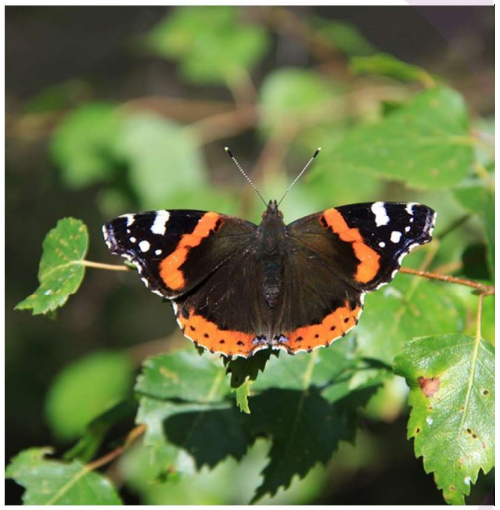
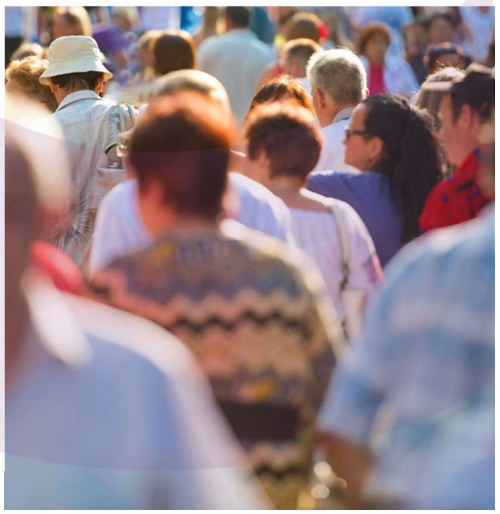
E.ON Climate & Renewables

Lorg Wind Farm

Baseline Ornithology Report - Breeding Season 2019





Wood Environment & Infrastructure Solutions UK Limited – December 2019

Report for

Hayley Meadley
Development Manager
E.ON Climate & Renewables
Westwood Way
Westwood Business Park
Coventry
CY4 8LG

Main contributors

Duncan Priddle

Issued by

.....

Gareth Hughes

Approved by

.....

Pete Clark

Wood

Partnership House
Regent Farm Road
Gosforth
Newcastle upon Tyne NE3 3AF
United Kingdom
Tel +44 (0) 191 272 6100

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Document revisions

No.	Details	Date
01	First draft for client review	10/12/2019
02	Final	22/12/2019

Executive summary

Purpose of this report

- This report documents the methods and results of the breeding bird surveys undertaken between March and August 2019 at the site of the proposed Lorg Wind Farm in Dumfries and Galloway;
- The Site is located 13 kilometres to the north-west of Moniaive, straddling Dumfries and Galloway and East Ayrshire and is bisected by the Water of Ken. The Site forms a small river valley surrounded by steep hills dominated by white moor managed for upland sheep and cattle grazing and is bordered by similar habitats to those found on Site as well as several commercial forestry plantations;
- A single internationally designated site for birds is located within 20km of the Site. The Muirkirk and North Lowther Uplands Special Protection Area (SPA), approximately 13km to the north-east is designated for breeding hen harrier, short-eared owl, golden plover, merlin and peregrine; and overwintering hen harrier. Hen harrier, golden plover, merlin and peregrine have been recorded on the Site;
- Survey work during the 2019 breeding season comprised of vantage point (VP) surveys, at four VP locations with 42 hours' observation per VP; two black grouse surveys of the Site plus 1.5km buffer; six raptor surveys of the Site plus 2km buffer; and four moorland bird surveys (MBS) of the Site plus 500m buffer.
- During the VP surveys a total of 38 flights of four target species were recorded (greylag goose, red kite, merlin and peregrine), of which 31 flights were recorded at 15-180m height, comprising:
  - Greylag goose (one flight, totalling 114 seconds);
  - Red kite (22 flights, totalling 3,285 seconds);
  - Merlin (one flight, totalling five seconds); and
  - Peregrine (three flights, totalling 155 seconds).
- There were no black grouse records from the black grouse surveys, nor during other survey work;
- A single Schedule 1 listed raptor species was confirmed to breed within the raptor survey area: peregrine;
- During moorland bird surveys (MBS), four target species were recorded: oystercatcher, curlew, snipe and common sandpiper. Using data from both these surveys and incidental records, it is concluded that three pairs of curlew, three pairs of snipe and two pairs of common sandpiper bred within the MBS area; and
- In addition, there were incidental records of seven target species: greylag goose (one record of 23 birds), pink-footed goose (four records, totalling 481 birds), goshawk (one record), red kite (12 records, totalling 13 birds), golden plover (one record of ten birds), merlin (one record) and peregrine (five records).

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1. Introduction

1.1 About this Document

Wood E&IS UK (Wood) was commissioned by E.ON Climate & Renewables (EC&R) to undertake bird surveys during the 2019 breeding season (March to August inclusive) for a proposed wind farm development at Lorg, Dumfries and Galloway, hereafter referred to as 'the Site'. This report describes the methods and results of the surveys, which were designed to be suitable to update the baseline breeding and wintering bird information for the Site. This work supplements breeding bird surveys that were undertaken at the Site by Natural Power in 2012; AMEC in 2013 and 2014; and Wood in 2018. Non-breeding bird surveys were also carried out at the Site during the 2010/11, 2012/13 and 2013/14 seasons by AMEC; and by Wood during 2018/19.

1.2 Site Description

The Site is located around Lorg Farmhouse within Dumfries and Galloway and is located approximately 12 kilometres north east of Carsphairn and 13 kilometres south of New Cumnock. A small part of the site extends into East Ayrshire. The Site and survey areas are illustrated in **Figure 1.1**. The Site is bisected by the Water of Ken with steep grass-dominated hillsides on either side of the river. Lorg Farmhouse and associated outbuildings are located in the centre of the Site in the valley bottom. The area around this unoccupied dwelling is surrounded by in-bye pasture and a small area of deciduous scrub. The Site is surrounded on three sides by commercial forestry plantations and open grassland areas similar to those on Site are present to the west. Afton Reservoir is located approximately 1.5km to the north-west.

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 sites or feeding areas 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 small proportion of a site. Therefore, the permanent loss of nesting and foraging habitat for birds tends to be 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.

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 the Site:

- Scottish Natural Heritage [SNH] (2017). *Recommended bird survey methods to inform impact assessment of onshore wind farms.* SNH, Battleby; and

- SNH (2018). *Assessing significance of impacts from onshore wind farms on birds outwith designated areas*. SNH, Battleby.

SNH (2017) guidance recommends that field surveys should be focussed on 'target species' which will generally be limited to those which are afforded a higher level of legislative protection; though some species may also be considered as such, as a result of their behaviour, which makes them more likely to be subject to impact from wind farms. There are three overarching species lists from which target species are generally derived[1]:

- Species for which Special Protection Areas (SPA) are designated and those listed under Annex I of 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); and
- Red listed birds of conservation concern (BoCC) (with reference to Eaton *et al*., 2015).

In addition, consideration should be given to species identified within Local Biodiversity Action Plans (LBAP), though target species should be limited to those likely to be affected by wind farms. As research indicates that most passerine species are not significantly affected by wind farms, many species included on the LBAPs and BoCC are not included as target species. Two LBAPs are considered when selecting target species, Dumfries and Galloway and Ayrshire as the Site straddles both.

Target species were selected following a data and literature review, and with regard to the results of previous survey work undertaken at the Site.

For the purposes of this report, nomenclature follows that of the International Ornithological Congress (IOC 2018). Scientific names for all species mentioned in the text and tables are included in **Appendix C**.

1.4 Desk Study

Full details of the updated desk study undertaken in autumn 2019 can be found in the Lorg Wind Farm Baseline Ornithology Report – Non-breeding Season 2018/19 and supporting Confidential Appendix (Wood, 2019[2]).

The data search was updated between January and March 2019, with records obtained from the RSPB and South Strathclyde and Dumfries and Galloway Raptor Study Groups. All records are detailed within the **Confidential Appendix** and are illustrated in the associated figures.

1.5 Target Species

The following key species of conservation concern (i.e. 'target species') were identified:

- Relevant SPA qualifying interests: hen harrier, golden plover, short-eared owl, merlin and peregrine;
- Annex I and/or Schedule 1 listed species, including those known to be present in the surrounding area: osprey, goshawk, red kite, dotterel, dunlin and barn owl;

[1] It may also be appropriate to collect information on non-target species during surveys and desk studies, particularly those of regional conservation concern. However, recording of such species is subsidiary to the recording of target species.
[2] Wood. 2019. E.ON Climate & Renewables Lorg Wind Farm Baseline Ornithology Report – Non-breeding Season 2018/19. Doc Ref. 32964-WOOD-XX-XX-RP-OE-0001_A_P01.1.

- Waterfowl and Annex I waders on late autumn and early spring passage, including pink-footed goose, whooper swan, other goose and swan species, but excluding feral and introduced breeding species (e.g. Canada goose); and
- Other species of conservation concern such as: black grouse and long-eared owl.

Additionally, the following secondary species were identified as potentially occurring: sparrowhawk, buzzard, oystercatcher, lapwing, curlew, snipe, common sandpiper, kestrel and raven.

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604000 603000 602000 601000 600000 599000 598000

Key

Site boundary

0 500 1,000 1,500 m

Scale at A3: 1:25,000

Client

Lorg Wind Farm
Baseline Ornithology Report
Breeding Season 2019

Figure 1.1
The Site

November 2019

wood.

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2. Survey Methods

2.1 Surveyors

All surveys were undertaken by experienced Wood Ornithologists, all of whom have extensive field experience and a detailed understanding of the key methodologies recommended within SNH guidance and experience of monitoring bird activity and distribution at proposed wind farm sites. Surveys were undertaken by Damian Bubb, Pete Clark ACIEEM, Euan Ferguson, Paul Massey MCIEEM, Duncan Priddle MCIEEM, Neil Rowntree, Paul Rowntree MCIEEM and James Spencer ACIEEM.

2.2 Vantage Point (VP) Surveys

Vantage-point (VP) watches were conducted in accordance with SNH (2017) guidance and undertaken between April and August 2019 inclusive. 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 guidance is that VPs 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. Four vantage points were selected (VP locations and view-sheds are shown in **Figure 2.1**) as being enough to survey the turbine layout, the locations of which were:

- VP6 – NS 63310 02387, view bearing 135°;
- VP7 – NS 65429 01955, view bearing 230°;
- VP8 – NS 65591 02003, view bearing 50°; and
- VP9 – NX 67651 99278 – view bearing 65°.

The viewshed analysis in **Figure 2.1** shows the area visible at a height of 15m. Flights were classified using the following three height bands:

- Band 1: <15m;
- Band 2: 15-180m; and
- Band 3: >180m.

These differ from the bands used for the 2018 and 2018/19 vantage point surveys. This is to account for changes to the proposed turbine heights.

A total of 168 hours of VP observation was undertaken between April and August 2019: 42 hours from each VP (42 hours and five minutes was undertaken from VP8). The methodology to minimise observer disturbance was to allow ten minutes before starting each watch and to remain as inconspicuous as possible (a bivvy bag and camouflaged clothing was used). A 180° arc was scanned alternately by eye and with binoculars until a target species was detected. Flight times of a target species were then recorded with a stopwatch with an audible timer (times were synchronised with the other surveyor when undertaking simultaneous watches from both VPs). Vantage point surveys were spread across the full range of daylight hours targeting diurnal raptors such as hen harrier, merlin, peregrine and goshawk, as well as crepuscular species such as golden plover, short-eared owl and barn owl. Only flights within the 2km view-shed were recorded, with all other target species flights out-with this zone noted as incidental records.

SNH (2017) guidance advises that VP surveys should be undertaken in good visibility and can be carried out on showery days providing the showers are not too frequent or prolonged. The cloud base should be high enough to allow observation of the collision risk height. Ideally observations should be undertaken in a range of wind conditions. Watches should be aimed to target heightened activity periods for the target species likely to be present and the survey programme adhered to this, with surveys planned for periods of suitable weather. The dates, times and weather conditions of the VP watches are provided in **Appendix A, Table A.1**.

2.3 Distribution and Abundance Surveys

Distribution and abundance survey areas are illustrated in **Figure 2.2**.

Moorland Bird Survey (MBS)

The moorland bird assemblage was surveyed using an adapted version of the Brown and Shepherd (1993) methodology. SNH (2017) recommend four visits, each at least seven days apart, covering the whole breeding season, each completed between 08:30 and 18:00. Surveys covered the Site plus a 500m buffer where access was available between mid-April and early July.

Surveys were undertaken in wind speeds of Beaufort force 4 or less and dry weather. The method involved a search effort of approximately 20-25 minutes within each 500 x 500m quadrat of open land and 1 minute per hectare for enclosed fields. Habitats within the survey area were assessed for their suitability to host breeding waders and areas with unsuitable land use such as plantations or with extreme gradients were scoped out. All suitable parts of each quadrat were approached to within 100m. Survey routes were varied between visits. Stops were made at regular intervals to scan and listen for birds and the identities and activities of birds were recorded using standard British Trust for Ornithology (BTO) notation. The focus of the surveys was breeding waders, but all raptors, owls, waterbirds and grouse were also mapped.

Dates, times and weather conditions during the moorland bird surveys (MBS) visits are provided in **Appendix A, Table A.2**.

Raptor Survey

Raptor survey visits were undertaken in late March, April, May, June and July 2019 and followed guidance detailed within Hardey *et al*., (2013), focussing on those species identified in the desk-based review including through survey work undertaken previously.

On the basis of the habitats present within the survey area and previous survey it was considered that there was potential for seven species of Schedule 1/Annex I raptors/owls to breed within the Site and associated survey buffer zones (1km for goshawk and 2km for all other species): osprey, red kite, goshawk, barn owl, short-eared owl, peregrine and merlin. Surveys were therefore tailored to these species and were focussed on potentially suitable habitat within the survey area.

All surveys were undertaken under an appropriate Schedule 1 licence and required liaising with the local Raptor Study Group (RSG) throughout the breeding season.

Dates, times and weather conditions during the raptor surveys are provided in **Appendix A, Table A.3**.

Black Grouse Survey

Black grouse activity was recorded within the survey area during the surveys conducted by Natural Power (2012) and Wood (2013 and 2014) following the methodology described in Gilbert *et al*., (1998). Surveys of the Site plus a 1.5km buffer (where access was available) were undertaken during the 2019 breeding season,

in line with SNH (2017) guidance. This specifies the need for two survey visits between late March and mid-May.

The surveys were undertaken as a fresh search, with each visit beginning an hour before sunrise and finishing two hours after sunrise. Surveyors aimed to get within 500m of all suitable habitat to detect lekking black grouse, primarily through listening for the distinctive sounds made by lekking males, but also through scanning from appropriate observation points to visually detect birds. Surveys avoided conditions of high winds and/or moderate to heavy precipitation.

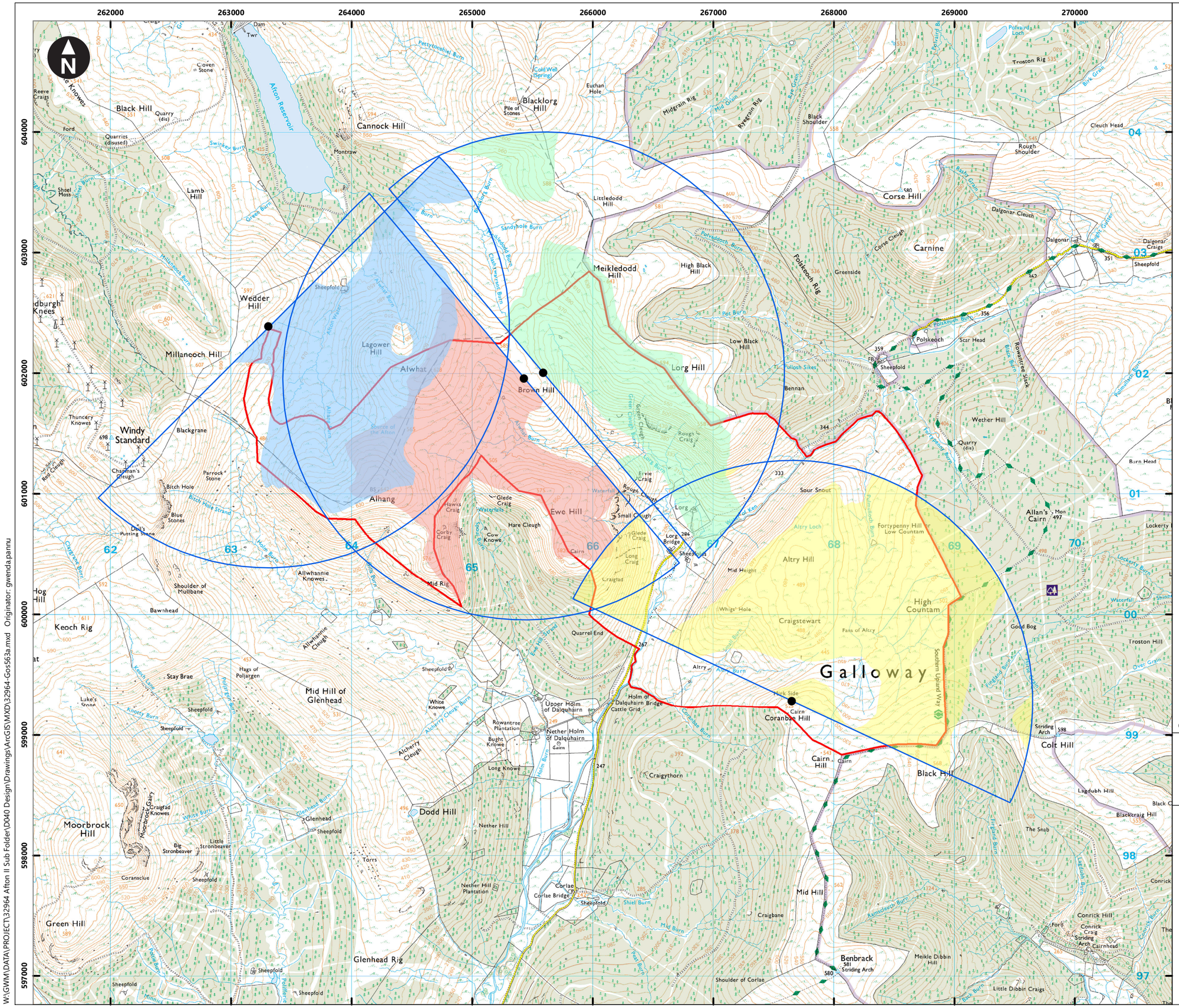
Dates, times and weather conditions during the black grouse surveys are provided in **Appendix A, Table A.4.**

2.4 Incidental Records

Birds seen outside of formal survey periods were also recorded (i.e. those observed during walks to and from VP locations, during other breaks in survey work and target species recorded during species-specific surveys). Detailed notes of activity of highly protected or 'target' species were made, and all flights mapped.

2.5 Limitations

It should be noted that access to land outwith the land ownership area was limited to land owned by Forestry Commission Scotland and Scottish Water (including Afton Wind Farm). Contextual data for land where access was unavailable was sought from the RSPB, for black grouse and other sensitive bird species, and the Raptor Study Groups of Dumfries and Galloway and South Strathclyde, for Schedule 1 raptor/owl data.



Key

- Site boundary
- 2km from vantage point
- Vantage point
- Vantage Point 6 Viewshed, viewpoint location NS 63310 02387
- Vantage Point 7 Viewshed, viewpoint location NS 65429 01955
- Vantage Point 8 Viewshed, viewpoint location NS 65591 02003
- Vantage Point 9 Viewshed, viewpoint location NX 67651 99278

0 500 1,000 1,500 m

Scale at A3: 1:30,000

Client

Lorg Wind Farm
Baseline Ornithology Report
Breeding Season 2019

Figure 2.1
Vantage Point Locations and Viewsheds

August 2022

wood.

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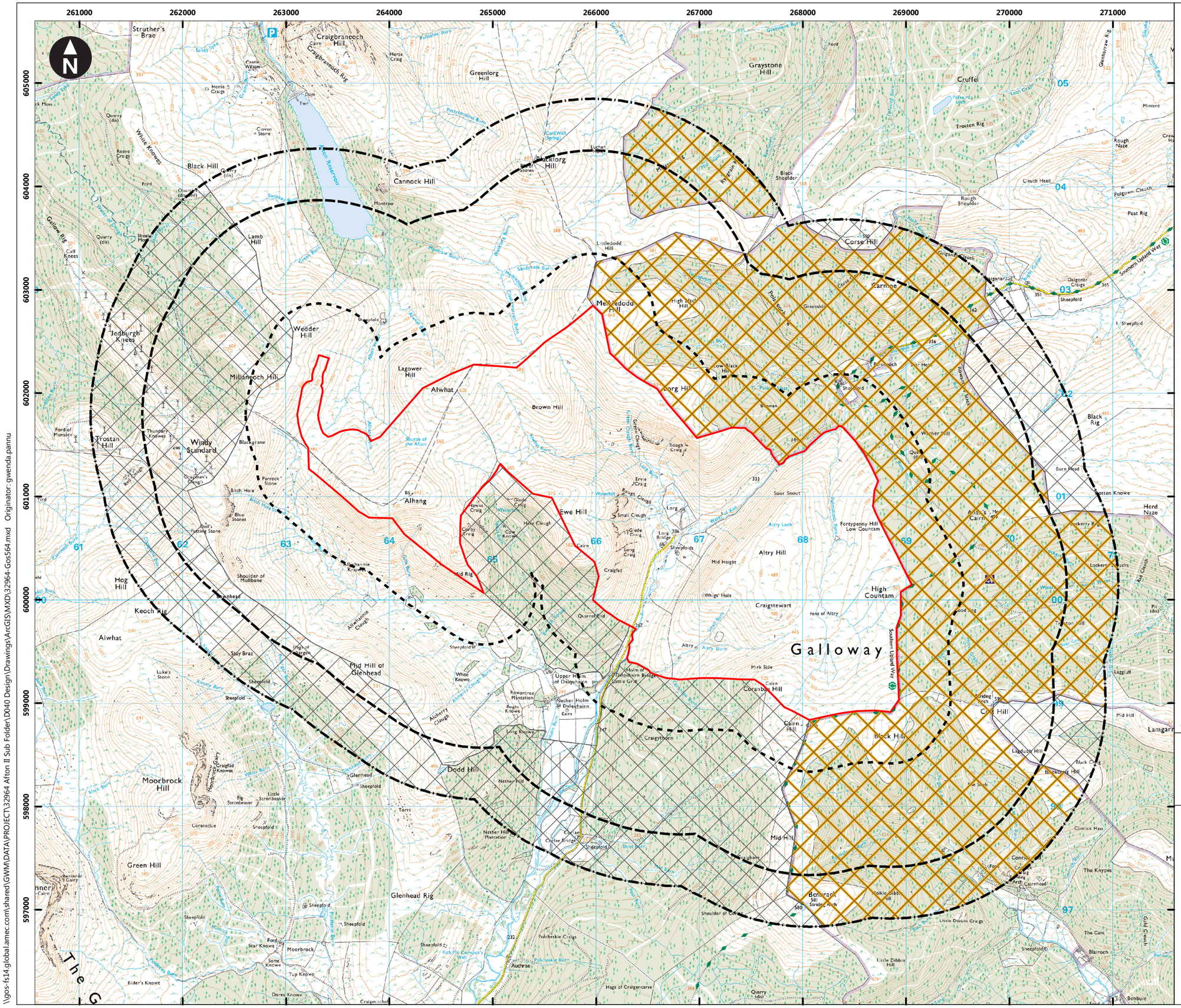

Client

Lorg Wind Farm
Baseline Ornithology Report
Breeding Season 2019

Figure 2.2
Distribution and Abundance Survey Areas

November 2019

wood.

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3. Survey Results

3.1 Vantage Point (VP) Surveys

The following target species were recorded during VP surveys; greylag goose, red kite, merlin and peregrine. Details of target species flights are provided in **Appendix B, Table B.1** and **Table 3.1** below presents a summary of flight activity, including reference to the duration of flight time between 15-180m height. The flight lines are illustrated in **Figure 3.1** (greylag goose and merlin). Red kite and peregrine activity is detailed and illustrated within the **Confidential Appendix.**

Table 3.1 Summary of Target Species Flight Activity

Species	No. of observations	Month(s) of observation	Total flight duration at 15-180m height (seconds)
Greylag goose	1	April 2019	114
Merlin	1	April 2019	5

Secondary Species

Buzzard were the second most commonly observed secondary species, recorded on 56% of VP watches. Curlew was the most commonly recorded wader, with records from 12 VP watches (19%). There were three records of snipe and two of common sandpiper. There was a record of a gull assemblage of 400 mixed lesser black-backed and herring gulls from VP6 on 28 June 2019. Kestrel were recorded on two VP watches. Raven were the most regularly recorded secondary species during the VP watches, with birds recorded on 55 of 64 watches (86%). Both individuals and family parties were observed, with small flocks developing as the season progressed. There was a notable count of up to 53 birds foraging on Meikledodd Hill in late July 2019.

3.2 Distribution and Abundance Surveys

Moorland Bird Survey (MBS)

Three species of wader were recorded during the MBS: curlew, snipe and common sandpiper. The results of the MBS, incidental wader records and resultant wader territory maps are illustrated in **Figures 3.2a-c.**

Although there were two incidental records of oystercatcher during the breeding season, the species was not recorded during any of the moorland bird surveys (MBS) and it is unlikely that this species bred within the survey area. There were three records of curlew, all of which were from the first visit on 17 April 2019. As a result of observations from the MBS only, no breeding curlew territories could be confirmed through territory mapping. However, in combination with 'incidental' records, it is possible to conclude that three pairs held territories. There were seven observations of snipe across the four MBS visits. In addition, there were a further ten incidental records of this species. In conclusion, it is estimated that there were three snipe territories within the MBS area. Common sandpiper was recorded during three MBS visits, with five records from other surveys. Two territories of common sandpiper can be identified using a combination of MBS and incidental records.

Secondary Species

Buzzard and raven were recorded on all MBS visits.

Raptor Survey

Three Annex I / Schedule 1 species were recorded during the raptor surveys: red kite, goshawk and peregrine. Full details of all species are provided within the **Confidential Appendix**.

Secondary Species

Secondary raptor/owl species recorded comprised: buzzard, sparrowhawk and kestrel. Raven was also recorded during the raptor surveys. No secondary raptor/owl species or raven nest sites were found within the raptor survey area.

Between five and six buzzard territories were recorded within the raptor survey area at: Polskeoch Rig, Carnine, Wether Hill, Quarrel Hill, and around the Spout and Millaneoch Burns. There were two records of sparrowhawk during the raptor surveys: on 28 March 2019 a pair were seen in-flight over Allan's Cairn; and a male was recorded flying down Spout Burn on 02 May 2019. Both areas held breeding attempts in 2018 but no evidence of breeding was found in 2019. Kestrel probably bred in the Spout Burn area as pair of birds were heard alarm calling there on 05 July 2019. Raven probably bred in the Spout Burn area, given the level of activity recorded there, but there was no conclusive proof found during the raptor surveys (e.g. a nest or concentration of sign).

Black Grouse Survey

No black grouse were recorded during the black grouse surveys and there were no other records of this species during the breeding season.

Secondary Species

Buzzard was recorded on a single occasion. There was a single record of oystercatcher, two records of curlew and common sandpiper, and three records of snipe. Raven was the most regularly recorded secondary species and was observed on five transects.

3.3 Incidental Records

There were 25 incidental records of seven target species: greylag goose (one record of 23 birds), pink-footed goose (four records, totalling 481 birds), goshawk (one record), red kite (12 records, totalling 13 birds) golden plover (one record of ten birds), merlin (one record) and peregrine (five records). All 'incidental' records (except for goshawk, red kite and peregrine) are presented in **Appendix B, Table B.2** and illustrated in **Figure 3.3**. Confidential incidental records are presented within the **Confidential Appendix**.

There was one incidental record of greylag geese on 28 March 2019, when a flock of 23 birds flew west towards High Countam during a black grouse survey. Three incidental records of pink-footed geese, occurred on the same date on 28 March 2019, reflecting a movement north of the species. Skeins of 130 and 200 were recorded flying high above the Water of Ken valley as well as at least one bird heard calling in-flight above Black Hill. Another skein of 150 birds was recorded in-flight during a raptor survey on 30 March 2019.

There was also an incidental record of ten golden plover in-flight near Meikledodd Hill from a raptor survey on 28 March 2019.

There was also a single incidental record of merlin. A male was seen in-flight to the east of Lagower Hill during a black grouse survey on 28 March 2019.

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32964_VP_030
32964_VP_029_a
32964_VP_029_b

Key

- Site boundary
- Greylag goose flightline
- Merlin flightline
- Flight at collision risk
- Flight above or below collision risk

0 500 1,000 1,500 m

Scale at A3: 1:25,000

Client

Lorg Wind Farm
Baseline Ornithology Report
Breeding Season 2019

Figure 3.1
Vantage Point Survey Results: Greylag Goose and Merlin

November 2019

wood.

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Key

Site boundary

Moorland bird survey area

CU - Curlew

CU Visit 1

CU Visit 2

CU Visit 3

CU Visit 4

CU Incidental record

Flight direction

CU Calling

CU Alarm calling

CU Singing bird

CU — CU Same individuals

CU - - - CU Different birds

—?— Unknown if same

CU CU Territory

CU CU Agressive encounter

0 500 1,000 1,500 m

Scale at A3: 1:25,000

Client

Lorg Wind Farm
Baseline Ornithology Report
Breeding Season 2019

Figure 3.2a
Curlew Territory Map

November 2019

wood.

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604000 603000 602000 601000 600000 599000 598000

Key

Site boundary

Moorland bird survey area

SN - Snipe

SN Visit 1

SN Visit 2

SN Visit 3

SN Visit 4

SN Incidental record

Flight direction

SN Calling

SN Alarm calling

(SN) Singing bird

SN—SN Same individuals

SN- - -SN Different birds

—?— Unknown if same

SN SN Territory

SN SN Agressive encounter

0 500 1,000 1,500 m

Scale at A3: 1:25,000

Client

Lorg Wind Farm
Baseline Ornithology Report
Breeding Season 2019

Figure 3.2b
Snipe Territory Map

November 2019

wood.

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604000 603000 602000 601000 600000 599000 598000

Key

Site boundary

Moorland bird survey area

CS - Common Sandpiper

CS Visit 1

CS Visit 2

CS Visit 3

CS Visit 4

CS Incidental record

Flight direction

CS Calling

CS Alarm calling

(CS) Singing bird

CS — CS Same individuals

CS - - - CS Different birds

—?— Unknown if same

CS CS Territory

CS CS Agressive encounter

0 500 1,000 1,500 m

Scale at A3: 1:25,000

Client

Lorg Wind Farm
Baseline Ornithology Report
Breeding Season 2019

Figure 3.2c
Common Sandpiper Territory Map

November 2019

wood.

32964-Gos568

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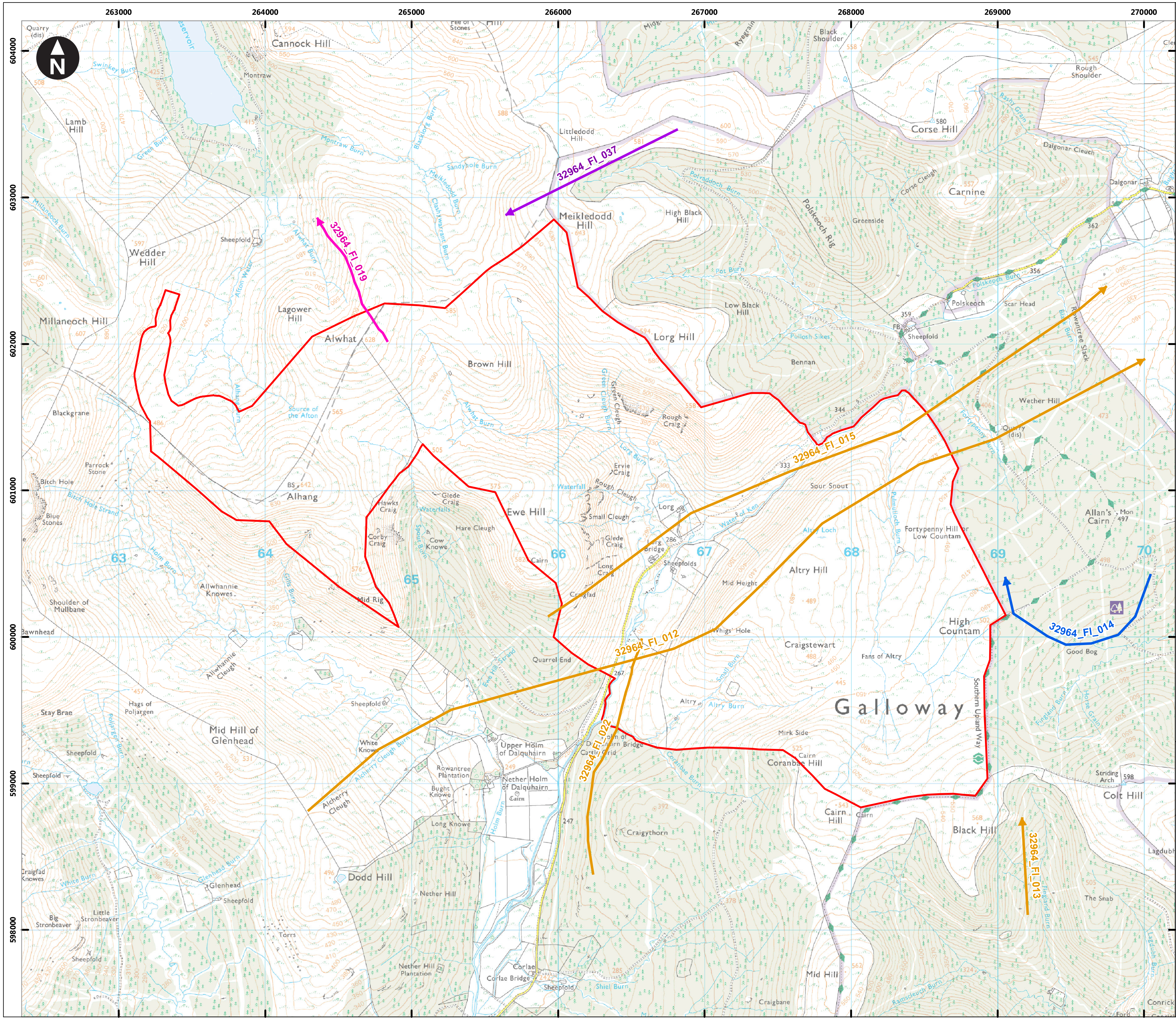

Client

Lorg Wind Farm
Baseline Ornithology Report
Breeding Season 2019

Figure 3.3
Incidental Records

November 2019

wood.

32964-Gos569

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4. Key Species Summary

A summary of target species activity and a review of their status is presented herein.

Pink-footed Goose

Pink-footed goose is BoCC amber-listed based upon its non-breeding localisation in the UK (Eaton *et al.* 2015). The current UK wintering population is estimated at 481,341 birds (Mitchell & Brides., 2017). The Western Southern Uplands and Inner Solway Natural Heritage Zone (NHZ) population is estimated at 34,621 wintering birds (Wilson *et al.,* 2015). Pink-footed goose is a casual breeder in the UK with most pairs referring to injured or escaped birds. No pairs were recorded to have bred in the UK in 2015 (Holling *et al*., 2017).

There were no records of pink-footed goose during the VP watches. There were four incidental records, all confined to the period of 28-30 March 2019 inclusive. On 28 March 2019, two skeins of 130 and 200 individuals were recorded flying northeast over the Site, with another record of pink-footed goose that was heard only. On 30 March 2019, another skein of 150 birds was recorded in-flight over the Site.

Greylag Goose

Greylag goose is BoCC amber-listed based upon its non-breeding localisation in the UK (Eaton *et al*., 2015). The current UK wintering population is estimated at 139,387 birds (Frost *et al*., 2018) with 2,959 the peak count in Dumfries and Galloway. Greylag goose is a widespread naturalised breeding bird in the UK with a population of 46,000 breeding pairs (Musgrove *et al*., 2013).

There was a single greylag goose flight of two birds in early April 2019, with 114 seconds of flight time recorded at 15-180m height. There was a single incidental record of a flock of 23 birds flying west over High Countam during a black grouse survey on 28 March 2019.

Goshawk

Goshawk is Schedule 1 and BoCC green-listed species being in a favourable conservation status. The UK population is estimated to be 542 pairs (Holling *et al*., 2017). The Scottish population is estimated to be 135 pairs. During the 2018 breeding season, of 22 pairs monitored, 33 young were fledged in Dumfries and Galloway (Challis *et al*., 2019).

Full details of goshawk activity can be found within the **Confidential Appendix**.

Red Kite

Red kite is an Annex I and Schedule 1 listed species and is also on the Scottish Biodiversity List (SBL). It is BoCC green-listed being in a favourable conservation status. The Scottish population was estimated at a minimum of 273 pairs in 2016 (Challis et al., 2019). The Western Southern Uplands and Inner Solway NHZ population was estimated at 83 pairs in 2013 (Wilson et al., 2015). In Dumfries and Galloway in 2018, 123 of 139 checked home ranges were occupied by pairs of which 92 pairs monitored fledged a minimum of 101 young (Challis et al., 2019).

Full details of red kite activity can be found within the **Confidential Appendix**.

Golden Plover

Golden plover is listed on the Muirkirk and North Lowther Uplands SPA citation and it is an Annex 1 and SBL listed species. The British breeding population is estimated at 38,000-59,000 pairs (Musgrove *et al.,* 2013) and the Scottish breeding population is estimated at around 15,000 pairs (Forrester *et al.,* 2007). The Western Southern Uplands and Inner Solway NHZ population is estimated at 778 pairs (Wilson *et al*., 2015).

There were no records of golden plover during the VP watches and the species wasn't recorded during the MBS. There was a single incidental record of this species; a flock of ten birds were flushed from the eastern side of Meikledodd Hill on 28 March 2019.

Snipe

Snipe is BoCC amber-listed based on the species' breeding range decline (Eaton *et al*., 2015), although this is mainly limited to lowland areas (Balmer *et al*., 2013). The current UK population is estimated at 80,000 breeding pairs (Musgrove *et al*., 2013). The Western Southern Uplands and Inner Solway NHZ population is estimated at 1,252 breeding pairs and the total Scottish population is estimated at 34,594 breeding pairs (Wilson *et al*., 2015).

Three pairs of snipe held territory within the Site Boundary.

Curlew

Curlew is BoCC red-listed based on the species' long-term population decline (Eaton *et al*., 2015). This species is also on the SBL. The current UK population is estimated at 68,000 breeding pairs (Musgrove *et al*., 2013). The Western Southern Uplands and Inner Solway NHZ population is estimated at 4,284 breeding pairs and the total Scottish population is estimated at 30,194 breeding pairs (Wilson *et al*., 2015).

Three pairs of curlew held territory within the Site Boundary, although it is likely that all breeding attempts failed.

Common Sandpiper

Common sandpiper is BoCC amber-listed based on the species' moderate breeding population decline (Eaton *et al*., 2015). The UK population is estimated to be 15,000 pairs (Musgrove *et al*., 2013).

A single pair of common sandpiper held territory within the Site Boundary, with a second pair within the 500m buffer. At least one pair was successful in fledging chicks.

Merlin

Merlin is listed on the Muirkirk and North Lowther Uplands SPA citation, and is an Annex I, Schedule 1 and SBL listed species. It is BoCC red-listed due to historical declines in the breeding population. The British population was estimated at 1,160 pairs in 2015 (Holling et al., 2017). The Scottish population was estimated at 708 pairs in 2008 (Ewing *et al.,* 2011). The Western Southern Uplands and Inner Solway NHZ population is estimated at 12 breeding pairs (Wilson *et al.,* 2015). In 2018 in Dumfries and Galloway, from 11 home ranges, eight were occupied by pairs, fledging a minimum of one chick (Challis *et al*., 2019).

There was a single merlin flight recorded during the VP watches. A female was recorded on 18 April 2019 and spent five seconds of flight time at 15-180m height. There was a single incidental record of a male merlin seen flying over Lagower Hill on 28 March 2019.

Peregrine

Peregrine is listed on the Muirkirk and North Lowther Uplands SPA citation, with a population of nine breeding pairs. The species is listed on Annex I, Schedule 1 and SBL. There were an estimated 1,701 breeding pairs in the UK in 2015 (Holling *et al*. 2017). During 2018, of 112 home ranges checked, 62 were occupied by pairs, producing a minimum number of 85 young. (Challis et al., 2019). The Western Southern Uplands and Inner Solway NHZ population is estimated at 34 breeding pairs (Wilson *et al.,* 2015) and the total Scottish population is estimated at 523 breeding pairs (Wilson *et al*. 2018 The UK population of peregrine continues to increase, probably because of reduced persecution, abundant prey and increased tolerance of humans (Balmer *et al.,* 2013).

Full details of peregrine activity can be found within the **Confidential Appendix**.

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Appendix A
Survey Conditions

Table A.1 Dates, Times and Weather Conditions during VP Watches

Date	Start	Finish	Length of VP watch (hrs)	Weather conditions (wind using Beaufort scale)
VP6				
04/04/19	14:20	17:20	3:00	Dry, Wind F4-6 SE, Cloud cover 4-6/8, Visibility >3km, Temp 1-3c.
18/04/19	05:45	08:45	3:00	Dry, Wind F4 SSW, Cloud cover 2-1/8, Visibility >3km, Temp 6-7c.
18/04/19	09:15	12:15	3:00	Dry, Wind F4-5 SSW, Cloud cover 1-8/8, Visibility >3km, Temp 7-10c.
01/05/19	14:30	17:30	3:00	Light showers, Wind F3 Variable, Cloud cover 7-8/8, Visibility 1-3km to >3km, Temp 6-7c.
01/05/19	18:00	19:30	1:30	Dry, Wind F3 NW, Cloud cover 4-7/8, Visibility >3km, Temp 6-7c.
13/05/19	13:00	16:00	3:00	Dry, Wind F3-4 SW, Cloud cover 2-6/8, Visibility >3km, Temp 11-12c.
13/05/19	16:30	18:00	1:30	Dry, Wind F3-4 SW, Cloud cover 3-5/8, Visibility >3km, Temp 10-11c.
12/06/19	06:30	09:30	3:00	Dry, Wind F5 NE, Cloud cover 8/8, Visibility >3km, Temp 4-5c.
12/06/19	10:00	11:30	1:30	Dry, Wind F5 NE, Cloud cover 8/8, Visibility >3km, Temp 5-6c.
28/06/19	06:05	09:05	3:00	Dry, Wind F4-5 SE, Cloud cover 0/8, Visibility >3km, Temp 10-15c.
28/06/19	09:35	11:05	1:30	Dry, Wind F5 SE, Cloud cover 0/8, Visibility >3km, Temp 15-16c.
29/07/19	18:35	21:35	3:00	Dry, Wind F3 S, Cloud cover 1-3/8, Visibility >3km, Temp 12-14c.
30/07/19	15:00	18:00	3:00	Dry, Wind F4 NE, Cloud cover 6-8/8, Visibility >3km, Temp 14-15c.
31/07/19	10:15	13:15	3:00	Showers, Wind F3-4 Variable, Cloud cover 7-8/8, Visibility >3km, Temp 12-13c.
01/08/19	10:00	13:00	3:00	Dry, Wind F1-2 Variable, Cloud cover 4-8/8, Visibility >3km, Temp 12-15c.
01/08/19	13:30	16:30	3:00	Light showers, Wind F1-3 Variable, Cloud cover 6-8/8, Visibility >3km, Temp 15c.
Total			**42 hrs**	
VP7				
09/04/19	10:45	13:45	3:00	Dry, Wind F3-4 E, Cloud cover 1-2/8, Visibility >3km, Temp 4-6c.
11/04/19	13:30	16:30	3:00	Dry, Wind F2-4 S, Cloud cover 5-6/8, Visibility >3km, Temp 3-4c.
18/04/19	06:40	09:40	3:00	Dry, Wind F4 SE, Cloud cover 2-3/8, Visibility >3km, Temp 4-6c.
09/05/19	12:15	15:15	3:00	Light showers, Wind F4 NE, Cloud cover 7-8/8, Visibility >3km, Temp 3-2c.
15/05/19	05:15	08:15	3:00	Dry, Wind F1-2 NE, Cloud cover 1/8, Visibility >3km, Temp 5-7c.
15/05/19	08:45	11:45	3:00	Dry, Wind F1-2 NE, Cloud cover 1/8, Visibility >3km, Temp 7-15c.

Date	Start	Finish	Length of VP watch (hrs)	Weather conditions (wind using Beaufort scale)
10/06/19	14:15	16:15	2:00	Dry, Wind F4 NW, Cloud cover 4-6/8, Visibility >3km, Temp 9-10c.
18/06/19	15:15	18:15	3:00	Dry, Wind F3-4 SW, Cloud cover 5/8 - 7/8, Visibility >3km, Temp 12-14c
20/06/19	07:02	10:02	3:00	Dry, Wind F4-6 W, Cloud cover 6/8 - 8/8, Visibility 1-3km, Temp 5-6c
20/06/19	10:30	11:30	1:00	Dry, Wind F3-4 W, Cloud cover 6-7/8, Visibility >3km, Temp 5c.
23/07/19	18:00	21:00	3:00	Dry, Wind F3-4 S, Cloud cover 1-7/8, Visibility >3km, Temp 14-15c.
23/07/19	14:30	17:30	3:00	Dry, Wind F4 SE, Cloud cover 4-8/8, Visibility 1-3km to >3km, Temp 15-17c.
24/07/19	17:30	20:30	3:00	Dry, Wind F4 SE, Cloud cover 3-4/8, Visibility >3km, Temp 15-18c.
30/07/19	15:15	17:15	2:00	Dry, Wind F3 ESE, Cloud cover 7-8/8, Visibility >3km, Temp 16c.
13/08/19	06:05	09:05	3:00	Dry, Wind F3-4 NW, Cloud cover 4-5/8, Visibility >3km, Temp 9-11c.
13/08/19	09:35	10:35	1:00	Light showers, Wind F4 NW, Cloud cover 6-7/8, Visibility >3km, Temp 11-12c.
Total			**42 hrs**	
VP8				
09/04/19	14:15	17:15	3:00	Dry, Wind F4-5 E, Cloud cover 1-3/8, Visibility >3km, Temp 4-5c.
11/04/19	10:00	13:00	3:00	Dry, Wind F3-4 Variable, Cloud cover 3-5/8, Visibility >3km, Temp 2-3c.
18/04/19	10:10	13:10	3:00	Dry, Wind F4 SE, Cloud cover 4-6/8, Visibility >3km, Temp 7-10c.
09/05/19	15:45	17:45	2:00	Dry, Wind F4-3 NE, Cloud cover 7-6/8, Visibility >3km, Temp 3c.
09/05/19	12:20	15:20	3:00	Light showers, Wind F4 NE, Cloud cover 8/8, Visibility >3km, Temp 3-2c.
13/05/19	13:45	16:45	3:00	Dry, Wind F3-4 S-SW, Cloud cover 3-5/8, Visibility >3km, Temp 14-16c.
13/05/19	17:15	18:15	1:00	Dry, Wind F2-3 S, Cloud cover 3/8, Visibility >3km, Temp 12c.
10/06/19	16:45	18:45	2:00	Dry, Wind F5 NW, Cloud cover 7-8/8, Visibility >3km, Temp 9-10c.
18/06/19	15:15	18:15	3:00	Dry, Wind F2-3 SW, Cloud cover 5-7/8, Visibility >3km, Temp 15c
20/06/19	10:32	11:32	1:00	Light showers, Wind F4 W, Cloud cover 6-7/8, Visibility 1-3km, Temp 6c
20/06/19	07:00	10:00	3:00	Dry, Wind F4-5 W, Cloud cover 7-8/8, Visibility >3km, Temp 4-5c.
23/07/19	14:30	17:30	3:00	Dry, Wind F4-5 S, Cloud cover 5-8/8, Visibility 1-3 to >3km, Temp 13-15c.
23/07/19	18:00	21:00	3:00	Dry, Wind F3-4 SE, Cloud cover 1-5/8, Visibility >3km, Temp 15c.
24/07/19	14:00	17:00	3:00	Dry, Wind F3-4 SE, Cloud cover 4-6/8, Visibility >3km, Temp 16-18c.

Date	Start	Finish	Length of VP watch (hrs)	Weather conditions (wind using Beaufort scale)
30/07/19	17:45	18:30	0:45	Heavy showers, Wind F4 ESE, Cloud cover 7-8/8, Visibility 1-3km, Temp 15c.
31/07/19	10:10	12:30	2:20	Dry, Wind F4-5 N, Cloud cover 7-8/8, Visibility >3km, Temp 14c.
13/08/19	06:05	09:05	3:00	Dry, Wind F3 W, Cloud cover 4-5/8, Visibility >3km, Temp 12-13c.
Total			**42 hrs 5m**	
VP9				
04/04/19	15:00	18:00	3:00	Dry, Wind F6-7, E, Cloud cover 4-6/8, Visibility >3km, Temp, -2c to -4c.
09/04/19	10:25	13:25	3:00	Dry, Wind F5 SE, Cloud cover 0-1/8, Visibility >3km, Temp 5c.
09/04/19	13:55	16:55	3:00	Dry, Wind F4-5 SE, Cloud cover 1-2/8, Visibility >3km, Temp 7c.
01/05/19	15:30	18:30	3:00	Light showers, Wind F2-3 NW-W, Cloud cover 7-8/8, Visibility >3km (<1km briefly during low cloud), Temp 6-8c.
02/05/19	08:20	09:20	1:00	Dry then heavy Rain, Wind F4 NW, Cloud Cover 8/8, Visibility 1-3km, Temp 3c.
09/05/19	12:00	15:00	3:00	Light showers, Wind F4 NE, Cloud Cover 8/8, Visibility 1-3km to >3km, Temp 5c.
09/05/19	15:30	17:30	2:00	Light showers, Wind F2-4 NE, Cloud Cover 8/8, Visibility >3km, Temp 5c.
20/06/19	06:50	09:50	3:00	Dry, Wind F3-4 W, Cloud cover 6/8, Visibility >3km, Temp 7-8c.
20/06/19	10:20	13:20	3:00	Dry, Wind F3-4 W, Cloud cover 6/8, Visibility >3km, Temp 8c.
28/06/19	06:45	09:45	3:00	Dry, Wind F6 ESE, Cloud cover 0/8, Visibility >3km, Temp 13c.
24/07/19	14:00	17:00	3:00	Dry, Wind F5-4 S, Cloud cover 6-8/8, Visibility >3km, Temp 14c.
24/07/19	17:30	20:30	3:00	Dry, Wind F4 S, Cloud cover 4-6/8, Visibility >3km, Temp 14c.
29/07/19	18:00	21:00	3:00	Dry, Wind F1-3 SW, Cloud cover 2-4/8, Visibility >3km, Temp 12-18c.
01/08/19	09:30	12:30	3:00	Dry, Wind F0-1 N, Cloud cover 5-7/8, Visibility >3km, Temp 11-13c.
01/08/19	13:00	16:00	3:00	Light showers, Wind F0-3 N-NE, Cloud cover 5-7/8, Visibility >3km, Temp 14-16c.
Total			**42 hrs**	

Table A.2 Dates, Times and Weather Conditions during Moorland Bird Surveys

Date	Start	Finish	Weather conditions
17/04/19	08:30	17:00	Dry, Wind F2-3 SE, Cloud Cover 0-5/8, Visibility >3km, Temp 5-16c.
17/04/19	08:30	17:30	Dry, Wind F3-4 SW, Cloud Cover 5-0/8, Visibility >3km, Temp 6-13c.

Date	Start	Finish	Weather conditions
23/05/19	08:30	17:00	Dry, Wind F2-4 W, Cloud cover 1-2/8, Visibility >3km, Temp 8-10c.
23/05/19	08:30	16:45	Dry, Wind F2-4 W, Cloud cover 1-2/8, Visibility >3km, Temp 4-13c.
06/06/19	08:30	15:45	Dry, Wind F2-6, Cloud cover 4/8 - 6/8, Visibility >2km, Temp 9-12c
06/06/19	08:30	16:30	Dry, Wind F2-4 S, Cloud cover 2-7/8, Visibility >3km, Temp 8-14c.
04/07/19	09:10	15:00	Dry, Wind F4-5 NW, Cloud cover 7-8/8, Visibility >3km, Temp 9-10c.
04/07/19	09:00	15:00	Dry, Wind F2-4 W, Cloud cover 4-8/8, Visibility >3km, Temp 8-14c.
04/07/19	09:20	15:30	Dry, Wind F1-2 W, Cloud cover 6-7/8, Visibility >3km, Temp 12-14c.

Table A.3 Dates, Times and Weather Conditions during Raptor Surveys

Date	Start	Finish	Weather conditions
28/03/19	09:00	13:00	Dry, Wind F3-4 SW, Cloud cover 7-4/8, Visibility >3km, Temp 3-7c.
28/03/19	08:20	10:20	Dry, Wind F4-5 Variable, Cloud cover 6-7/8, Visibility >3km, Temp 6c.
28/03/19	11:50	13:20	Dry, Wind F5-6 SW, Cloud cover 2-4/8, Visibility >3km, Temp 7-8c.
28/03/19	09:30	12:00	Dry, Wind F3 Variable, Cloud cover 5-7/8, Visibility >3km, Temp 6-7c.
28/03/19	09:10	12:30	Dry, Wind F2-3 W, Cloud cover 4-6/8, Visibility >3km, Temp 8c.
25/04/19	10:25	15:15	Dry, Wind F2 SE, Cloud cover 5-7/8, Visibility >3km, Temp 13-11c.
02/05/19	08:35	11:35	Light showers, Wind F2 NW, Cloud cover 5-8/8, Visibility 1-3km, Temp 7-9c.
09/05/19	15:15	17:05	Dry, Wind F4-3 NE, Cloud cover 7-6/8, Visibility >3km, Temp 3c.
10/05/19	07:00	10:30	Dry, Wind F2-3 SE, Cloud cover 1-2/8, Visibility >3km, Temp 6-10c.
18/06/19	14:00	19:00	Dry, Wind F3 SW, Cloud 5-6/8, Visibility >3km, Temp 13-16c.
19/06/19	09:15	17:00	Dry, Wind SW2-3, Cloud cover 2-5/8, Visibility >3km, Temp 14-16c.
19/06/19	09:00	17:00	Dry, Wind F3 SW, Cloud cover 4-8/8, Visibility >3km, Temp 14-15c.
20/06/19	12:30	14:30	Light showers, Wind F4-5 W, Cloud cover 6-7/8, Visibility >3km, Temp 10c.
04/07/19	15:30	17:30	Dry, Wind F3-4 W, Cloud cover 8/8, Visibility >3km, Temp 14c.
05/07/19	09:00	12:50	Light showers, Wind F3 W, Cloud cover 3-8/8, Visibility 1-3 to >3km, Temp 9-12c.
08/07/19	11:55	18:00	Dry, Wind F2-4 SW, Cloud cover 6-8/8, Visibility >3km, Temp 13-14c.
08/07/19	11:45	18:00	Dry, Wind F2-3 SW, Cloud cover 6-8/8, Visibility >3km, Temp 15c.
09/07/19	13:30	15:45	Light showers, Wind F1 SW, Cloud cover 8/8, Visibility 1-2km, Temp 16c.

Table A.4 Dates, Times and Weather Conditions during Black Grouse Surveys

Date	Start	Finish	Weather conditions
28/03/19	05:00	08:00	Dry, Wind F1-3 SW, Cloud cover 7-8/8, Visibility >3km (c500m for last 30mins), Temp 3-2c.
28/03/19	05:00	08:00	Dry, Wind F2-4 S-variable, Cloud cover 7-8/8, Visibility >3km (c30m for last 20mins), Temp 4c.
28/03/19	05:00	08:00	Dry, Wind F2-3, SW, Cloud cover 8/8, Visibility >3km (c30-50m for last 30 mins), Temp 3-4c.
28/03/19	05:00	08:00	Dry, Wind F1-2 W, Cloud cover 5-7, Visibility 1-2km, Temp 8c.
29/03/19	04:56	07:45	Drizzle, Wind F2-3 W, Cloud cover 4-7/8, Visibility <1km to >3km (mist for first hour), Temp 5-8c.
25/04/19	04:50	07:35	Dry, Wind F4-5 SE, Cloud cover 6-8/8, Visibility <1km, Temp 4-5c.
25/04/19	04:50	07:40	Dry, Wind F3 E, Cloud cover 4-8/8, Visibility >2km, Temp 7-8c.
25/04/19	04:50	08:20	Dry, Wind F2 SE, Cloud cover 7-5/8, Visibility <1km to >2km, Temp 8-10c.
02/05/19	04:34	07:25	Light showers, Wind F3 NW, Cloud cover 5-8/8, Visibility 1-2km, Temp 3c.
02/05/19	04:35	07:35	Light showers, Wind F2 NW, Cloud cover 6-8/8, Visibility <1km, Temp 4-5c.
10/05/19	04:20	06:50	Dry, Wind F2 SE, Cloud cover 2-3/8, Visibility >3km, Temp 2-6c.

Appendix B
Survey results

Table B.1 Vantage Point Survey Results

Flight reference no.	Date	Time	VP	No. of birds	Notes	Flight time at 15-180m height (secs)	Total time at 15-180m height (multiplied where more than one bird involved in the flight)
Greylag goose							
32964_VP_030	11/04/19	07:37	6	2	Flew west along valley. Lost behind Alhang.	57	114
Merlin							
32964_VP_029_a	18/04/19	07:56	7	1	Probable female.	0	0
32964_VP_029_b	18/04/19	07:56	7	1	Lost from view behind hill.	5	5

Table B.2 Incidental Records

Unique ID	Species	Count	Date	Notes
32964_FI_014	Greylag goose	23	28/03/19	Skein flew west at 07:08 during a black grouse survey and was then lost from view near High Countam behind the treeline.
32964_FI_012	Pink-footed goose	130	28/03/19	Skein flew northeast, calling, along Water of Ken valley at 06:54 during a black grouse survey.
32964_FI_013	Pink-footed goose	>1	28/03/19	Heard calling in flight above Black Hill in low cloud at 07:25 but not located during a black grouse survey.
32964_FI_015	Pink-footed goose	200	28/03/19	Skein flew northeast, calling, along Water of Ken valley at 08:46 during a black grouse survey.
32964_FI_022	Pink-footed goose	150	30/03/19	Seen in-flight during a raptor survey at 08:43.
32964_FI_037	Golden plover	10	28/03/19	In flight during a raptor survey.
32964_FI_019	Merlin	1	28/03/19	Male flew low in valley east of Lagower Hill heading north at 06:58 before being lost from view over hill during a black grouse survey.

Appendix C
Species List

Table C.1 Species Names

IOC species name (2018)	Scientific name	IOC species name (2018)	Scientific name
Canada Goose	*Branta canadensis*	**Curlew**	*Numenius arquata*
Pink-footed goose	*Anser brachyrhynchus*	**Dunlin**	*Calidris alpina*
Greylag goose	*Anser anser*	**Snipe**	Gallinago gallinago
Whooper swan	*Cygnus cygnus*	**Common sandpiper**	*Actitis hypoleucos*
Black grouse	*Tetrao tetrix*	**Herring gull**	*Larus argentatus*
Osprey	*Pandion haliaetus*	**Lesser black-backed gull**	*Larus fuscus*
Hen harrier	*Circus cyaneus*	**Barn owl**	*Tyto alba*
Sparrowhawk	*Accipter nisus*	**Long-eared owl**	*Asio otus*
Goshawk	*Accipiter gentilis*	**Short-eared owl**	*Asio flammeus*
Red kite	*Milvus milvus*	**Kestrel**	*Falco tinnunculus*
Common buzzard	*Buteo buteo*	**Merlin**	*Falco columbarius*
Oystercatcher	*Haematopus ostralegus*	**Peregrine**	*Falco peregrinus*
Lapwing	*Vanellus vanellus*	**Carrion crow**	*Corvus corone*
Golden plover	*Pluvialis apricaria*	**Raven**	*Corvus corax*
Dotterel	Charadrius morinellus		