightlines recorded	Total number of birds recorded	Total bird seconds recorded
Barn owl	1	1	30
Barnacle goose	1	2	330
Common sandpiper	1	1	15
Curlew	28	34	2,070
Golden plover	2	340	31,200
Greylag goose	49	467	122,925
Hen harrier	47	49	7,485
Lapwing	4	8	540
Merlin	1	1	45
Oystercatcher	3	4	240
Peregrine	1	1	90
Pink-footed goose	33	2681	784,470
Snipe	11	11	990
Whooper swan	7	28	3,810

#### 4.2.1.1 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 are discussed in the sections below. **Table 8-6** and **Table 8-7** summarise the number of flightlines identified and the proportion/number of those flightlines considered 'at-risk'.

- 'At-risk' is defined as – a flight having at least part of its duration (i) at Potential Collision Height (PCH)<sup>4</sup>; (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<sup>5</sup> (19 m to 151 m).

Three target species recorded during flight activity surveys were not identified within the CRAA and associated viewsheds and so are not considered within the sections below. These species are: barn owl, barnacle goose, and golden plover. 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.

<sup>4</sup> 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.

<sup>5</sup> 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.

**Table 8-6 Flightlines identified within the CRAA and associated viewshed and the proportion of these 'at-risk', 2009-2011**

Species	Number of flightlines identified within the CRAA and associated viewshed	Number of these flightlines identified to be 'at-risk'
Curlew	14	14
Greylag goose	1	1
Lapwing	2	2
Merlin	1	1
Osprey	1	1
Peregrine	1	1
Snipe	1	1

**Table 8-7 Flightlines identified within the CRAA and associated viewshed and the proportion of these 'at-risk', 2014-2015**

Species	Number of flightlines identified within the CRAA and associated viewshed	Number of these flightlines identified to be 'at-risk'
Common sandpiper	1	1
Curlew	23	22
Greylag goose	36	35
Hen harrier	44	44
Lapwing	4	4
Merlin	1	1
Oystercatcher	2	2
Pink-footed goose	14	8
Snipe	7	7
Whooper swan	4	4

**Table 8-8 to Table 8-12** detail per species the number and proportion of flight activity within each flight height category (below, at, and above PCH) for each season surveyed. 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.

**Table 8-8 Target species bird seconds within the CRAA (2009/2010 non-breeding season)**

Species	Bird seconds within height bands (non-breeding season <sup>6</sup> )					
	Flights	Below PCH	At PCH	Above PCH	Total	
Snipe	Seconds	1	0.00	4.97	0.00	4.97
	Percentage		0.00	100.00	0.00	100.00

<sup>6</sup> The general non-breeding season is defined as September to mid-March inclusive by SNH (2014). These observations were collected between the dates of 11<sup>th</sup> November 2009 and 22<sup>nd</sup> March 2010.

**Table 8-9 Target species bird seconds within the CRAA (2010 breeding season)**

Species	Bird seconds within height bands (breeding season <sup>7</sup> )					
		Flights	Below PCH	At PCH	Above PCH	Total
Curlew	Seconds	14	0.00	705.00	0.00	705.00
	Percentage		0.00	100.00	0.00	100.00
Greylag goose	Seconds	1	0.00	60.00	0.00	60.00
	Percentage		0.00	100.00	0.00	100.00
Lapwing	Seconds	2	0.00	40.00	0.00	40.00
	Percentage		0.00	100.00	0.00	100.00
Merlin	Seconds	1	0.00	60.00	0.00	60.00
	Percentage		0.00	100.00	0.00	100.00
Osprey	Seconds	1	0.00	258.48	0.00	258.48
	Percentage		0.00	100.00	0.00	100.00

**Table 8-10 Target species bird seconds within the CRAA (2010/2011 non-breeding season)**

Species	Bird seconds within height bands (non-breeding season <sup>8</sup> )					
		Flights	Below PCH	At PCH	Above PCH	Total
Peregrine	Seconds	1	0.00	30.00	0.00	30.00
	Percentage		0.00	100.00	0.00	100.00

**Table 8-11 Target species bird seconds within the CRAA (2014/2015 non-breeding season)**

Species	Bird seconds within height bands (non-breeding season <sup>9</sup> )					
		Flights	Below PCH	At PCH	Above PCH	Total
Curlew	Seconds	7	68.26	507.66	0.00	575.92
	Percentage		11.85	88.15	0.00	100.00
Greylag goose	Seconds	24	142.85	11596.79	292.03	12031.67
	Percentage		1.19	96.39	2.43	100.00
Hen harrier	Seconds	43	3617.00	2292.59	0.00	5909.59
	Percentage		61.21	38.79	0.00	100.00
Lapwing	Seconds	1	0.00	87.86	0.00	87.86
	Percentage		0.00	100.00	0.00	100.00
Merlin	Seconds	1	28.41	16.59	0.00	45.00
	Percentage		63.12	36.88	0.00	100.00

<sup>7</sup> The general breeding season is defined as mid-March to August inclusive by SNH (2014). These observations were collected between the dates of 19<sup>th</sup> April and 16<sup>th</sup> August 2010.

<sup>8</sup> The general non-breeding season is defined as September to mid-March inclusive by SNH (2014). These observations were collected between the dates of 7<sup>th</sup> September and 27<sup>th</sup> October 2010.

<sup>9</sup> The general non-breeding season is defined as September to mid-March inclusive by SNH (2014). These observations were collected between the dates of 27<sup>th</sup> September 2014 and 27<sup>th</sup> March 2015.

Species	Bird seconds within height bands (non-breeding season <sup>9</sup> )					
	Flights	Below PCH	At PCH	Above PCH	Total	
Oystercatcher	Seconds	1	11.19	15.41	0.00	26.60
	Percentage		42.08	57.92	0.00	100.00
Pink-footed goose	Seconds	11	15.18	15972.45	7070.97	23058.60
	Percentage		0.07	69.27	30.67	100.00
Snipe	Seconds	4	0.00	91.46	0.00	91.46
	Percentage		0.00	100.00	0.00	100.00
Whooper swan	Seconds	4	53.16	65.88	0.00	119.04
	Percentage		44.66	55.34	0.00	100.00

**Table 8-12 Target species bird seconds within the CRAA (2015 breeding season)**

Species	Bird seconds within height bands (breeding season <sup>10</sup> )					
	Flights	Below PCH	At PCH	Above PCH	Total	
Common sandpiper	Seconds	1	9.47	5.53	0.00	15.00
	Percentage		63.12	36.88	0.00	100.00
Curlew	Seconds	16	204.68	281.26	115.37	601.31
	Percentage		34.04	46.77	19.19	100.00
Greylag goose	Seconds	12	561.25	1162.41	1015.70	2739.36
	Percentage		20.49	42.43	37.08	100.00
Hen harrier	Seconds	1	73.43	135.96	0.00	209.40
	Percentage		35.07	64.93	0.00	100.00
Lapwing	Seconds	3	179.90	135.10	0.00	315.00
	Percentage		57.11	42.89	0.00	100.00
Oystercatcher	Seconds	1	3.54	13.29	0.00	16.83
	Percentage		21.04	78.96	0.00	100.00
Pink-footed goose	Seconds	3	0.00	1511.16	18493.28	20004.44
	Percentage		0.00	7.55	92.45	100.00
Snipe	Seconds	3	4.80	502.93	0.00	507.73
	Percentage		0.95	99.05	0.00	100.00

#### 4.2.1.2 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 8-13** and **Table 8-14** provide the estimated collision rates and number of seasons per collision for each species. A dashed line indicates that no “at-risk” flights were recorded during that season, and estimated collision risk is consequently zero.

<sup>10</sup> The general breeding season is defined as mid-March to August inclusive by SNH (2014). These observations were collected between the dates of 2<sup>nd</sup> April and 24<sup>th</sup> August 2015.

**Table 8-13 Estimated weighted collision rate per season**

Species	2009/2010 non- breeding season	2010 breeding season	2010/2011 non- breeding season	2014/2015 non- breeding season	2015 breeding season
Common sandpiper	-	-	-	-	0.0007
Curlew	-	0.0641	-	0.0558	0.0543
Greylag goose	-	0.0007	-	0.1686	0.0297
Hen harrier	-	-	-	0.1136	0.0118
Lapwing	-	0.0029	-	0.0076	0.0206
Merlin	-	0.0043	-	0.0014	-
Osprey	-	0.0229	-	-	-
Oystercatcher	-	-	-	0.0015	0.0023
Peregrine	-	-	0.0044	-	-
Pink-footed goose	-	-	-	0.2179	0.0362
Snipe	0.0008	-	-	0.0092	0.0890
Whooper swan	-	-	-	0.0129	-

**Table 8-14 Estimated number of seasons per collision**

Species	Equivalent to one bird per non- breeding seasons (2009/2010)	Equivalent to one bird per breeding seasons (2010)	Equivalent to one bird per non- breeding seasons (2010/2011)	Equivalent to one bird per non- breeding seasons (2014/2015)	Equivalent to one bird per breeding seasons (2015)
Common sandpiper	-	-	-	-	1460.55
Curlew	-	15.61	-	17.92	18.42
Greylag goose	-	1386.6	-	5.93	33.69
Hen harrier	-	-	-	8.80	84.50
Lapwing	-	348.34	-	131.13	48.55
Merlin	-	232.47	-	694.97	-
Osprey	-	43.82	-	-	-
Oystercatcher	-	-	-	653.47	431.36
Peregrine	-	-	227.08	-	-
Pink-footed goose	-	-	-	4.59	27.62
Snipe	1280.00	-	-	108.55	11.24
Whooper swan	-	-	-	77.47	-

#### 4.2.2 Breeding Birds

One complete breeding bird survey (comprising of four visits) was conducted in the 2015 breeding season (May to July 2015). Surveys recorded seven wader species, of which five were considered to be breeding within the site (**Table 8-15**). Breeding activity is discussed per species in the sections below and wader activity is detailed on **Figure 8.25**. Further details of the breeding bird surveys are provided within Annex C and survey methodology is provided within Annex B.

**Table 8-15 Breeding wader territories within the site and 500 m buffer, 2015**

Species	Number of territories within the site	Number of territories within 500m site buffer	Total number of territories
Common sandpiper	2	3	5
Curlew	2	3	5
Lapwing	2	4-5	6-7
Oystercatcher	0	3	3
Redshank	1	3	4
Ringed plover	0	2	2
Snipe	7	6	13

#### 4.2.2.1 Common Sandpiper

There were five assumed territories of common sandpipers, two territories within the site and three within the 500 m buffer zone.

One territory occurred in the eastern section of the site at Alder Pond adjacent to the tarmac road. A bird was seen there during a VP watch on 30th April, a bird was also present there on 8th May and a pair on 13th May. A second territory occurred slightly further west where a bird was sitting on a fence post on 11th June and a bird was in flight nearby on 12th June. A third territory occurred on the Poniel Water below Craigend in the north-eastern 500 m buffer where a bird was present on 13th May.

A bird at the large pond that overlapped the north-western 500 m buffer on 8th June was believed to be part of a fourth territory, with an incidental record of a pair on the former opencast lagoon on the western boundary on 15th June implying a fifth territory.

#### 4.2.2.2 Curlew

Four curlew territories were assumed on the moorland in the southern section of the site and adjacent buffer. There were a multitude of registrations on the first two MBS visits, with much smaller numbers of observations on the third and fourth visits. Observations from VP watches from Arkney Hill which overlooked this area were used to aid interpretation of the data. Two territories were assumed in the southern section of the site, one to the south of the tarmac road, which runs through the centre of the site, and one in the south-east corner of the site.

In addition there was one territory south of the Hagshaw Hill Wind Farm access road to the south-west of the Scottish Power compound. Birds were heard (but were out of view) displaying there on many occasions during the VP watches. A further territory was believed to be present there but located mainly or entirely outside the 500 m buffer zone. A fourth territory was assumed to the south-east of Arkney Hill, also within the 500 m buffer zone. Again, birds were heard displaying there out of view on many occasions during VP watches.

A bird flew through the north-eastern corner of the site calling on 13th May and a bird was heard alarm-calling there repeatedly on 19th June. This territory may have been located mainly outside the site boundary but at the very least overlapped the north-eastern corner.

There was also a curlew territory to the north of the VP located at Wallace's Cave from where birds were heard displaying (mostly out of view) on numerous occasions. However, this territory was located outside the 500 m buffer zone and is not included in the total of five breeding territories.

#### 4.2.2.3 Golden Plover

There were no registrations of golden plover within the site or in the surrounding 500 m buffer zone but five birds were recorded at Windrow Hill on the Hagshaw Wind Farm on 1st May which then headed towards the Douglas West site.

#### 4.2.2.4 Lapwing

Six to seven assumed lapwing territories occurred primarily in the north-western area of the site, two within the site and four to five in the surrounding 500 m buffer zone. The first two territories were located around a small pond in the north western section of the site adjacent to the tarmac road where up to four birds were recorded on several occasions, including four displaying birds on 17th April and four, one of which was displaying, on 20th April. Four birds were also present on 8th May with two on 12th May. An adult and two chicks were recorded on 15th June with the two chicks being almost adult-sized by 25th June. It is likely that the second pair failed.

Two territories occurred at a pair of former opencast coal mine lagoons which overlap the western 500 m buffer zone where two birds were displaying on 6th April. Four birds, one of which displaying, were present on 20th April, one was displaying on 8th May and one was recorded in flight on 15th June.

One to two further territories occurred at a large pond that overlapped the north-western 500 m buffer zone. Five birds were present there on 6th April. According to the Brown and Shepherd (1993<sup>vii</sup>) moorland bird survey methodology this counts as two pairs; however, the lowland methodology of O'Brien & Smith (1992<sup>viii</sup>) would discard this record as being outside the survey window which starts in the lowlands in mid-April. Two birds were present on 20th April, one was displaying on 15th May, one was present on 8th June, and two on 27th June. One to two breeding territories were therefore assumed in this location.

A further territory was assumed around the north-eastern section of the site /north-eastern buffer where a bird was displaying on 8th May and a bird was heard calling on 19th June.

#### 4.2.2.5 Oystercatcher

Three assumed oystercatcher territories were recorded within the 500 m buffer zone at opposite extremities of the site: one was inside the fenced high voltage area near the Scottish Power compound at Douglas West. Birds arrived there early with a pair present on 28th February. Singles were then recorded on 6th, 7th April and 20th April and 8th May. A bird was sitting on three eggs on 13th May and a bird was alarm-calling at the nearby sheep pens on 13th June with an adult and a chick present on 29th June. Two territories were present on the large pond which straddles the north-western boundary. A single bird was present there on 20th April, with a pair there on 15th May, two pairs on 8th June and a pair and a single bird on 27th June.

#### 4.2.2.6 Redshank

Four redshank territories were assumed to be present in the site area, one within the site boundary and three in the north-western buffer zone. A territory was present at the small pond in the north-

western section of the site just west of the tarmac road where a pair were present on 17th April, singles on 20th April (singing) and 21st April. A pair was calling there on 8th May, while two birds in flight to the south and south-west on 15th May were thought to be associated with this territory. Two birds, one in song, were also present at this pond on 8th June.

A second territory occurred on the western boundary of the buffer zone where a pair was alarm-calling on 20th April, the only registration from this pond. There were two more territories at the large pond straddling the north-western boundary of the buffer zone. Three birds were there on 6th April, one was singing on 15th May and two birds, one in song, were present on 8th June.

#### 4.2.2.7 Ringed Plover

One assumed ringed plover territory occurred at the pair of ponds overlapping the western 500 m buffer zone where a pair of birds was recorded on 15th May and singles were present on 8th and 27th June. There were three (empty) nest scrapes on an island in the centre of one of the ponds, indicating that breeding took place there either in 2015 and/or previous years. A bird was also recorded at the large pond on the north-western boundary on 8th June with two to three birds there on 26th June, implying at least one territory there. A bird calling at the DP in the north-eastern corner of the site on 27th June is thought unlikely to be related to a territory-holding bird. Altogether two territories were therefore assumed.

#### 4.2.2.8 Snipe

Altogether 13 snipe territories were believed to have been present, seven within the site and six in the surrounding 500 m buffer zone. One territory occurred in the southern 500 m buffer zone to the south-west of the Scottish Power compound where birds were chirping on 7th and 8th April and a bird was heard calling on 13th May. A second territory appeared to straddle the boundary of the southern 500 m buffer with a bird drumming at Rob's Hill south of the 500 m buffer zone shortly after sunrise on 1st May and a bird calling on the very edge of the buffer on 13th May. Three territories occurred along the Hagshaw Wind Farm access track (one within the site boundary), with multiple registrations of chipping birds there in April, mid-May and late June. One to two birds were also heard chipping in these areas on several occasions from the VP watches at nearby Arkney Hill.

Another territory occurred near the black grouse plantation strip along the south-western boundary of the site where a bird was chipping on 8th May and two birds were calling on 13th May.

Two territories appeared to be located along and to the south of the tarmac road in the centre of the site with registrations of chipping and calling birds on several dates. A further territory straddled the tarmac road to the south of the DP around the location of the proposed wood drying facility with birds recorded calling and chipping there on 20th April, 15th May and 29th June.

Although no registrations were made during the MBS visits, a bird was repeatedly heard chipping and occasionally drumming just south of Wallace's Cave during VP watches and a territory was strongly presumed there.

Two territories occurred either side of the tarmac road in the north-western section of the site with birds chipping to the west of the road on 6th and 17th April and drumming to the east after sunset on 17th April and chipping nearby on 29th June.

Finally, a territory occurred just outside the westernmost corner of the site where a bird was flushed on 8th June and a bird was drumming further east on 29th June.

### 4.2.3 *Scarce Breeding Birds*

#### 4.2.3.1 *Raptors*

Scarce breeding bird surveys were conducted during the 2015 (April to July) breeding season. No breeding evidence of any target raptor species was observed, however four Schedule 1 raptor species (hen harrier, goshawk, merlin and peregrine) were recorded in flight within the 2 km survey buffer. Full details of the scarce breeding bird surveys are provided within Annexes C and Confidential Annex D, and survey methodology is provided within Annex B.

#### 4.2.3.2 *Barn Owl*

Barn owl surveys were carried out from January to September 2015. No barn owl signs were recorded within the site, however barn owl/signs were found at 3 locations within the wider 1.5 km buffer (**Confidential Figure C8.3**). Full details of the barn owl surveys are provided within Annexes C and Confidential Annex D, and survey methodology is provided within Annex B.

#### 4.2.4 *Black Grouse*

Surveys to identify areas of black grouse activity, locate lek locations and establish lek size were conducted in the 2015 breeding season during mid-March and May. A single lekking male was recorded in the Blackwood Hill area of the Hagshaw Hill Wind Farm within 500 m of the site, but over 1 km from the closest infrastructure (**Confidential Figure C8.1**). A female black grouse was flushed during a breeding bird survey visit in May in the northern section of the site. No other black grouse sightings were made during either the targeted black grouse surveys or any other surveys. Full details of the black grouse surveys are provided within Annexes C and Confidential Annex D and survey methodology is provided within Annex B.

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<sup>i</sup> Scottish Natural Heritage (2014) Recommended Bird Survey Methods to inform impact assessment of Onshore Windfarms.

<sup>ii</sup> EC Directive 79/409 on the Conservation of Wild Birds. Special Protection Area (SPA) citation: Muirkirk and North Lowther Uplands, Strathclyde and Ayrshire / Dumfries and Galloway, UK9003261.

<sup>iii</sup> Site of Special Scientific Interest (SSSI) citation: Muirkirk Uplands, East Ayrshire / South Lanarkshire, Site Code 8166.

<sup>iv</sup> Site of Special Scientific Interest (SSSI) citation: North Lowther Uplands, Dumfries and Galloway / South Lanarkshire, Site Code 8161.

<sup>v</sup> [http://www.snh.org.uk/pdfs/publications/nnr/The\\_Reserve\\_Story\\_for\\_Clyde\\_Valley\\_Woodlands\\_NNR.pdf](http://www.snh.org.uk/pdfs/publications/nnr/The_Reserve_Story_for_Clyde_Valley_Woodlands_NNR.pdf)

<sup>vi</sup> Zisman, S., Pendlebury, C., Turner, L. & Austin, M. (2009) East Ayrshire Black Grouse Lek Distribution 2007: An Analysis of Current Status and Trends. Scottish Natural Heritage Commissioned Report No. 289.

<sup>vii</sup> Brown, A.F. & Shepherd, K.B. (1993) A Method for Censusing Upland Breeding Waders. *Bird Study*, 40(3): 189-195.

<sup>viii</sup> O'Brien, M. & Smith, K.W. (1992) Changes in the status of waders breeding on wet lowland grassland in England and Wales between 1982 and 1989. *Bird Study*, 39: 165-176.