Corkey Windfarm Repowering

Technical Appendix A9.1 Ornithology Technical Report 2014-2019

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A9.1 Ornithology Surveys 2014 – 2019

1. Introduction

1. This **Technical Appendix A9.1** details the methods and findings for Chapter 9 – Ornithology of the Environmental Statement (ES) for the Corkey Windfarm Repowering proposal (the Development), which is fully set out in the ES.

2. Baseline ornithology monitoring was undertaken by Bird Surveyors Ltd to establish the distribution and abundance of existing ornithological features for re-powering of the Operational Corkey Windfarm, Co. Antrim. The baseline information provides information used to inform the design of the Development and inform potential impacts of the Development due to collision, disturbance and/or displacement of birds.

3. The methods utilised have four main aims:

- To provide baseline data on all extant ornithological features to establish the risk posed to birds due to the Development;
- To quantify the risk of collision with turbines to extant bird species flying through the Development area throughout the year;
- To identify locations of priority target species territories to establish risk posed due to Development; and
- To identify mitigatory habitats, options and future monitoring needs, where required, upon assessment of displacement and/or collision risk due to the Development

4. The objectives of baseline monitoring were to:

- Establish the sensitivities and designated site features within the landscape, in particular to establish and identify any species-specific risk and identify key ornithological receptors;
- Establish the distribution and abundance of nearest known priority species using desk-based studies;
- Establish the spatial distribution and relative abundance of all bird species from primary field surveys during the breeding and wintering season from walkover and vantage point surveys within 500 m of the Development;
- Establish the breeding distribution and abundance of curlew *Numenius arquata* within 800 m of the Development (see Pearce – Higgins et al., 2009)[1];
- Establish the breeding distribution and abundance of snipe *Gallinago gallinago* within 500 m of the Development;
- Establish the breeding distribution and abundance of red grouse *Lagopus lagopus* within 500 m of the Development;
- Establish the distribution and abundance of priority species (specifically waders, raptors, swans and geese) from primary field surveys during both the breeding and wintering season within 2 km and 5 km (swans / hen harrier); and
- Establish the distribution and abundance of suitable displacement habitats or mitigation options and provide recommendations for management, if necessary.

5. This Technical Appendix is further analysed and reviewed in **Chapter 9** of the ES and should be read in conjunction with that Chapter and also **Volume 2: Figures.**

6. This Technical Appendix A9.1 includes the following elements:

- Assessment Methodology; and
- Baseline Description.

2. Assessment Methodology

7. A range of guidance, best practice and peer-review methodologies have been utilised in the scoping, preparation and completion of the surveys works undertaken for the Development.

2.1. Study Area / Survey Area

8. The ornithological survey area was digitally mapped in ArcGIS 10.5 and defined as the Site Boundary at the time of scoping (hereafter Survey Area) buffered by 500 m (hereafter 500 m Survey Area) respectively for breeding and wintering bird surveys and vantage point surveys (**Figure 9.1**). This buffer was selected as recent research has shown the majority of wind turbine effects are prevalent up to 500 m (Pearce-Higgins *et al.,* 2009, Ruddock & Reid, 2010[2]; **Figure 9.1; Figure 9.2**).

9. An 800 m buffer (hereafter 800 m Survey Area) defined the search area for curlew during breeding season surveys; as displacement effects on this species are considered up to 800 m (Pearce-Higgins *et al.,* 2009; **Figure 9.1**). The wider priority species survey area was defined as the 2 km buffer (hereafter 2 km Survey Area) to search for hen harrier and merlin nest locations and/or breeding territories or wintering locations of species considered vulnerable and/or priority species within Northern Ireland (**Table 9.1**). A wider search area up to 5 km (hereafter 5 km Survey Area) was utilised during priority species searches for swans and geese, hen harrier and merlin (**Figure 9.3**). Additional analyses and mapping were conducted where necessary on the Operational Corkey Windfarm turbines and the Development turbines and associated 500 m buffers.

Table 9.1: Details of species surveyed during vantage point observations and priority species searches.

Species	Vantage Point (Target 1) *	Vantage Point (Target 2) **	Migration Vantage Point	Priority Species Surveys (2 km)
Hen harrier	•		•	•
Peregrine falcon	•		•	•
Merlin	•		•	•
White-tailed eagle	•		•	•
Golden eagle	•		•	•
Goshawk	•		•	•
Osprey	•		•	•
Red kite	•		•	•
Marsh harrier	•		•	•
Golden plover	•		•	•
Whooper swan	•		•	•
Mute swan	•		•	•
Chough	•		•	•
Barn owl	•		•	•
Short-eared owl	•		•	•
Long-eared owl	•		•	•
Red grouse	•		•	(500 m)
Curlew	•		•	•
Geese (all species)	•		•	•
Buzzard		•	•	•
Kestrel		•	•	•
Sparrowhawk		•	•	•
Snipe		•	•	(500 m)
Lapwing		•	•	•
Raven		•	•	•
Grey heron		•	•	•
Cormorant		•	•	•
Corncrake		•	•	•

[1] Pearce-Higgins, J.W., Stephen, L., Langston, R.H.W., Bainbridge, I.P. & Bullman, R. (2009). The distribution of breeding birds around upland wind farms. *Journal of Applied Ecology* 46: 1323-1331.
[2] Ruddock, M. & Reid, N. (2010). Review of windfarms and their impact on biodiversity: guidance for developments in Northern Ireland. *Report by the Natural Heritage Research Partnership, Quercus for the Northern Ireland Environment Agency, Northern Ireland, UK.*

Species	Vantage Point (Target 1) *	Vantage Point (Target 2) **	Migration Vantage Point	Priority Species Surveys (2 km)
Waders (all species)		•	•	•
Ducks (all species)		•	•	•
Grebes (all species)		•	•	•
Gulls (all species)		•	•	•
Terns (all species)		•	•	•
SPA citation species (all)	•	•	•	•

* Target 1 species are recorded to the nearest minute, and assigned a five minute interval and the flight route is mapped. Flying height (at 15 second intervals) and flight duration to the nearest second are recorded.

** Target 2 species are recorded to the nearest minute and assigned a five minute interval and the flight route is mapped. Flying height is recorded at point of detection and an altitudinal range also recorded for the duration of the bout.

2.2. Review of Site Sensitivities & Designations

10. Desktop studies were undertaken including a review of designated site databases to establish local, regional or national importance of the area and especially for designated ornithological receptors up to 10 km from the survey area.

11. Data searches were conducted for Northern Ireland, which were obtained from Northern Ireland Environment within Department of Agriculture & Rural Affairs (DAERA) www.daera-ni.gov.uk/topics/biodiversity-land-and-landscapes/protected-areas. The GIS data (shapefiles) were downloaded and imported into the project GIS and projected accordingly to ensure standard spatial reference of all databases and designated boundaries.

12. Data for Northern Ireland were reviewed on Special Areas of Conservation (SAC), Special Protection Areas (SPA), Areas of Special Scientific Interest (ASSI), RAMSAR sites, National Nature Reserves (NNR), Areas of Outstanding Natural Beauty (AONB), World Heritage Sites and Landscape Character Areas (LCA).

13. The details of these designated sites, including any protected and/or cited ornithological features were also extracted from the site synopsis documents, where available, along with the distance to the Site Boundary which was calculated in ArcGIS.

2.3. Review of published data and data requests

14. This study identified and reviewed external data sources on both general and priority target bird species in order to inform the indicative species risk matrix within the site and wider area as well as to inform the indicative work programme for bird surveys.

15. Online and/or hard copy data requests were submitted to establish the types and/or abundance of key bird species in the area in order to understand whether any wider impacts or ornithology issues could arise. These included data obtained at the 10km resolution and/or at the tetrad (2 km by 2 km) resolution where available.

16. Data requests were submitted to the National Biodiversity Network (NBN), British Trust for Ornithology (BTO), Northern Ireland Raptor Study Group (NIRSG). These were mostly available at the 10 km resolution but where possible the information requests were extended to include the nearest known historical geese, swan, raptor, wader and/or other priority species locations.

17. Published literature were reviewed to identify priority species breeding or wintering areas derived from both data consultation and published reports for wintering whooper swan (Robinson et al., 2004[3]), red grouse (Allen et al., 2004[4]; Cummins et al., 2010[5]) and breeding hen harrier (Sim et al., 2007[6]; Hayhow et al., 2013[7]; Wotton et al.,2018[8]).

18. Extant ornithological information of ornithology, particularly raptors, from the author's personal knowledge (Dr Marc Ruddock) having surveyed in the Antrim Hills for more than a decade, and other project ornithologists with knowledge of the area were also reviewed to identify other key constraints and/or vulnerable target species.

2.4. Breeding Bird Surveys (BBS)

19. Breeding bird territories were surveyed using a modified Brown & Shepherd (1993)[9] transect methodology to incorporate passerines and provide breeding estimates and distribution for all bird species within the 500 m turbine buffer boundary and for breeding curlew within 800 m of the turbines. This survey included an assessment of the abundance of meadow pipits and skylarks, considered to be important prey species for hen harriers and merlin.

20. To allow for variation in detection of early and late breeding species four surveys were conducted in April, May, June and July respectively. Fieldwork commenced earlier in the day to maximise detection for passerines. Periods of high wind (>Force 4) and low visibility were avoided to maximise visual and auditory detection rates of birds. Equipment used during the surveys included Leica 8-12 x 40 binoculars; Leica APO Televid 70 and a Sony Alpha 77 digital camera with a 500 mm lens.

21. Surveys covered the ground systematically with constant search effort and all points within the survey area were closely approached to within 100m depending on accessibility. Improved pasture was scanned with binoculars and observed for short periods to identify foraging areas of detected species. Where accessibility was constrained the surveyor stopped and scanned with binoculars and listened for bird song/calls. Patches of scrub, isolated trees, rocky outcrops, streams, water-bodies, buildings and linear features such as hedge rows and trees were investigated closely. The surveyor paused at regular intervals to scan and listen for calling and singing birds.

22. Behaviours indicative of breeding were recorded in the field. When individuals or pairs of birds were encountered, efforts were made to establish whether, in the fieldworker's opinion, the birds were different from those previously encountered, and involved attention to the movements of birds, together with birds' sex and plumage characteristics. Where necessary, surveyors retraced their steps in order to check the continued presence of previously recorded birds.

23. The location and activity of birds were recorded using standard (BTO) codes and the position of each bird was mapped at the point it was first detected. At the end of each visit a summary map was compiled showing the location of each identified territory or breeding pair. Population estimates were derived by comparing the summary maps for the four surveys and identifying distinct territories (Marchant, 1983), plotted centrally by convention and assessing breeding behaviours and spatial locations to establish breeding status.

24. Based on diagnostic evidence each detected species is categorised as:

- **Confirmed breeding** – single and/or pair of birds exhibiting breeding behaviour or evidence of breeding including i) courtship or territorial display (on multiple visits); ii) alarm calling or agitated behaviour by adult(s) indicating the presence of a nearby nest or young (e.g. repetitive alarm calling, distraction display); iii) territorial dispute; iv) fledged young; v) nest building; vi) active nest or recently used nest; vii) adults removing faecal sac; viii) adult(s) carrying food;
- **Probable breeding** – single or pair of birds occupying suitable breeding habitat and exhibiting breeding behaviour (e.g. singing) **or** pair of birds occupying suitable breeding habitat but not exhibiting breeding behaviour or evidence of breeding;
- **Possible breeding** – single birds occupying suitable breeding habitat and not exhibiting breeding behaviour or evidence of breeding; and

[3] Robinson, JA, K Colhoun, JG McElwaine & EC Rees. 2004. Whooper Swan *Cygnus cygnus* (Iceland population) in Britain and Ireland 1960/61 – 1999/2000. Waterbird Review Series. The Wildfowl & Wetlands Trust/Joint Nature. Conservation Committee, Slimbridge.
[4] Allen, D., Mellon, C. Mahwhinney, K. (2004). The status of red grouse in Northern Ireland. Unpublished report to Environment and Heritage Service.
[5] Cummins, S., Bleasdale, A., Douglas, C., Newton, S., O' Halloran, J. & Wilson, H.J. (2010). The status of Red Grouse in Ireland and the effects of land use, habitat and habitat quality on their distribution. Irish Wildlife Manuals, No. 50. National Parks and Wildlife Service, Department of the Environment, Heritage and Local Government, Dublin, Ireland.
[6] Sim, I.M.W, Dillon, I.A., Eaton, M.A., Etheridge, B., Lindley, P., Riley, H., Saunders, R., Sharpe, C., Tickner, M. (2007). Status of the Hen harrier Circus cyaneus in the UK and Isle of Man in 2004, and a comparison with the 1988/89 and 1998 surveys. Bird Study 54: 256–267
[7] 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 the Isle of Man in 2010. Bird Study 60: 446-458.
[8] Wotton, S., Bladwell, S., Morris, N., Raw, D., Ruddock, M., Stevenson, A., Stirling-Aird, P. & Eaton, M. (2018) Status of the Hen Harrier *Circus cyaneus* in the UK and Isle of Man in 2016. Bird Study 65: 145-160.
[9] Brown, A.F. & Shepherd, K.B. (1993). A method for censusing upland breeding waders. *Bird Study* 40: 189-195.

- **Non-breeding** – sightings of birds commuting, foraging or flying above the site and exhibiting no attachment to the survey area.

25. Each detected species, from breeding surveys were classified according to regional and national conservation status as red, amber or green listed (Colhoun & Cummins, 2013[10]; Eaton et al., 2015[11]).

2.5. Wintering Bird Surveys (WBS)

26. Winter bird surveys were carried out using transects covering the whole survey area and 500 m buffer during the winter period from September to March. Surveys covered the ground systematically with constant search effort and all points within the survey area were closely approached to within 50-100 m depending on accessibility.

27. The surveyor paused at regular intervals to scan and listen for calling and singing birds. Where accessibility was constrained the surveyor stopped and scanned with binoculars and listened for bird song/calls. Patches of scrub, isolated trees, rocky outcrops, streams, water-bodies, buildings and linear features such as hedge rows and trees were investigated closely. Improved pasture was scanned with binoculars and observed for short periods to identify foraging areas of extant species.

28. Species locations, numbers and brief description of behaviours were plotted, at the point they were first detected, using standard BTO codes on hard copy maps and/or by GPS on a recording form.

29. Each detected species from breeding surveys were classified according to regional and national conservation status as red, amber or green listed (Colhoun & Cummins, 2013; Eaton et al., 2015).

2.6. Breeding Vantage Point (BVP) and Wintering Vantage Point (WVP) Surveys

30. Vantage point surveys were carried out over the breeding period from March to August and over the wintering period from September to February / March) in order to collect information on flying heights, distribution and occurrence of target species (**Table 9.1**; SNH, 2005).

31. Focal observations from four vantage points over-looking the site were utilised to assess target species activity, flight height and flight routes in a hierarchical fashion (see **Table 9.1**). Where target species were recorded inside the survey boundary the detection time, flight trajectory, flight duration (to the nearest second) and flight height were assigned within stratified height bands (<15 m, 15 m – 25 m, 25 m – 50 m, 50 m – 75 m, 75 m – 100 m, 100 m – 125 m; 125 m – 140 m; >140 m) to reflect the parameters of the proposed turbines and flying height above ground level was recorded visually at detection and at 15 second intervals using an audible countdown timer.

32. The vantage points were located outside the 500 m boundary, where possible, to minimise effects of observer disturbance to bird activity and/or behaviour. Based on topographical constraints and in order to ensure clear visibility of key ornithological habitats (particularly the quarry to the east) two of the vantage point locations were inside the survey area boundary but given existing infrastructure, windfarm operational activities and agricultural activity inside the survey area no key constraints or disturbances are considered to have occurred or been derived due to the location of these vantage points.

33. Observers scanned a 180° arc both visually and with binoculars (Leica 8-12 x 40). Weather conditions were recorded at hourly intervals from the start of the focal observation until the end of the observation period. The weather conditions recorded included cloud cover, cloud height (estimated in metres from height above ground level), wind direction and speed (Beaufort Scale), precipitation and visibility (km). A range of diurnal and crepuscular times and weather conditions were sampled. Migration Vantage Point (MVP) Surveys.

34. Focal observations of target species were carried out from a single vantage point located to assess the spatial distribution and occurrence of migrating birds over-flying the proposed development. Bird migration occurs in two distinct seasonal periods' i.e. autumn migration arbitrarily defined from September to November and spring migration arbitrarily defined from late January to late March/early April.

35. The minimum recommended survey effort is 36 hours for each seasonal period (SNH, 2005) although it is recognised survey scope may be lower for re-powering developments (SNH, 2014). A range of times and weather conditions were sampled although migration surveys were not conducted during periods of high winds or persistent heavy rain. However, when encountered, intermittent periods of poor visibility (i.e. fog) were surveyed using auditory techniques.

36. The autumn migration vantage point (AMVP) and spring migration vantage point (SMVP) were selected on elevated ground to maximise visibility and covered a viewing arc of 180° facing north (in autumn) and south (in spring) of the survey area (**Figure 9.1**) to maximise the detection of arriving and/or localised movements of over-flying migrants.

37. Target species were defined primarily as the migratory species generally detected in Northern Ireland; **Table 9.1**) although all vantage point target species were also included (**Table 9.1**). Whilst, preferably, vantage points should not be located outside the development boundary, where possible, to minimise effects of disturbance on bird activity and/or behaviour, due to topographical constraints it was necessary to locate the MVPs within the 500 m survey boundary (**Figure 9.1**) to facilitate detection of migrant birds over the survey area and track flight(s) when detected.

38. Weather conditions were recorded at hourly intervals from the start of the focal observation until the end of the observation period. The weather conditions recorded included cloud cover, cloud height (estimated in metres from height above known landscape features), wind direction and speed (Beaufort Scale), precipitation and visibility (km). A range of diurnal and crepuscular times and weather conditions were sampled.

39. Focal observations from a single migration vantage points over-looking the site were utilised to assess target species activity, flight height and flight routes in a hierarchical fashion (see **Table 9.1**). Where target species were recorded inside the survey boundary the detection time, flight trajectory, flight duration (to the nearest second) and flight height were assigned within stratified height bands (<15 m, 15 m – 25 m, 25 m – 50 m, 50 m – 75 m, 75 m – 100 m, 100 m – 125 m; 125 m – 140 m; >140 m) to reflect the parameters of the proposed turbines and flying height above ground level was recorded visually at detection and at 15 second intervals using an audible countdown timer.

40. The vantage points were located outside the 500 m boundary, where possible, to minimise effects of observer disturbance to bird activity and/or behaviour. Based on topographical constraints and in order to ensure clear visibility of key ornithological habitats (particularly the quarry to the east) two of the vantage point locations were inside the survey area boundary but given existing infrastructure, windfarm operational activities and agricultural activity inside the survey area no key constraints or disturbances are considered to have occurred or been derived due to the location of these vantage points.

41. Observers scanned a 180° arc both visually and with binoculars (Leica 8-12 x 42). Weather conditions were recorded at hourly intervals from the start of the focal observation until the end of the observation period. The weather conditions recorded included cloud cover, cloud height (estimated in metres from height above ground level), wind direction and speed (Beaufort Scale), precipitation and visibility (km). A range of diurnal and crepuscular times and weather conditions were sampled.

2.7. Breeding Priority Species Surveys (PSS)

42. Breeding priority species searches were carried out between March and August to establish if suitable habitat(s) contained breeding target species (**Table 9.1**) to identify risk species for turbine collision or displacement. These searches include specific assessments of the suitable habitat(s) to identify nesting distribution and breeding status for species of high conservation concern notably Annex I (EU Birds Directive), Schedule 1 (Wildlife (Northern Ireland) Order 1985) and Birds of Conservation Concern (Colhoun & Cummins, 2013; Eaton *et al.,* 2015; **Table 9.1**) within the 2 km Survey Area.

2.7.1. Raptor surveys

43. Surveys for breeding raptors specifically followed prescribed methods (Hardey et al., 2006; 2009; 2013) between March and August. For breeding locations, each detected species is categorised the same as for breeding bird surveys as confirmed, probable or possible. Priority species search effort was primarily undertaken outside the 500 m and 800 m boundary since vantage point and transect breeding bird surveys were concentrated in these areas, and nesting target species would be identified during these surveys.

44. Specifically for hen harriers, the survey area was thoroughly searched and suitable habitats were identified up to 5 km from the survey area (**Figure 9.1**) during the breeding season. This included areas of deep, contiguous heather *Calluna vulgaris*

[10] Colhoun, K. & Cummins, S. (2013). Birds of conservation concern in Ireland 2014 – 2019. Irish Birds 9: 523-544.

1. [11] Eaton MA, Aebischer NJ., Brown AF., Hearn R., Lock L., Musgrove AJ., Noble DG., Stroud D. and Gregory R.D (2015) Birds of Conservation Concern 4: the population status of birds in the United Kingdom, Channel Islands and the Isle of Man. British Birds 108, pp 708–746[11]

and pre-thicket stage coniferous forest plantations which were surveyed (Sim et al., 2007; Hardey et al., 2013[12]). Vantage points were chosen to offer unrestricted views over suitable habitat within these categories to watch for target species. The nearest known territory and/or optimal hen harrier habitat was also surveyed.

45. Raptor surveys were undertaken for merlin with additional walkover effort along the edges of mature conifer plantations (Ewing et al., 2011[13]) to look for signs e.g. prey remains and/or suitable old crow nests occupied by merlin. Surveys were conducted over the course of the breeding season March to August inclusive. All target species seen during vantage points were recorded. Details of search effort, weather conditions and locations of breeding attempts and/or territories were reported and/or mapped where relevant.

46. To support the primary field surveys recent extant ornithological information for Schedule 1 (Wildlife NI Order 1985) raptors was requested from the Northern Ireland Raptor Study Group (NIRSG) within the 2 km buffer survey area (see **Figure 9.1**). In addition, the data request was extended to establish the nearest known hen harrier, merlin and peregrine nest and/or historical territory locations.

2.7.2. Red grouse surveys

47. Additional breeding season surveys were carried out for red grouse in April and August. This method comprised dusk and / or dawn counts for calling grouse to establish the abundance and distribution within the 500 m survey boundary (Natural Research, 2007). Surveys were carried out, from a vantage point, at dusk to familiarise the observer with area and location of birds and counts were conducted again at dawn the following morning.

48. The observers were positioned at strategically located vantage points that afforded comprehensive coverage of the survey area. All parts of the survey area were within approximately 1km of a vantage point. The dusk count commenced one hour before dark and continued until no further cocks were heard. Dawn counts began 30 minutes before first light and continued until one hour after dawn.

49. Observers listened intently for calling grouse. When a bird was heard its sex was determined, the time noted, and a compass bearing of its location taken together with an estimate of distance from the observer. This procedure was repeated for each new grouse heard or seen. Observers compared registrations at the end of the survey to establish if any calls were duplicated. In August, an extensive walkover survey was conducted to identify the locations of red grouse coveys, if any, within the application site and 500 m survey buffer.

2.7.3. Wader surveys

50. Curlew, lapwing and snipe were also specifically targeted during searches between March and August and additional walkover surveys were conducted where required. These included “dusk” surveys during May to look and listen for displaying (‘drumming’ and ‘chipping’) snipe within survey buffers and also locations which were recorded from vantage points.

51. Curlew were surveyed using vantage point and walkover surveys at suitable habitat and all sightings of curlew were followed up to establish breeding activity. To establish the location of curlew, lapwing and snipe territories; cumulative analyses were undertaken which integrated observations from the vantage points, breeding bird surveys and priority species searches to identify distinct territories.

2.8. Wintering Priority Species Surveys

52. During the winter, between September 2012 and March 2013, surveys were carried out to identify hen harrier winter roosts and whooper swan roosting and foraging areas and/or commuting routes. Surveys for hen harriers were carried out at suitable habitat (Hardey et al., 2009) at dawn and/or dusk.

53. Whooper swan surveys were carried out within all parts within the 2 km survey boundary during each survey visit. These latter surveys including driving and/or walking all parts of the 2 km survey area, with short vantage point or walkover surveys completed at areas not visible from the road. Simultaneously, wider (5-10 km) searches were carried out to identify the nearest whooper swan wintering areas and desktop reviews of published whooper swan wintering areas (Robinson et al., 2004).

54. During whooper swan surveys, swans (and any other waterbirds or wildfowl) were counted during short vantage point observations with telescope (Leica APO Televid x 20-60) and/or binoculars and the location recorded according to the nearest townland name. Records of swan movements and/or direction of movements were recorded during surveys.

2.9. Survey efforts

55. The extensive suite of surveys undertaken for the Development spanned a five year period (2014 – 2019) and were undertaken by Bird Surveyors Ltd on behalf of ScottishPower Renewables by experienced and expert ornithologists including Dr Marc Ruddock, Mr Andrew Murray, Mr Karl Hamilton, Mr Douglas Ruddock, Mr Craig Swenarton and Mr Kevin Mawhinney. Several hundred hours were undertaken in survey effort to inform the baseline assessment and ornithological analysis (**Table 9.2**).

Table 9.2: Survey Effort

Survey Type	Survey Season	Timeframe	Hours completed
Breeding Walkover Surveys	Mar - Jul	Mar 2014 – Jul 2014; Mar 2018 – Jul 2018	103 hours 96 hours
Wintering Walkover Surveys	Sep - Feb	Sep 2014 – Feb 2015; Sep 2018 – Mar 2019	43 hours 37 hours
Breeding Vantage Point Surveys	Mar - Aug	4 VPs Mar 2014 – Aug 2014 4 VPs Mar 2018 – Aug 2018	36+ hours per VP per season
Wintering Vantage Point Surveys	Sep – Feb / Mar	4 VPs Sep 2014 – Feb 2015 4 VPs Sep 2018 – Mar 2019	36+ hours per VP per season
Spring Migration Vantage Point Surveys	Jan – Apr (spring)	4 VPs Jan 2015 – Apr 2015 4 VPs Jan 2018 – Apr 2018	36 hours per VP per season
Autumn Migration Vantage Point Surveys	Sep – Nov (autumn)	4 VPs Sep 2014 – Nov 2014 4 VPs Sep 2018 – Nov 2018	36 hours per VP per season
Breeding Priority Species	Mar - Aug	Mar 2014 – Aug 2014; Mar 2015 – Aug 2015; Mar 2016 – Aug 2016; Mar 2018 – Aug 2018	112 – 115 hours
Wintering Priority Species	Sep – Feb / early Mar	Sep 2014 – Feb 2015; Sep 2016 – Mar 2017; Sep 2018 – Feb 2019	57 – 74 hours

3. Baseline conditions

56. This section details the technical findings from the suite of desktop and literature reviews and field surveys undertaken for the Development. The key parameters at this site are that the baseline comprises an operational windfarm with associated infrastructure and 10 Nordtank 500-37 turbines which have been in operation since 1994.

3.1. Review of Site Sensitivities & Designations

57. The Site is not located within any nationally or internationally designated sites for ornithological features (see **Figure 9.4**). The Site is adjacent to the Antrim Coast and Glens AONB. The Antrim Hills SPA designated for hen harrier and merlin is located approximately 0.8 km away from the survey area. This SPA was designated in 2006 which is 12 years after the approval of the Operational Corkey Windfarm in 1994. An adjacent windfarm (Gruig) was approved in 2007 post-designation of the SPA and a single turbine approved to the west more recently and more recently a wind farm at Altaveeden immediately adjacent to the SPA (see further details in cumulative analysis in **Chapter 9**).

58. The Slieveanorra & Croaghan ASSI (designated in 2009) is located approximately 3 km away from the survey area and is designated for peatland habitats, but also lists hen harrier, merlin, snipe, red grouse and raven in the citation documents. The Slieveanorra Nature Reserve is located within 5 km of the Survey Area and cites hen harrier, merlin and grouse. There are

[12] Hardey, J., Crick, H., Wernham, C., Riley, H., Etheridge, B. & Thompson, D. (2013). Raptors: a field guide to survey and monitoring (3rd Edition). The Stationery Office, Edinburgh.
[13] Ewing, S.R., Rebecca, G.W., Heavisides, A., Court, I.R., Lindley, P., Ruddock, M., Cohen, S. & Eaton, M.A. (2011). Breeding status of Merlins Falco columbarius in the UK in 2008. Bird Study 58: 379-389.

several other designated sites between 5 km and 10 km of the Site Boundary some of which cite ornithology features (see **Table 9.3**). Baseline surveys and assessment will thus further consider any flight path connectivity between designated sites.

Table 9.3: Details of designated sites within 10km of the Site

Reference	Name	County	Status	Distance (km)	Primary Site Features	Secondary Site Features	Year
UK9020301	Antrim Hills	Antrim	SPA	1.0	Hen harrier, merlin	-	2006
ASSI303	Slieveanorra and Croaghan	Antrim	ASSI	2.8	Peatlands	Hen harrier, merlin, snipe, red grouse and raven	2009
NR20	Slievanorra Forest	Antrim	NNR	4.2	Peatlands	Hen harrier, merlin, red grouse	-
ASSI123	Caldanagh Bog	Antrim	ASSI	6.6	Lowland raised bog	Curlew, snipe, golden plover	1996
ASSI067	Garron Plateau	Antrim	ASSI	7.4	Peatlands	Red grouse, golden plover, dunlin, common sandpiper, merlin, peregrine falcon, buzzard, hen harrier, raven	1994
UK12010	Garron Plateau RAMSAR site	ANTRIM	RAMSAR	7.4	Peatlands	Golden plover	1998
ASSI082	Tievebulliagh	Antrim	ASSI	8.0	Flora, fauna, geological and physiographical features	Peregrine falcon	1995
ASSI254	Glenballyemon River	Antrim	ASSI	8.1	Riverine	Dipper	2009
ASSI161	Breen Wood	Antrim	ASSI	10.3	Woodlands	Wood warbler, buzzard, pied flycatcher	1997
NR7	Breen Oakwood	Antrim	NNR	10.4	Woodlands	Treecreeper, buzzard, sparrowhawk	-

3.2. Review of published data and data requests

59. A range of data requests were undertaken to establish and identify the range of target species for surveys and / or assessment of key ornithological receptors and / or pathways for significant effects on ornithology. The survey area and associated 500 m buffer (**Figure 9.1**) are located primarily within 10 km square ID12 and ID02, however the wider survey boundary for priority species surveys extend into two additional 10 km squares (ID01; ID11). Data requests and reviews have been undertaken with NBN, BTO, NIRSG and published literature. A data request to RSPB was undertaken but no results have been received to date (May 2019).

3.2.1. National Biodiversity Network (NBN)

60. National Biodiversity Network (NBN) provide an extensive database of species occurrence within UK & Ireland. Database queries for a 10km buffer from the centre of the Site and included 10 km national grid squares ID01, ID02, ID11; ID12 revealed that there were 115 bird species recorded (**Table 9.4**). There were 25 red-listed and 39 amber-listed species recorded of conservation priority in Ireland (Colhoun & Cummins, 2013) and there were 28 red-listed and 35 amber-listed species recorded of conservation priority in the UK (Eaton et al., 2015). Within a 2 km radius there were fewer species recorded (n = 55).

Table 9.4: Details of bird species detected within 10 km radius of the Development from NBN

Tyto alba	Barn owl	BO	RED	GREEN
Cygnus columbianus	Bewick's swan	BS	RED	AMBER
Turdus merula	Blackbird	B.	GREEN	GREEN
Sylvia atricapilla	Blackcap	BC	GREEN	GREEN
Chroicocephalus ridibundus	Black-headed gull	BH	RED	AMBER
Cyanistes caeruleus	Blue tit	BT	GREEN	GREEN
Fringilla montifringilla	Brambling	BL	GREEN	GREEN
Pyrrhula pyrrhula	Bullfinch	BF	GREEN	AMBER
Fringilla coelebs	Chaffinch	CH	GREEN	GREEN
Phylloscopus collybita	Chiffchaff	CC	GREEN	GREEN
Periparus ater	Coal tit	CT	GREEN	GREEN
Streptopelia decaocto	Collared dove	CD	GREEN	GREEN
Buteo buteo	Common buzzard	BZ	GREEN	GREEN
Loxia curvirostra	Common crossbill	CR	GREEN	GREEN
Larus canus	Common gull	CM	AMBER	AMBER
Actitis hypoleucos	Common sandpiper	CS	AMBER	AMBER
Fulica atra	Coot	CO	AMBER	GREEN
Phalacrocorax carbo	Cormorant	CA	AMBER	GREEN
Crex crex	Corncrake	CE	RED	RED
Cuculus canorus	Cuckoo	CK	GREEN	RED
Numenius arquata	Curlew	CU	RED	RED
Cinclus cinclus	Dipper	DI	GREEN	AMBER
Prunella modularis	Dunnock	D.	GREEN	AMBER
Columba livia	Feral pigeon	FP	GREEN	GREEN
Turdus pilaris	Fieldfare	FF	GREEN	RED
Fulmarus glacialis	Fulmar	F.	GREEN	AMBER
Regulus regulus	Goldcrest	GC	AMBER	GREEN
Pluvialis apricaria	Golden plover	GP	RED	GREEN
Bucephala clangula	Goldeneye	GN	RED	AMBER
Carduelis carduelis	Goldfinch	GO	GREEN	GREEN
Locustella naevia	Grasshopper warbler	GH	GREEN	RED
Larus marinus	Great black-backed gull	GB	AMBER	AMBER
Parus major	Great tit	GT	GREEN	GREEN
Podiceps cristatus	Great-crested grebe	GG	AMBER	GREEN
Chloris chloris	Greenfinch	GR	AMBER	GREEN
Ardea cinerea	Grey heron	H.	GREEN	GREEN
Perdix perdix	Grey partridge	P.	RED	RED
Motacilla cinerea	Grey wagtail	GL	RED	RED
Anser anser	Greylag goose	GJ	AMBER	AMBER

Circus cyaneus	Hen harrier	HH	AMBER	RED
Larus argentatus	Herring gull	HG	RED	RED
Corvus cornix	Hooded crow	HC	GREEN	GREEN
Delichon urbicum	House martin	HM	AMBER	AMBER
Passer domesticus	House sparrow	HS	AMBER	RED
Lymnocryptes minimus	Jack snipe	JS	AMBER	GREEN
Corvus monedula	Jackdaw	JD	GREEN	GREEN
Garrulus glandarius	Jay	J.	GREEN	GREEN
Falco tinnunculus	Kestrel	K.	AMBER	AMBER
Alcedo atthis	Kingfisher	KF	AMBER	AMBER
Vanellus vanellus	Lapwing	L.	RED	RED
Larus fuscus	Lesser black-backed gull	LB	AMBER	AMBER
Acanthis cabaret	Lesser redpoll	LR	GREEN	RED
Linaria cannabina	Linnet	LI	AMBER	RED
Tachybaptus ruficollis	Little grebe	LG	AMBER	GREEN
Asio otus	Long-eared owl	LE	GREEN	GREEN
Aegithalos caudatus	Long-tailed tit	LT	GREEN	GREEN
Pica pica	Magpie	MG	GREEN	GREEN
Anas platyrhynchos	Mallard	MA	GREEN	AMBER
Anthus pratensis	Meadow pipit	MP	RED	AMBER
Falco columbarius	Merlin	ML	AMBER	RED
Turdus viscivorus	Mistle thrush	M.	AMBER	RED
Gallinula chloropus	Moorhen	MH	GREEN	GREEN
Cygnus olor	Mute swan	MS	AMBER	AMBER
Caprimulgus europaeus	Nightjar	NJ	RED	AMBER
Falco peregrinus	Peregrine	PE	GREEN	GREEN
Phasianus colchicus	Pheasant	PH	GREEN	GREEN
Motacilla alba	Pied wagtail	PW	GREEN	GREEN
Motacilla alba	Pied wagtail	PW	GREEN	GREEN
Aythya ferina	Pochard	PO	RED	RED
Corvus corax	Raven	RN	GREEN	GREEN
Lagopus lagopus	Red grouse	RG	RED	AMBER
Lagopus lagopus	Red grouse	RG	RED	AMBER
Alectoris rufa	Red-legged partridge	RL	GREEN	GREEN
Acanthis flammea	Redpoll	FQ	GREEN	GREEN
Tringa totanus	Redshank	RK	RED	AMBER
Phoenicurus phoenicurus	Redstart	RT	AMBER	AMBER
Turdus iliacus	Redwing	RE	GREEN	RED
Emberiza schoeniclus	Reed bunting	RB	GREEN	AMBER
Acrocephalus scirpaceus	Reed warbler	RW	AMBER	GREEN
Charadrius hiaticula	Ringed plover	RP	GREEN	RED
Erithacus rubecula	Robin	R.	AMBER	GREEN
Corvus frugilegus	Rook	RO	GREEN	GREEN
Riparia riparia	Sand martin	SM	AMBER	GREEN
Acrocephalus schoenobaenus	Sedge warbler	SW	GREEN	GREEN
Tadorna tadorna	Shelduck	SU	AMBER	AMBER
Asio flammeus	Short-eared owl	SE	AMBER	AMBER
Anas clypeata	Shoveler	SV	RED	AMBER
Spinus spinus	Siskin	SK	GREEN	GREEN
Alauda arvensis	Skylark	S.	AMBER	RED
Gallinago gallinago	Snipe	SN	AMBER	AMBER
Plectrophenax nivalis	Snow bunting	SB	GREEN	AMBER
Turdus philomelos	Song thrush	ST	GREEN	RED
Accipiter nisus	Sparrowhawk	SH	AMBER	GREEN
Muscicapa striata	Spotted flycatcher	SF	AMBER	RED
Sturnus vulgaris	Starling	SG	AMBER	RED
Columba oenas	Stock dove	SD	AMBER	AMBER
Hirundo rustica	Swallow	SL	AMBER	GREEN
Apus apus	Swift	SI	AMBER	AMBER
Anas crecca	Teal	T.	AMBER	AMBER
Passer montanus	Tree sparrow	TS	AMBER	RED
Certhia familiaris	Treecreeper	TC	GREEN	GREEN
Aythya fuligula	Tufted duck	TU	RED	GREEN
Linaria flavirostris	Twite	TW	RED	RED
Rallus aquaticus	Water rail	WA	GREEN	GREEN
Oenanthe oenanthe	Wheatear	W.	AMBER	GREEN
Saxicola rubetra	Whinchat	WC	RED	RED
Haliaeetus albicilla	White-tailed eagle	WE	RED	RED
Sylvia communis	Whitethroat	WH	GREEN	GREEN
Cygnus cygnus	Whooper swan	WS	AMBER	AMBER
Anas penelope	Wigeon	WN	RED	AMBER
Phylloscopus trochilus	Willow warbler	WW	GREEN	AMBER
Scolopax rusticola	Woodcock	WK	RED	RED
Columba palumbus	Woodpigeon	WP	GREEN	GREEN
Troglodytes troglodytes	Wren	WR	GREEN	GREEN
Emberiza citrinella	Yellowhammer	Y.	RED	RED

3.2.2. Bird Atlas (BTO)

61. The Bird Atlas 2007 – 2011 (Balmer *et al.,* 2013[14]) is the key resource for the UK & Ireland for understanding bird distribution, breeding / wintering status and abundance. All these data are published based on 10 km grid resolution, but some records are resolved to tetrad (2 km x 2 km) and these are described where available (**Appendix 9.2**). Data were obtained for 10km square ID12 and ID02 which showed 82 species were recorded (**Appendix 9.2**) of which 72 species were recorded breeding

[14] Balmer, D., Gillings, S., Caffrey, B., Swan, B., Downie, I. & Fuller, R. (2013). Bird Atlas 2007-11: The breeding and wintering birds of Britain and Ireland. British Trust for Ornithology.

and the remainder 60 species) were recorded in the wintering season. Not all of these species will be breeding or wintering on the specific sites given the wider 10km search area but it is shown that a wide range of bird species occur in the area.

62. Based on Irish conservation status (Colhoun & Cummins, 2013) there were 10 red-listed and 28 amber-listed species (**Appendix 9.2**) and there were 19 red-listed and 19 amber-listed species recorded of conservation priority in the UK (Eaton et al., 2015). There were seven raptor species recorded (buzzard, hen harrier, goshawk kestrel, merlin, peregrine and sparrowhawk; **Appendix 9.2**) in the area in the BTO Atlas maps (Balmer et al., 2013). There were a range of wader species recorded including common sandpiper, lapwing, snipe, curlew and woodcock (**Appendix 9.2**).

3.2.3. Raptor records

63. The NIRSG and historical knowledge from this area of Dr Marc Ruddock record the presence of eight different raptor species at the 10 km square resolution within ID01, ID02, ID11 and ID12 namely; buzzard, hen harrier, kestrel, merlin, long-eared owl, peregrine, goshawk and sparrowhawk (**Table 9.6**). The majority of these species were associated with the 10 km square ID12. A smaller number of less common species have been recorded in the area (some of which are corroborated by the NBN data (**Table 9.4**) but not known to be breeding including golden eagle, white-tailed eagle, osprey, hobby, honey buzzard and marsh harrier. Eagle sightings in particular have typically been immature, non-territory holding individuals (M. Ruddock, personal observations).

64. Hen harriers in this area are primarily located in young forest plantations and/or heather lacunas within the forest plantations (M. Ruddock, personal observation) rather than on open moorland and are not known to occur within the survey area or within 500 m, but certainly occur within 2 km including in recent years (M. Ruddock, personal observation).

65. A review of published data for hen harrier is available from recent national hen harrier surveys (Hayhow et al., 2013[15]; Wotton et al., 2018[16]) where in 2010, there were 13 pairs of hen harrier recorded in the Antrim Hills SPA. However, in 2016, the SPA had declined to nine pairs which is considerably lower than the 25 pairs recorded at designation of the SPA. Wotton et al., (2018) note that the SPA populations in Northern Ireland have declined by approximately 50% since designation.

66. Collectively, through various data sources, historically one to two pairs of hen harrier typically occur within 2 – 3 km of the survey area and this species has historically nested both in deep heather and in tree nests within the SPA boundary and also in areas outside the SPA boundary including in adjacent lands. Similarly, merlin are known to have occurred along the forest edge within the SPA and within 1 – 2 km of the survey area. Further surveys and on the extant locations of this species are recorded in this report.

Table 9.6. Details of raptor species known to occur within adjacent 10km squares

Latin name	Common name	Species	ID01	ID02	ID11	ID12
Tyto alba	Barn owl	BO	No records	No records	No records	No records
Buteo buteo	Buzzard	BZ	Confirmed	Confirmed	Confirmed	Confirmed
Aquila chrysaetos	Golden Eagle	EA	No records	No records	No records	Sightings
Accipiter gentilis	Goshawk	GI	No records	No records	No records	Confirmed
Circus cyaneus	Hen harrier	HH	Sightings	No records	Confirmed	Confirmed
Falco subbuteo	Hobby	HY	No records	No records	No records	Sightings
Pernis apivorous	Honey Buzzard	HZ	No records	No records	No records	Sightings
Falco tinnunculus	Kestrel	K.	Confirmed	Confirmed	Probable	Confirmed
Asio otus	Long-eared owl	LE	Confirmed	No records	No records	No records
Circus aeruginosus	Marsh harrier	MR	No records	No records	No records	Sightings
Falco columbarius	Merlin	ML	Confirmed	No records	Confirmed	Confirmed
Pandion halietus	Osprey	OP	No records	No records	Sightings	No records
Falco peregrinus	Peregrine	PE	No records	Confirmed	Confirmed	Confirmed
Milvus milvus	Red Kite	KT	Sightings	No records	No records	No records
Asio flammeus	Short-eared owl	SE	No records	No records	No records	No records
Accipiter nisus	Sparrowhawk	SH	Probable	Confirmed	Confirmed	Confirmed
Haliaeetus albicilla	White-tailed eagle	WE	No records	No records	No records	Sightings

3.2.4. Whooper swan

67. Robinson *et al.,* (2004) published All-Ireland whooper swan wintering sites and more recently whooper swan have been recorded breeding in Ireland (see Balmer *et al.,* 2013). Based on these published data, wintering whooper swan are known to occur closest at 12.2 km from the nearest existing turbines but ranged between 12.3 km and 20.1 km (**Figure 9.5**) away from the site boundary.

68. Other data sources collated here have recorded whooper swans in other areas and some were recorded in these primary surveys including during dawn or dusk roost watches. Recent Bird Atlas data (Balmer *et al.,* 2013) recorded swans in the 10km squares which contain the site boundary and/or associated survey buffers.

69. Therefore cumulatively, whooper swan are recorded to occur in other 10km squares over a much wider area including the site (Figure 9.1) and there are numerous potential suitable stop-over or roosting loughs although this prediction would require to be examined during more extensive bird surveys.

3.2.5. Waders & red grouse

70. The biodiversity databases record common sandpiper, curlew, golden plover, jack snipe, lapwing, redshank, ringed plover, snipe and woodcock (**Table 9.3**) although no time frame (or season) of sightings is provided in those databases. In recent surveys (Balmer *et al.,* 2013) there were only a smaller range of species recorded some of which may occur in habitats not present within the site boundary and/or wider survey buffer areas. This wider area is also known to historically have held curlew in the previous Bird Atlas (1988 – 1991; Gibbons *et al.,* 1994[17]).

71. Curlew and snipe appear to be the most likely priority breeding wader species based on these data and habitat is eminently suitable in and around the windfarm and landownership areas. These species do occur in the area as confirmed by field surveys and confirmed via data requests and on the basis of extant / suitable habitats in the area and it would be expected that this species would occur during breeding bird surveys.

72. Red grouse surveys conducted by Allen *et al.,* (2004) do report red grouse occurrence in all these 10km squares and across most of the survey buffers where suitable habitat occurs (**Figure 9.6**). All aggregated data sources including NBN and BTO data requests confirm the presence of this species in the locality and field surveys shall confirm red grouse distribution and abundance, including within the survey area and in the wider 500 m buffer area (**Figure 9.1**).

3.3. Field Surveys 2014 - 2015

73. The results of the range of surveys undertaken between 2014 and 2015 are described in further details here and then further analysis and interpretation is undertaken in **Chapter 9 – Ornithology** of the ES.

74. The suite of surveys carried out during 2014 included breeding bird surveys, winter walkover surveys, breeding and wintering vantage point surveys, migration vantage point surveys and breeding and wintering priority species surveys. This suite of surveys was conducted over a 13 month period between January 2014 and February 2015.

[15]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 the Isle of Man in 2010. Bird Study 60: 446-458.
[16] Wotton, S., Bladwell, S., Morris, N., Raw, D., Ruddock, M., Stevenson, A., Stirling-Aird, P. & Eaton, M. (2018) Status of the Hen Harrier *Circus cyaneus* in the UK and Isle of Man in 2016. Bird Study 65: 145-160.
[17] Gibbons, D.W., Reid, J.B. & Chapman, R.A. (1993). *The New Atlas of Breeding Birds in Britain and Ireland: 1988-1991.* London: Poyser.

3.3.1. Breeding Bird Surveys

75. Breeding season transect surveys were carried out between during April and July 2014 (**Table 9.7**). There were 103 hours and 30 minutes of transect surveys undertaken, covering the survey area and both the 500 m buffer, for all species, and the 800 m buffer, for priority species (curlew) (see also Section 9.3.3.6.3 for curlew analysis).

76. Two parts of the site boundary were not accessible (**Figure 9.7**) for walkover surveys, but both of these parcels were surveyed using visual and auditory observations from the adjacent landownership areas. There were not considered to be any constraints to species detection undertaking this method and neither parcel has any proposed infrastructure and these parcels also had extant turf extraction activities and extant turbines in the southern parcel and also historical hard-standing infrastructure, a single wind turbine and historical land drainage in the northern parcel (**Figure 9.2**).

Table 9.7 Summary of survey effort and weather during breeding bird surveys

Month	Day	Year	Obs	Start	End	Dur	Cloud Cover	Cloud Height (m)	Wind - Dir & Speed	Precip	Vis (km)
04	10	2014	AM	06:45	11:45	05:00	10	600	SW4	NIL	3
04	10	2014	KH	06:45	11:45	05:00	10	400	WSW3	ILR	5
04	22	2014	AM	10:30	14:15	03:45	9	450	E4	NIL	5
04	22	2014	MR	10:25	14:15	03:50	9	450	E4	NIL	5
04	22	2014	KH	10:30	14:15	03:45	10	500	NE4	NIL	5
04	28	2014	KH	10:40	14:00	03:20	10	450	E2	NIL	4
04	28	2014	AM	10:40	14:00	03:20	10	450	E2	NIL	4
04	28	2014	MR	10:40	14:00	03:20	9	900	E2	NIL	5
05	07	2014	KH	06:50	09:50	03:00	9	400	SW4	ILR	5
05	19	2014	AM	10:45	14:45	04:00	10	800	SE4	ILR	5
05	19	2014	KH	10:45	14:45	04:00	10	800	ESE4	ILR	5
05	19	2014	MR	10:45	14:45	04:00	10	800	SE2	ILR	5
05	19	2014	KH	15:00	18:00	03:00	10	1000	NE4	ILR	5
05	19	2014	MR	15:00	18:00	03:00	10	1000	NE4	ILR	5
05	28	2014	MR	20:45	22:05	01:20	7	1000	NE2	NIL	5
06	12	2014	AM	14:35	16:40	02:05	5	900	S2	NIL	5
06	24	2014	MR	06:45	14:55	08:10	10	400	W1	NIL	1.5
06	26	2014	MR	06:50	15:15	08:25	10	600	SE3	NIL	1
06	26	2014	AM	07:05	15:00	07:55	10	480	SE4	ILR	4
07	04	2014	AM	07:10	11:10	04:00	10	400	SW3	CLR	3
07	11	2014	AM	08:20	15:30	07:10	10	500	W2	NIL	5
07	11	2014	MR	07:55	12:00	04:05	9	700	SW2	NIL	5
07	29	2014	DR	06:35	10:30	03:55	10	500	NW2	ILR	5
07	29	2014	MR	06:25	10:30	04:05	10	500	NW2	ILR	5

77. There were 56 species recorded (**Table 9.8**) within the 500 m survey boundary (**Figure 9.1**) of which only six were red-listed species in Ireland (grey wagtail; golden plover; herring gull; meadow pipit; red grouse and whinchat; Colhoun & Cummins, 2013) and 12 UK red-listed species (Eaton et al., 2014; grasshopper warbler, grey wagtail, herring gull, house sparrow; linnet; lesser redpoll; mistle thrush; skylark; starling; song thrush; tree sparrow and whinchat).

78. There were fewer species (13) recorded within the existing 500 m turbine buffer (**Table 9.9**) including three red-listed species (Colhoun & Cummins, 2013; golden plover, meadow pipit and red grouse) and two UK red-listed species (Eaton et al., 2014; lesser redpoll and skylark). There were 14 species recorded within the 500 m turbine buffer including three red-listed species (Colhoun & Cummins, 2013; golden plover, meadow pipit and red grouse) and three UK red-listed species (Eaton et al., 2014; linnet; lesser redpoll and skylark).

79. Behavioural analysis for all the species within the 500 m survey boundary indicates that there were 43 extant species recorded and/or exhibiting breeding behaviours. There were 37 confirmed breeding species and another seven probable and nine possible breeding species respectively (**Table 9.10**; **Figures 9.8; 9.9; 9.10**). There were fewer confirmed breeding species in the existing (n = 6) and proposed (n =6) 500 m turbine buffers; and an additional one and three respectively probable and one and three possible breeding species.

80. Meadow pipits and skylarks were widespread across parts of the survey area (**Figure 9.11**) and the habitat associations of these species were evident from the distribution (**Figure 9.12**) with a scarcity in areas of improved pasture and / or afforested habitats and wider presence on the semi-improved / semi-natural habitats.

81. Analyses of breeding bird transect surveys for waders indicates that there was evidence of three to four snipe territories within the survey area and 500 m buffer of which two were located within either the 500 m existing or 500 m proposed turbine buffers. Additional territories were detected during other surveys (Sections 9.3.3.6) where cumulative analyses are undertaken of all snipe (and red grouse).

82. There were no curlew territories inside the survey area and 500 m buffer but one territory was recorded within 800 m buffer but was beyond 500 m and 800 m from any existing or proposed turbines.

83. There were three red grouse territories recorded during breeding bird surveys within the survey area and 500 m buffer but further priority species surveys were undertaken to identify the full distribution and abundance of these species in the survey areas (see Section 9.3.3.6). The same three territories identified during walkover surveys were within 500 m of existing turbines but only two were within 500 m of the proposed turbines.

84. A confirmed pair of peregrine falcons nested within the survey area and 500 m buffer and successfully fledged young (**Figure 9.8**).

Table 9.8 – Summary of numbers of territories of each species detected during breeding bird surveys inside the 500 m survey area including conservation status

Species	Confirmed	Probable	Possible	Non-breeding	TOTAL	BOCCI3	BOCC4
B.	4	18	5		27	GREEN	GREEN
BC		3			3	GREEN	GREEN
BT	3	11	8		22	GREEN	GREEN
BZ	1				1	GREEN	GREEN
CA				1	1	AMBER	GREEN
CD	1	2	1		4	GREEN	GREEN
CH	14	48	8		70	GREEN	GREEN
CT	1	6	4		11	GREEN	GREEN
D.		14	1		15	GREEN	AMBER
FP	1		2		3	GREEN	GREEN
GB				2	2	AMBER	AMBER
GC	1		2		3	AMBER	GREEN
GF		1			1	GREEN	GREEN
GH	2				2	GREEN	RED

Species	Confirmed	Probable	Possible	Non-breeding	TOTAL	BOCCI3	BOCC4
GL	1		3		4	RED	RED
GO	3	4	2		9	GREEN	GREEN
GP				1	1	RED	GREEN
GR	4	2	1		7	AMBER	GREEN
GT	3	6	4		13	GREEN	GREEN
H.				2	2	GREEN	GREEN
HC	2	5			7	GREEN	GREEN
HG				1	1	RED	RED
HM	1	4	5		10	AMBER	AMBER
HS	5	9	4		18	AMBER	RED
JD	12	16	7	4	39	GREEN	GREEN
K.				1	1	AMBER	AMBER
LB				7	7	AMBER	AMBER
LI	9	3	3		15	AMBER	RED
LR			1		1	GREEN	RED
LT			1		1	GREEN	GREEN
M.		3			3	AMBER	RED
MG	14	4	6		24	GREEN	GREEN
MP	103	198	70		371	RED	AMBER
PE	1				1	GREEN	GREEN
PH			1		1	GREEN	GREEN
PW	8	1	6		15	GREEN	GREEN
R.	7	36	1		44	AMBER	GREEN
RB	4	1	7		12	GREEN	AMBER
RG	1	1	1		3	RED	AMBER
RN	1			6	7	GREEN	GREEN
RO	3	9	4	1	17	GREEN	GREEN
S.	5	169			174	AMBER	RED
SC	8	1	4		13	AMBER	GREEN
SG	28	10	4	3	45	AMBER	RED
SH				1	1	AMBER	GREEN
SK		3			3	GREEN	GREEN
SL	17	18	7	6	48	AMBER	GREEN
SM			1		1	AMBER	GREEN
SN	3		1		4	AMBER	AMBER
ST		5			5	GREEN	RED
TS		1			1	AMBER	RED
W.	3	4	3		10	AMBER	GREEN
WC	1	1			2	RED	RED
WP	5	8	4		17	GREEN	GREEN
WR	21	24	9		54	GREEN	GREEN
WW	1	24			25	GREEN	AMBER
TOTAL	302	673	191	36	1202		

Table 9.9 – Summary of numbers of territories of each species detected during breeding bird surveys inside the existing 500 m turbine area including conservation status

Species	Confirmed	Probable	Possible	Non-breeding	TOTAL	BOCCI3	BOCC4
GP				1	1	RED	GREEN
HC	1	1			2	GREEN	GREEN
K.				1	1	AMBER	AMBER
LR			1		1	GREEN	RED
MP	45	91	29		165	RED	AMBER
RB			2		2	GREEN	AMBER
RG	1	1	1		3	RED	AMBER
RN				4	4	GREEN	GREEN
S.	2	44			46	AMBER	RED
SC	2		3		5	AMBER	GREEN
SN	2				2	AMBER	AMBER
W.		2	1		3	AMBER	GREEN
WR			3		3	GREEN	GREEN
TOTAL	53	139	40	6	238		

Table 9.9 – Summary of numbers of territories of each species detected during breeding bird surveys inside the proposed 500 m turbine area including conservation status

Species	Confirmed	Probable	Possible	Non-breeding	TOTAL	BOCCI3	BOCC4
B.		1			1	GREEN	GREEN
GP				1	1	RED	GREEN
HC	1	1			2	GREEN	GREEN
LI	1				1	AMBER	RED
LR			1		1	GREEN	RED
MP	45	109	28		182	RED	AMBER
RB			2		2	GREEN	AMBER
RG		1	1		2	RED	AMBER
RN				2	2	GREEN	GREEN

Species	Confirmed	Probable	Possible	Non-breeding	TOTAL	BOCCI3	BOCC4
S.	4	71			75	AMBER	RED
SC	2		2		4	AMBER	GREEN
SN	2				2	AMBER	AMBER
W.		2	1		3	AMBER	GREEN
WR			1		1	GREEN	GREEN
TOTAL	55	185	36	3	279		

85.

3.3.2. Wintering Bird Surveys

86. Wintering season transect surveys were carried out between September 2014 and February 2015 inclusive (**Table 9.10**). There were 43 hours and 55 minutes completed in wintering walkover surveys.

Table 9.10 Summary of survey effort and weather during wintering bird surveys

Month	Day	Year	Obs	Start	End	Dur	Cloud Cover	Cloud Height (m)	Wind - Dir & Speed	Precip	Vis (km)
09	17	2014	AM	07:00	08:30	01:30	10	250	E4	NIL	0.5
09	17	2014	AM	11:30	14:20	02:50	10	250	E4	NIL	0.5
09	29	2014	AM	11:45	15:00	03:15	5	600	SW3	NIL	5
10	06	2014	AM	06:35	09:05	02:30	8	450	S3	NIL	5
10	22	2014	AM	11:50	14:50	03:00	10	375	SW3	NIL	4
10	27	2014	AM	08:05	11:05	03:00	10	350	SW4	ILR	1
11	18	2014	KH	08:10	09:40	01:30	6	450	SE4	NIL	5
11	18	2014	KH	12:40	14:10	01:30	6	500	SE5	NIL	5
11	25	2014	KH	08:10	10:40	02:30	9	500	E3	NIL	5
11	25	2014	KH	13:40	14:40	01:00	10	400	E4	NIL	1.5
12	09	2014	KH	13:10	16:10	03:00	10	300	SW5	CLR	0.5
12	30	2014	KH	10:00	11:30	01:30	7	600	SW4	NIL	5
12	30	2014	KH	14:30	16:00	01:30	6	900	SW5	NIL	5
01	24	2015	MR	09:55	14:05	04:10	7	750	W4	NIL	3
01	26	2015	AM	12:25	15:40	03:15	8	600	NW4	NIL	5
02	04	2015	AM	14:05	15:40	01:35	6	800	NE2	NIL	5
02	18	2015	KH	12:35	15:35	03:00	10	400	SW5	ILR	5
02	25	2015	KH	12:15	15:35	03:20	10	300	SW4	ILR	0.5

87. There were 412 observation of 1,447 individuals from 39 species recorded (**Tables 9.11; Figure 9.13)** within the 500 m survey area (**Figure 9.1**) of which only five were red-listed species in Ireland (grey wagtail, golden plover, meadow pipit, red grouse and woodcock; Colhoun & Cummins, 2013) and 10 UK red-listed species (fieldfare, grey wagtail, house sparrow, mistle thrush, skylark, starling, song thrush, tree sparrow and woodcock; Eaton et al., 2014).

88. There were fewer species (91 observations of 194 individuals from 14 species) recorded within the 500 m existing turbine buffer (**Tables 9.12**) including four red-listed species (Colhoun & Cummins, 2013; golden plover, meadow pipit, red grouse, and woodcock) and four UK red-listed species (Eaton et al., 2014; linnet, skylark, starling and woodcock).

89. Whilst within the proposed turbine 500 m buffer there were 111 detections of 250 individuals from 15 species (**Table 9.13**) including five red-listed species (Colhoun & Cummins, 2013; grey wagtail, golden plover, meadow pipit, red grouse, and woodcock) and four UK red-listed species (Eaton et al., 2014; linnet, skylark, starling and woodcock).

Table 9.11. Summary of numbers of each species detected during wintering bird surveys inside the 500 m survey area including conservation status

Species	No. of detections	No. of individuals	BOCCI3	BOCC4
B.	13	13	GREEN	GREEN
BT	13	17	GREEN	GREEN
BZ	8	9	GREEN	GREEN
CD	1	1	GREEN	GREEN
CH	19	30	GREEN	GREEN
CT	3	4	GREEN	GREEN
D.	5	6	GREEN	AMBER
FF	3	48	GREEN	RED
FP	2	4	GREEN	GREEN
GL	1	2	RED	RED
GO	1	1	GREEN	GREEN
GP	3	16	RED	GREEN
GT	8	14	GREEN	GREEN
H.	1	1	GREEN	GREEN
HC	32	61	GREEN	GREEN
HS	3	9	AMBER	RED
JD	23	223	GREEN	GREEN
K.	4	4	AMBER	AMBER
LI	6	20	AMBER	RED
M.	5	7	AMBER	RED
MG	20	28	GREEN	GREEN
MP	59	163	RED	AMBER
PE	1	1	GREEN	GREEN
PW	11	14	GREEN	GREEN
R.	22	23	AMBER	GREEN
RG	2	2	RED	AMBER
RN	16	27	GREEN	GREEN
RO	23	181	GREEN	GREEN
S.	4	9	AMBER	RED
SC	5	5	AMBER	GREEN

Species	No. of detections	No. of individuals	BOCCI3	BOCC4
SG	18	322	AMBER	RED
SH	1	1	AMBER	GREEN
SN	28	31	AMBER	AMBER
ST	2	2	GREEN	RED
TS	1	7	AMBER	RED
W.	10	13	AMBER	GREEN
WK	2	2	RED	RED
WP	5	44	GREEN	GREEN
WR	28	32	GREEN	GREEN
TOTAL	412	1447		

Table 9.12 – Summary of numbers of each species detected during wintering bird surveys inside the existing 500 m turbine area including conservation status

Species	No. of detections	No. of individuals	BOCCI3	BOCC4
GP	3	16	RED	GREEN
HC	5	7	GREEN	GREEN
K.	1	1	AMBER	AMBER
LI	2	8	AMBER	RED
MP	36	87	RED	AMBER
RG	2	2	RED	AMBER
RN	5	13	GREEN	GREEN
S.	2	6	AMBER	RED
SC	4	4	AMBER	GREEN
SG	1	13	AMBER	RED
SN	19	22	AMBER	AMBER
W.	6	9	AMBER	GREEN
WK	1	1	RED	RED
WR	4	5	GREEN	GREEN
TOTAL	91	194		

Table 9.13 – Summary of numbers of each species detected during wintering bird surveys inside the proposed 500 m turbine area including conservation status

Species	No. of detections	No. of individuals	BOCCI3	BOCC4
GL	1	2	RED	RED
GP	3	16	RED	GREEN
HC	10	17	GREEN	GREEN
K.	1	1	AMBER	AMBER
LI	2	8	AMBER	RED
MP	44	124	RED	AMBER
RG	1	1	RED	AMBER
RN	6	14	GREEN	GREEN
S.	4	9	AMBER	RED
SC	4	4	AMBER	GREEN
SG	1	13	AMBER	RED
SN	23	26	AMBER	AMBER
W.	6	9	AMBER	GREEN
WK	1	1	RED	RED
WR	4	5	GREEN	GREEN
TOTAL	111	250		

3.3.3. Breeding Vantage Point Surveys

90. There were 36 to 39 hours observation completed at each of the four vantage points between March 2014 and August 2014 (**Tables 9.14 & 9.15**). The additional three-hour vantage point in June was to help establish breeding curlew activity in the locality. Cumulative observation time from all vantage points over the survey area was 147 hours during the study period (**Table 9.15**). Survey times ranged from 05.50 hrs to 23.05 hrs (**Table 9.14**) and covered a wide range of weather conditions (**Table 9.16**).

Table 9.14 – Breeding vantage point survey effort

Type	VP No	Observer	Month	Day	Year	Start	End	Duration
BVP	1	DR	3	19	2014	07:50	10:50	03:00
BVP	2	DR	3	26	2014	13:05	16:05	03:00
BVP	1	KH	3	26	2014	10:05	13:05	03:00
BVP	3	AM	3	26	2014	10:10	13:10	03:00
BVP	3	KH	3	26	2014	13:15	16:15	03:00
BVP	4	AM	3	26	2014	13:25	16:25	03:00
BVP	2	DR	3	29	2014	12:20	15:20	03:00
BVP	4	MR	3	29	2014	12:25	15:25	03:00
BVP	2	AM	4	10	2014	11:50	14:50	03:00
BVP	4	KH	4	15	2014	07:40	10:40	03:00
BVP	3	AM	4	15	2014	07:50	10:50	03:00
BVP	1	KH	4	22	2014	15:00	18:00	03:00

Type	VP No	Observer	Month	Day	Year	Start	End	Duration
BVP	4	AM	4	22	2014	15:15	18:15	03:00
BVP	2	DR	4	24	2014	06:05	09:05	03:00
BVP	1	DR	4	24	2014	09:10	12:10	03:00
BVP	3	DR	4	28	2014	09:30	12:30	03:00
BVP	1	DR	5	7	2014	06:50	09:50	03:00
BVP	3	DR	5	7	2014	09:55	12:55	03:00
BVP	4	DR	5	13	2014	06:00	09:00	03:00
BVP	1	DR	5	13	2014	09:10	12:10	03:00
BVP	4	DR	5	19	2014	11:45	14:45	03:00
BVP	2	DR	5	19	2014	15:20	18:20	03:00
BVP	2	MR	5	19	2014	20:05	23:05	03:00
BVP	3	DR	5	27	2014	05:50	08:50	03:00
BVP	4	DR	6	5	2014	08:00	11:00	03:00
BVP	1	AM	6	5	2014	08:15	11:15	03:00
BVP	2	DR	6	7	2014	06:35	09:35	03:00
BVP	3	DR	6	7	2014	10:00	13:00	03:00
BVP	1	DR	6	13	2014	05:55	08:55	03:00
BVP	1	DR	6	24	2014	07:50	10:50	03:00
BVP	3	DR	6	24	2014	11:00	14:00	03:00
BVP	2	DR	6	26	2014	08:35	11:35	03:00
BVP	4	DR	6	26	2014	12:05	15:05	03:00
BVP	3	DR	7	4	2014	08:10	11:10	03:00
BVP	1	DR	7	4	2014	11:15	14:15	03:00
BVP	2	DR	7	11	2014	08:25	11:25	03:00
BVP	4	DR	7	11	2014	11:40	14:40	03:00
BVP	4	DR	7	17	2014	08:50	11:50	03:00
BVP	3	DR	7	17	2014	12:05	15:05	03:00
BVP	1	DR	7	25	2014	05:55	08:55	03:00
BVP	2	DR	7	29	2014	10:45	13:45	03:00
BVP	1	AM	8	6	2014	07:55	10:55	03:00
BVP	4	DR	8	6	2014	07:45	10:45	03:00
BVP	4	MR	8	12	2014	11:35	14:35	03:00
BVP	3	DR	8	13	2014	08:10	11:10	03:00
BVP	2	DR	8	28	2014	06:15	09:15	03:00
BVP	1	DR	8	28	2014	09:25	12:25	03:00
BVP	2	DR	8	30	2014	09:10	12:10	03:00
BVP	3	MR	8	30	2014	09:35	12:35	03:00

Table 9.15 – Breeding vantage point survey effort by month

VP No.	Mar	Apr	May	Jun	Jul	Aug	TOTAL
1	6	6	6	9	6	6	39
2	6	6	6	6	6	6	36
3	6	6	6	6	6	6	36
4	6	6	6	6	6	6	36
TOTAL	24	24	24	30	24	24	147

Table 9.16 – Breeding vantage point weather conditions

VP & DATE			Cloud Cover				Cloud Height (m)				Wind - Direction & Speed				Precipitation				Visibility (km)			
VP No.	M	D	0	+1	+2	+3	0	+1	+2	+3	0	+1	+2	+3	0	+1	+2	+3	0	+1	+2	+3
1	3	19	14	10	10	8	7	500	500	500	500	SW3	SW3	SW3	SW3	NIL	NIL	NIL	NIL	2.5	2.5	3	3
2	3	26	14	10	9	6	4	400	500	500	1000	N2	N2	NE2	NE2	ILM	ILM	NIL	NIL	2.5	2.5	2.5	3
1	3	26	14	10	10	10	10	400	400	400	400	NE3	NE3	NE3	NE4	ILR	ILR	ILR	CLR	1.5	1.5	2	2
3	3	26	14	10	10	10	9	350	380	380	450	E2	E1	E2	E3	ILR	ILR	ILR	NIL	2	2	3	5
3	3	26	14	10	6	4	4	450	600	600	600	NE3	NE2	NE2	NE2	ILR	NIL	NIL	NIL	2.5	5	5	5
4	3	26	14	8	8	5	4	550	500	600	600	E3	E3	E3	E2	NIL	NIL	NIL	NIL	5	5	5	5
2	3	29	14	10	10	10	7	450	450	400	500	SE4	SE4	SE5	SE5	ILR	CLM	CLM	NIL	0.5	1	1	1.5
4	3	29	14	10	10	10	9	550	550	800	1000	SE4	SE4	SE4	SE3	ILR	ILR	NIL	NIL	1	1	2	2
2	4	10	14	10	10	10	10	500	600	600	450	SW4	SW4	SW4	SW4	ILR	ILR	ILR	ILR	3	5	3	2
4	4	15	14	3	3	4	3	900	900	900	900	E4	E4	SE4	SE4	NIL	NIL	NIL	NIL	5	5	5	5
3	4	15	14	1	2	2	2	800	900	900	900	SE2	SE3	SE3	SE3	NIL	NIL	NIL	NIL	5	5	5	5
1	4	22	14	9	9	8	9	500	500	500	500	E4	E4	E4	E4	NIL	ILR	NIL	NIL	5	5	5	5
4	4	22	14	6	7	8	8	600	600	600	600	SE4	SE4	SE4	SE4	NIL	NIL	NIL	NIL	5	5	5	5
2	4	24	14	9	10	10	10	450	400	380	400	SE3	SE3	SE3	SE3	NIL	NIL	NIL	NIL	3	3	3	3
1	4	24	14	10	8	5	5	400	450	500	500	SE3	S2	S2	S2	NIL	NIL	NIL	NIL	3	3	3	2.5
3	4	28	14	10	10	3	10	400	400	400	400	E2	E2	E2	E2	CLM	ILM	NIL	CLM	1.5	2	2	1.5
1	5	7	14	10	10	10	10	400	400	375	375	S3	SW3	SW3	SW3	NIL	NIL	CLR	CLR	3	2	2	2
3	5	7	14	10	10	10	10	350	350	350	350	SW3	SW4	SW4	SW4	CLR	CHR	CLR	CHR	0.5	0.5	1	1
4	5	13	14	8	8	8	9	400	450	400	400	W1	W2	W1	W1	NIL	NIL	NIL	ILM	5	5	5	5
1	5	13	14	9	9	8	8	400	400	450	500	NW3	NW3	NW2	NW2	NIL	NIL	NIL	NIL	3	3	3	3
4	5	19	14	10	10	9	9	500	500	700	700	SE2	SE2	E3	E3	NIL	CLR	CLR	NIL	3	3	3	3
2	5	19	14	9	10	9	9	700	700	700	700	E3	E3	NE3	E3	NIL	NIL	NIL	NIL	3	3	3	3
2	5	19	14	10	10	10	10	500	400	700	800	NE2	NE3	NE3	NE3	NIL	NIL	NIL	NIL	2	1	2	2
3	5	27	14	2	1	2	2	400	500	500	500	SE2	SE2	S2	S2	NIL	NIL	NIL	NIL	3	3	3	3
4	6	5	14	10	10	10	10	375	375	400	375	NW4	NW4	W4	NW4	CLR	ILR	NIL	NIL	1.5	1.5	1.5	2
1	6	5	14	10	10	10	10	300	350	350	350	NW3	NW3	NW3	NW3	NIL	NIL	NIL	NIL	2	3	4	4

VP & DATE			Cloud Cover				Cloud Height (m)				Wind - Direction & Speed				Precipitation				Visibility (km)			
VP No.	M	D	0	+1	+2	+3	0	+1	+2	+3	0	+1	+2	+3	0	+1	+2	+3	0	+1	+2	+3
2	6	7	14	10	10	10	10	450	450	400	400	SE5	SE5	SE5	SE5	NIL	ILR	CHR	ILR	2.5	2	1	1.5
3	6	7	14	10	10	10	10	400	375	375	375	SE4	SE5	SE5	SE4	ILR	CHR	ILR	ILR	2	1	1.5	1.5
1	6	13	14	6	6	7	7	600	750	750	750	SW2	SW2	SW2	SW3	NIL	NIL	NIL	NIL	2.5	2.5	2.5	2.5
1	6	24	14	10	10	10	10	375	375	400	400	NW2	NW2	NW2	NW2	CLM	NIL	CLR	ILR	2	2	1.5	2
3	6	24	14	10	10	10	10	420	420	450	450	NW2	NW3	NW2	NW2	CLM	CLR	CLR	NIL	2	1.5	1.5	2
2	6	26	14	10	10	10	10	400	350	350	350	SE4	SE4	SE4	SE4	ILM	IHM	IHM	IHM	2	1	0.5	0.5
4	6	26	14	10	10	10	10	350	350	350	400	SE4	SE4	SE4	SE3	CLM	ILR	NIL	ILR	2.5	2.5	2	2
3	7	4	14	10	10	10	10	400	375	375	400	SW3	SW3	SW3	SW3	CLR	CHR	CHR	CLR	1.5	1.5	1.5	1.5
1	7	4	14	10	10	10	10	400	450	450	350	SW3	SW3	SW3	SW3	CLR	CLR	IHR	IHR	1.5	1.5	1	1.5
2	7	11	14	8	9	10	10	750	750	750	500	W3	W2	W3	W3	NIL	NIL	NIL	ILR	5	5	5	5
4	7	11	14	10	9	8	8	500	500	500	500	SW3	SW3	SW3	SW3	NIL	NIL	NIL	NIL	5	5	5	5
4	7	17	14	6	6	7	8	750	750	750	750	S2	S2	S2	S2	NIL	NIL	NIL	NIL	3	5	5	5
3	7	17	14	8	6	6	5	750	750	750	750	S3	S2	S3	S3	NIL	NIL	NIL	NIL	3	3	3	3
1	7	25	14	2	1	1	0	900	900	900	-	SE1	SE1	SE1	E1	NIL	NIL	NIL	NIL	3	3	3	3
2	7	29	14	10	10	10	10	400	575	500	500	NW4	NW4	NW4	NW4	ILR	ILR	NIL	NIL	1.5	1.5	3	3
1	8	6	14	8	10	9	7	450	380	480	500	NW1	NW1	NW1	NW1	NIL	NIL	NIL	NIL	3	3	4	5
4	8	6	14	8	10	10	10	500	400	375	375	W1	W1	W1	W1	NIL	ILM	NIL	NIL	2.5	2	2	2.5
4	8	12	14	10	10	10	10	450	450	400	400	S3	S2	S2	SW2	ILR	ILR	NIL	IHR	2	1.5	1.5	2
3	8	13	14	10	10	10	10	375	400	375	400	NW3	NW3	NW3	NW3	IHR	ILR	NIL	NIL	1.5	2	2	2
2	8	28	14	10	10	10	10	300	300	350	300	S3	S3	S3	S2	IHM	ILR	IHM	IHM	0.5	1	0.5	1
1	8	28	14	10	9	8	8	300	375	400	450	S2	S3	S3	S3	ILR	NIL	NIL	NIL	1	2	2.5	2.5
2	8	30	14	8	7	9	9	500	500	500	500	W3	W4	W3	W3	NIL	ILR	ILR	ILR	5	5	5	5
3	8	30	14	5	5	7	8	900	900	900	1000	SW2	SW2	SW2	SW2	NIL	NIL	NIL	NIL	2	2	2	2

91. There were 12 target species (**Table 9.1**) recorded inside the survey area and 500 m buffer; buzzard, cormorant, common gull, curlew, heron, kestrel, lesser black-backed gull, peregrine, red grouse, raven, sparrowhawk and snipe (**Tables 9.17 & 9.18**). The occurrence rate of the detected species was less than 2% of total observation time for five species, and greater than 2% for seven species (**Table 9.18**) with most frequently recorded were raven and lesser black-backed gull accounting for 75% of the observation duration. As requested by NIEA, buzzard, kestrel and raven flights were additionally mapped (**Figures 9.14; 9.15 & 9.16**, see also Section 9.3.3.4).

Table 9.17 – Breeding vantage point sightings records recorded within the survey area and 500 m buffer.

VP No	Month	Day	Year	Target	Species	Number	Time Detected	Number of 5 min intervals	Comments
1	3	19	2014	2	RN	1	08:40	1	
1	3	19	2014	2	LB	2	09:00	1	
1	3	19	2014	2	RN	2	09:20	1	
1	3	19	2014	2	RN	1	09:45	1	
1	3	19	2014	2	K.	1	10:20	1	Direct undulating flight, disappeared for part of flight behind small hill.
2	3	26	2014	2	RN	1	13:35	1	
2	3	26	2014	2	RN	1	13:50	1	
2	3	26	2014	2	RN	1	15:10	1	Dropped below blade height.
2	3	26	2014	2	RN	1	15:20	1	
4	3	26	2014	2	BZ	1	13:30	1	BZ lifted from fence to perch in tree, flew from tree to tree.
4	3	26	2014	2	RN	4	13:35	1	Calling and tumbling on southern ridge.
4	3	26	2014	2	LB	1	13:45	2	
4	3	26	2014	2	RN	3	14:00	3	East down valley, perched on fence.
4	3	26	2014	2	RN	1	14:00	2	Second bird flew up and down valley.
4	3	26	2014	2	RN	1	15:15	1	Calling flying high over Corkey
4	3	26	2014	2	RN	1	15:35	2	Mobbing HC (2)
4	3	29	2014	2	RN	1	12:45	1	
4	3	29	2014	2	RN	1	13:50	1	
4	3	29	2014	2	RN	1	14:00	1	
4	4	15	2014	2	RN	1	08:20	1	Flying and foraging
4	4	15	2014	2	RN	2	08:35	1	Flying , foraging and chased by 2 HC
4	4	15	2014	2	LB	2	08:35	1	Flying calling and foraging in grass
4	4	15	2014	2	BZ	1	09:30	1	
1	4	22	2014	2	RN	2	16:25	1	Flying low north to east
1	4	22	2014	2	LB	2	17:35	1	Flying west to east
4	4	22	2014	2	SH	1	16:15	1	Chased by HC (1)
4	4	22	2014	2	LB	2	16:45	1	Calling, landed in field south-west of VP
4	4	22	2014	2	RN	1	16:50	1	
4	4	22	2014	2	RN	2	17:20	1	Flying from direction of alarming CU which was off-site
4	4	22	2014	2	LB	2	17:40	1	Flew north calling
4	4	22	2014	2	RN	2	17:45	1	Flew south
2	4	24	2014	2	RN	1	07:00	1	
2	4	24	2014	2	RN	2	07:40	1	
2	4	24	2014	2	K.	1	08:25	1	
1	4	24	2014	2	CA	1	09:35	1	
1	4	24	2014	2	H.	1	10:10	1	

VP No	Month	Day	Year	Target	Species	Number	Time Detected	Number of 5 min intervals	Comments
1	4	24	2014	2	RN	2	10:35	1	
1	4	24	2014	2	RN	1	11:20	1	
3	4	28	2014	2	SN	2	10:40	1	Bleating, heard calling
1	5	7	2014	2	LB	1	07:10	1	
1	5	7	2014	1	CU	1	07:20	1	
1	5	7	2014	2	RN	2	07:35	1	
4	5	13	2014	2	RN	2	06:10	15	
4	5	13	2014	2	LB	2	08:35	1	
1	5	13	2014	2	RN	1	09:35	1	
1	5	13	2014	2	LB	1	10:45	1	
1	5	13	2014	2	K.	1	11:05	1	
4	5	19	2014	2	RN	2	12:05	1	
4	5	19	2014	2	LB	2	13:55	1	
2	5	19	2014	2	LB	1	16:20	1	
2	5	19	2014	2	BZ	1	16:45	1	
2	5	19	2014	2	RN	1	17:05	1	
2	5	19	2014	2	RN	3	17:40	1	Playing and tumbling
2	5	19	2014	2	SN	1	21:10	1	
2	5	19	2014	2	SN	1	21:35	1	
2	5	19	2014	2	SN	1	22:10	1	
2	5	19	2014	2	RN	1	22:15	1	
2	5	19	2014	2	SN	1	22:40	1	
3	5	27	2014	2	RN	1	06:55	1	
3	5	27	2014	2	CA	3	08:05	1	
3	5	27	2014	2	K.	1	08:15	1	
4	6	5	2014	2	RN	1	09:55	1	
4	6	5	2014	2	LB	2	10:25	1	
1	6	5	2014	2	LB	6	09:15	1	
2	6	7	2014	1	PE	1	07:30	1	Male flew off quarry face
2	6	7	2014	2	RN	2	09:15	1	
3	6	7	2014	2	K.	1	10:55	1	
3	6	7	2014	2	RN	1	11:40	1	
1	6	13	2014	2	K.	1	06:50	1	Hunting
1	6	13	2014	2	RN	2	07:10	1	
1	6	13	2014	2	RN	1	08:05	1	
1	6	13	2014	2	LB	1	08:25	1	
1	6	24	2014	2	RN	1	08:25	1	
1	6	24	2014	2	LB	1	08:40	1	
1	6	24	2014	2	SN	1	08:50	1	Heard calling
1	6	24	2014	1	CU	1	09:10	1	
1	6	24	2014	2	SH	1	09:35	1	Female

VP No	Month	Day	Year	Target	Species	Number	Time Detected	Number of 5 min intervals	Comments
3	6	24	2014	2	RN	1	12:55	1	
3	6	24	2014	2	LB	1	13:30	1	
3	6	24	2014	2	LB	2	13:45	1	
2	6	26	2014	2	RN	1	10:10	1	Heard calling
4	6	26	2014	2	LB	2	13:10	1	
4	6	26	2014	2	BZ	1	13:55	1	
4	6	26	2014	2	LB	1	14:15	1	
3	7	4	2014	2	LB	1	09:15	1	
2	7	11	2014	2	BZ	2	08:55	1	Circling / soaring bird landed in trees.
2	7	11	2014	2	CM	7	09:50	1	
2	7	11	2014	2	RN	1	10:15	1	
2	7	11	2014	2	LB	1	11:00	1	
4	7	11	2014	1	CU	1	11:45	1	
4	7	11	2014	2	LB	2	12:35	1	
4	7	11	2014	2	RN	1	12:45	1	On ground then flew
4	7	11	2014	2	RN	1	13:10	1	
4	7	11	2014	2	LB	1	13:45	1	
4	7	11	2014	2	K.	1	14:20	1	Hunting / hovering, attacked by PE (half hearted). Interacted for 35s before peregrine climbed and kestrel escaped.
4	7	11	2014	1	PE	1	14:20	1	Female
4	7	17	2014	2	BZ	1	09:30	1	
4	7	17	2014	2	RN	1	10:05	1	
4	7	17	2014	1	PE	2	11:10	1	Continual circling/ calling, lazy drift across site (north to south). Male and juvenile
4	7	17	2014	2	BZ	2	11:20	1	Circling
4	7	17	2014	2	LB	1	11:25	1	
3	7	17	2014	2	RN	1	12:40	1	
3	7	17	2014	2	CA	1	13:15	1	
3	7	17	2014	2	LB	2	14:20	1	
1	7	25	2014	2	RN	2	06:30	1	
1	7	25	2014	2	CA	1	07:05	1	
1	7	25	2014	2	LB	2	07:45	1	
2	7	29	2014	2	RN	2	11:10	1	Circling, playing in wind, close to turbine.
2	7	29	2014	2	RN	1	11:42	1	
2	7	29	2014	2	RN	2	13:20	1	
4	8	6	2014	2	RN	1	08:10	1	
4	8	6	2014	2	LB	1	08:40	1	
4	8	6	2014	2	RN	1	09:10	1	

VP No	Month	Day	Year	Target	Species	Number	Time Detected	Number of 5 min intervals	Comments
4	8	6	2014	2	RN	2	09:20	1	
4	8	6	2014	2	RN	1	09:25	1	
4	8	6	2014	2	RN	1	09:35	1	
4	8	12	2014	2	RN	2	11:40	1	Feeding on dead livestock
4	8	12	2014	2	RN	1	12:10	1	
4	8	12	2014	2	RN	1	12:55	1	
4	8	12	2014	2	RN	2	13:30	1	
4	8	12	2014	2	LB	4	13:35	1	
4	8	12	2014	2	RN	2	13:40	1	
3	8	13	2014	2	RN	1	08:45	1	
2	8	28	2014	2	RN	1	06:55	1	Heard calling
2	8	28	2014	2	RN	1	07:40	1	Heard calling
2	8	28	2014	2	LB	2	08:25	1	
2	8	28	2014	2	RN	2	09:00	1	
2	8	28	2014	2	RN	1	09:10	1	Heard calling
1	8	28	2014	2	RN	2	09:40	1	
1	8	28	2014	2	RN	1	09:50	1	
1	8	28	2014	2	SN	1	10:05	1	Disturbed by grazing cattle.
1	8	28	2014	2	RN	1	10:20	1	
1	8	28	2014	2	H.	1	11:05	1	
2	8	30	2014	2	RN	6	09:35	1	
2	8	30	2014	2	RN	1	09:45	1	
2	8	30	2014	2	RG	1	10:00	1	Disturbed by hunting fox 200m below vp.
2	8	30	2014	1	PE	1	10:30	1	Female went out of sight over rise but possibly hunting of starling flock.
2	8	30	2014	2	BZ	5	10:35	1	Circling, hovering, soaring.
2	8	30	2014	2	RN	1	11:00	1	Mobbing buzzard.
2	8	30	2014	2	BZ	2	11:00	1	
2	8	30	2014	2	RN	1	11:20	1	
2	8	30	2014	2	RN	1	11:35	1	
3	8	30	2014	2	RN	1	10:15	1	
3	8	30	2014	2	RG	1	10:45	1	Calling
3	8	30	2014	2	RN	2	10:50	1	

Table 9.18 – Breeding vantage point aggregated species sightings records within the survey area and 500 m buffer.

Species	Number of detections	%	Number of five minute intervals	%
BZ	9	6.2	9	5.5
CA	4	2.8	4	2.4
CM	1	0.7	1	0.6
CU	3	2.1	3	1.8
H.	2	1.4	2	1.2
K.	7	4.8	7	4.3
LB	29	20.0	30	18.3
PE	4	2.8	4	2.4
RG	2	1.4	2	1.2
RN	75	51.7	93	56.7
SH	2	1.4	2	1.2
SN	7	4.8	7	4.3
TOTAL	145		164	

92. Two target 1 species (**Table 9.18**) were recorded (**Tables 9.18 & 9.19**); curlew (3) and peregrine (4) and had flying height(s) recorded (**Table 9.20**) and were mapped (**Figure 9.17**).

93. There were two hen harrier flights observed from vantage points but both of these were recorded outside the 500 m buffer. There was an adult male seen on 15/4/2014 over the forest and an adult female seen on the 30/8/2014 both were observed flying and foraging / hunting. Curlew were recorded on an additional four occasions from vantage points on the 22/4/2014; 5/7/2014 (x2) and 24/6/2014 but were all beyond the 500 m buffer.

94. Most frequently recorded target 1 species flights were peregrine (**Table 9.19; Figure 9.17**), which were observed in the later summer period (June to August 2014) and curlew were observed in mid-summer (May to July 2014). Peregrine and curlew flights (**Figure 9.17**) both originated from known breeding sites nearby and for peregrines included sightings of juveniles post-fledging (**Tables 9.17 & 9.19**).

95. There were 310 seconds of peregrine flight recorded within the survey area and 500 m buffer (**Table 9.20**). There were 60 seconds (18.5%) above indicative rotor height (140 m) and 265 seconds (81.5%) at collision risk height (15 m – 140 m). Curlew flights within the survey area and 500 m buffer were 198 seconds in duration with 34 seconds (17.2%) below potential collision height (PCH) with 164 seconds (82.8%) within PCH but all flights were below 25 m a.g.l.

Table 9.19 – Breeding vantage point aggregated species sightings records within the survey area and 500 m buffer by month

Species	Mar	Apr	May	Jun	Jul	Aug	TOTAL
BZ	1	1	1	1	3	2	9
CA		1	1		2		4
CM					1		1
CU			1	1	1		3
H.		1				1	2
K.	1	1	2	2	1		7
LB	2	4	5	8	7	3	29
PE				1	2	1	4
RG						2	2
RN	15	10	8	8	9	25	75
SH		1		1			2
SN		1	4	1		1	7
Total	19	20	22	23	26	35	145

Table 9.20 – Breeding vantage point flying height and duration of Target 1 species records inside the survey area and 500 m buffer

VP No	Month	Day	Year	Species	No	Time 1st detected	Duration (secs)	<15m	15-25m	25-50m	50-75m	50-100m	100-125m	125-140m	>140 m	Notes
1	5	7	2014	CU	1	07:18	49	34	15							Low silent flight
2	6	7	2014	PE	1	07:30	12			12						Male flew off quarry face
1	6	24	2014	CU	1	09:07	73		73							Intermittent calling, direct flight.
4	7	11	2014	CU	1	11:43	76		76							
4	7	11	2014	PE	1	14:17	95		20	25	20	25	5			Female, attack on kestrel.
4	7	17	2014	PE	2	11:07	175				10	10	60	65	30	Male and juvenile. Lazy circling flight across site, juvenile continually calling.
2	8	30	2014	PE	1	10:28	43			13					30	Female, stooping rapidly

3.3.4. Wintering Vantage Point Surveys

96. There were 36 hours observation completed at each of the four vantage points between September 2014 and February 2015 (**Tables 9.21 & 9.22**). Cumulative observation time from all vantage points over the survey area was 144 hours during the study period (Table 11.14). Survey times ranged from 06.40hrs to 18.40hrs (**Table 9.21**) and covered a wide range of weather conditions (**Table 9.23**).

Table 9.21 – Wintering vantage point survey effort

Type	VP No	Observer	Month	Day	Year	Start	End	Duration
WVP	3	DR	9	2	2014	07:55	10:55	03:00
WVP	1	DR	9	2	2014	11:00	14:00	03:00
WVP	4	DR	9	10	2014	10:05	13:05	03:00
WVP	2	AM	9	17	2014	08:30	11:30	03:00
WVP	1	DR	9	17	2014	08:15	11:15	03:00
WVP	4	AM	9	24	2014	15:40	18:40	03:00
WVP	2	DR	9	29	2014	12:00	15:00	03:00
WVP	3	DR	9	30	2014	06:40	09:40	03:00
WVP	3	DR	10	10	2014	07:05	10:05	03:00
WVP	1	DR	10	10	2014	10:10	13:10	03:00
WVP	2	DR	10	17	2014	10:20	13:20	03:00
WVP	4	DR	10	22	2014	11:50	14:50	03:00
WVP	1	AM	10	24	2014	12:15	15:15	03:00
WVP	2	DR	10	27	2014	08:05	11:05	03:00
WVP	4	DR	10	27	2014	11:25	14:25	03:00
WVP	3	DR	10	29	2014	09:55	12:55	03:00
WVP	4	DR	11	4	2014	10:00	13:00	03:00
WVP	2	DR	11	6	2014	10:25	13:25	03:00
WVP	1	DR	11	11	2014	07:15	10:15	03:00
WVP	3	AM	11	18	2014	08:10	11:10	03:00
WVP	2	KH	11	18	2014	09:40	12:40	03:00
WVP	3	KH	11	25	2014	10:40	13:40	03:00
WVP	1	AM	11	25	2014	11:30	14:30	03:00
WVP	4	AM	11	27	2014	09:00	12:00	03:00
WVP	1	AM	12	3	2014	12:40	15:40	03:00
WVP	4	KH	12	3	2014	12:40	15:40	03:00
WVP	3	AM	12	9	2014	13:15	16:15	03:00
WVP	1	MR	12	18	2014	12:45	15:45	03:00
WVP	4	AM	12	18	2014	13:00	16:00	03:00
WVP	2	AM	12	18	2014	09:50	12:50	03:00
WVP	3	MR	12	27	2014	07:45	10:45	03:00
WVP	2	KH	12	30	2014	11:30	14:30	03:00

Type	VP No	Observer	Month	Day	Year	Start	End	Duration
WVP	3	DR	1	5	2015	09:15	12:15	03:00
WVP	1	DR	1	5	2015	12:00	15:00	03:00
WVP	2	DR	1	16	2015	07:55	10:55	03:00
WVP	4	DR	1	16	2015	11:05	14:05	03:00
WVP	3	DR	1	19	2015	07:55	10:55	03:00
WVP	1	DR	1	19	2015	11:00	14:00	03:00
WVP	4	DR	1	24	2015	11:10	14:10	03:00
WVP	2	DR	1	26	2015	12:30	15:30	03:00
WVP	1	DR	2	3	2015	07:35	10:35	03:00
WVP	4	DR	2	3	2015	10:45	13:45	03:00
WVP	3	DR	2	10	2015	07:25	10:25	03:00
WVP	2	DR	2	10	2015	10:45	13:45	03:00
WVP	4	DR	2	18	2015	12:35	15:35	03:00
WVP	1	AM	2	18	2015	12:40	15:40	03:00
WVP	3	DR	2	19	2015	07:35	10:35	03:00
WVP	2	DR	2	25	2015	12:15	15:15	03:00

Table 9.22 – Wintering vantage point survey effort by month

VP No.	Sep	Oct	Nov	Dec	Jan	Feb	TOTAL
1	6	6	6	6	6	6	36
2	6	6	6	6	6	6	36
3	6	6	6	6	6	6	36
4	6	6	6	6	6	6	36
TOTAL	24	24	24	24	24	24	144

Table 9.23 – Wintering vantage point weather conditions

VP & DATE			Cloud Cover				Cloud Height (m)				Wind - Direction & Speed				Precipitation				Visibility (km)			
VP No.	M	D	0	+1	+2	+3	0	+1	+2	+3	0	+1	+2	+3	0	+1	+2	+3	0	+1	+2	+3
3	9	2	14	10	10	10	10	750	750	750	750	S2	S2	S1	S1	NIL	NIL	NIL	NIL	3	3	3	3
1	9	2	14	10	10	10	10	750	750	600	600	S2	S2	S2	S2	NIL	NIL	NIL	NIL	3	3	3	3
4	9	10	14	5	6	8	9	650	500	500	500	SE2	SE2	SE2	SE2	NIL	NIL	NIL	NIL	3	3	3	3
2	9	17	14	10	10	10	8	250	250	450	500	E4	E4	E4	E3	NIL	NIL	NIL	NIL	0.5	0.5	3	5
1	9	17	14	10	10	9	6	300	350	400	450	E3	E3	E3	E3	CLM	CLM	ILM	ILM	1.5	2	2.5	2.5
4	9	24	14	8	8	8	8	700	700	700	700	NW3	NW3	NW3	NW3	NIL	NIL	NIL	NIL	5	5	5	5
2	9	29	14	6	5	5	6	600	750	600	600	S3	SW3	SW3	W4	NIL	NIL	NIL	NIL	5	5	5	5

VP & DATE			Cloud Cover				Cloud Height (m)				Wind - Direction & Speed				Precipitation				Visibility (km)			
VP No.	M	D	0	+1	+2	+3	0	+1	+2	+3	0	+1	+2	+3	0	+1	+2	+3	0	+1	+2	+3
3	9	30	14	10	10	10	10	375	375	375	375	S4	S4	S4	S4	NIL	ILR	NIL	NIL	1.5	1	1.5	1.5
3	10	10	14	7	7	10	8	400	400	350	400	SW2	S2	S2	S2	NIL	ILM	CLM	NIL	1	1.5	5	1.5
1	10	10	14	9	8	7	6	375	400	450	500	SW2	SW2	S3	S3	ILR	NIL	NIL	NIL	1.5	2	2	2
2	10	17	14	8	8	9	8	350	400	400	450	S3	S3	S3	S3	ILM	ILM	ILR	NIL	2	2	2	2.5
4	10	22	14	10	10	10	10	375	400	400	450	SW4	SW4	SW4	SW4	NIL	NIL	NIL	NIL	2	2	2	2
1	10	24	14	7	8	8	8	800	800	800	800	SW3	SW3	SW3	SW3	NIL	NIL	NIL	NIL	5	5	5	5
2	10	27	14	10	10	10	10	375	375	400	400	SW4	SW5	SW5	SW5	CLM	CLM	CLM	NIL	0.5	1	1	2.5
4	10	27	14	10	10	10	10	450	400	400	400	SW5	SW5	SW4	SW4	NIL	ILR	NIL	NIL	3	3	3	3
3	10	29	14	5	5	7	7	750	750	750	750	SE3	SE3	E3	E3	NIL	NIL	NIL	NIL	2	2	2	2
4	11	4	14	4	5	5	4	600	600	600	600	N3	NE3	NE3	NE3	NIL	NIL	NIL	NIL	5	5	5	5
2	11	6	14	10	10	10	10	400	375	400	400	SE5	SE5	S5	S5	CHR	CLR	CLR	CLR	1.5	2	2	2
1	11	11	14	10	10	10	10	400	375	400	400	SE3	SE3	SE3	SE3	ILR	NIL	ILR	ILR	1.5	1.5	1.5	1.5
3	11	18	14	10	10	10	10	500	500	500	500	SE3	SE3	SE3	SE3	NIL	NIL	NIL	NIL	5	5	5	5
2	11	18	14	7	7	6	6	500	500	500	500	SE5	SE5	SE5	SE5	NIL	NIL	NIL	NIL	5	5	5	5
3	11	25	14	9	10	10	10	500	350	350	350	E4	E4	SE4	SE4	NIL	NIL	NIL	NIL	5	5	1	1
1	11	25	14	10	10	10	10	375	350	350	350	E1	E1	E1	E1	NIL	NIL	NIL	NIL	3	3	3	3
4	11	27	14	10	10	10	10	500	500	350	400	SE3	SE3	SE3	SE3	NIL	CLR	CLR	CLR	5	5	5	5
1	12	3	14	10	10	10	10	400	600	600	600	SW1	SW1	SW1	SW1	NIL	NIL	NIL	NIL	5	5	5	5
4	12	3	14	9	9	9	10	450	450	400	450	SW3	SW3	SW3	SW4	NIL	NIL	NIL	NIL	5	5	5	3
3	12	9	14	10	10	10	10	300	350	300	300	SW5	SW4	SW4	SW4	CLR	CLR	CLR	CLR	0.5	1	0.5	0.5
1	12	18	14	10	10	10	10	420	400	500	500	W3	W2	W2	NW2	NIL	ILR	NIL	NIL	2	2	2	2
4	12	18	14	10	10	8	10	400	450	550	450	NW3	W3	W3	W3	NIL	ILR	NIL	NIL	5	5	5	5
2	12	18	14	10	10	10	10	450	400	350	350	W4	NW5	NW5	NW4	NIL	CLR	ILR	NIL	5	1.5	0.5	1
3	12	27	14	6	6	6	6	600	900	900	900	SW2	SW2	SW2	SW2	NIL	NIL	NIL	ILR	5	5	5	5
2	12	30	14	6	4	2	3	600	600	600	600	SW5	SW5	SW5	SW5	NIL	NIL	NIL	NIL	5	5	5	5
3	1	5	15	10	10	10	10	350	300	350	350	S4	S4	S3	S3	CHM	CHM	CLM	CLM	0.5	0.5	0.75	0.75
1	1	5	15	10	10	10	10	350	350	350	400	S3	S3	S3	S3	ILM	NIL	NIL	NIL	1	1.5	1.5	1.5
2	1	16	15	6	8	8	6	450	450	400	400	SW3	SW3	SW3	SW3	ILM	ILS	NIL	NIL	2.5	2.5	2.5	2.5
4	1	16	15	8	10	6	4	450	450	600	600	SW3	SW3	SW2	SW2	NIL	ILS	NIL	NIL	2.5	2.5	2.5	2.5
3	1	19	15	3	3	5	6	750	750	600	600	SW1	SW1	SW1	SW1	NIL	NIL	NIL	NIL	2.5	2.5	2.5	2.5
1	1	19	15	6	7	8	10	600	600	500	500	SW1	SW1	S1	S1	NIL	NIL	NIL	NIL	2.5	2.5	2.5	2.5
4	1	24	15	7	8	7	9	750	750	650	650	W4	W4	W4	W4	NIL	NIL	NIL	NIL	2.5	2.5	2.5	2.5
2	1	26	15	6	9	8	8	600	600	600	600	NW4	NW4	NW4	NW4	NIL	NIL	NIL	NIL	3	2.5	2.5	2.5
1	2	3	15	2	2	2	2	1000	1000	1000	1000	-	-	-	NW1	NIL	NIL	NIL	NIL	2.5	2.5	2.5	2.5
4	2	3	15	2	7	8	9	1000	450	600	500	NE1	NE2	NE3	NE3	NIL	IHS	NIL	ILS	2.5	1	1	2.5

VP & DATE				Cloud Cover				Cloud Height (m)				Wind - Direction & Speed				Precipitation				Visibility (km)			
VP No.	M	D		0	+1	+2	+3	0	+1	+2	+3	0	+1	+2	+3	0	+1	+2	+3	0	+1	+2	+3
3	2	10	15	10	10	10	10	350	375	350	350	SW2	SW2	SW2	SW2	CLM	CLM	CLM	CLM	1.5	1.5	1.5	1.5
2	2	10	15	10	10	10	10	350	375	375	400	SW2	SW2	S2	S2	CHM	CLM	CLM	CLM	0.5	2.5	2.5	2.5
4	2	18	15	10	10	10	10	400	400	450	450	SW4	SW4	SW4	SW4	NIL	NIL	NIL	NIL	2.5	2.5	2.5	2.5
1	2	18	15	10	10	10	10	380	400	450	450	SW2	SW2	SW2	SW2	NIL	NIL	NIL	NIL	3	3	3	3
3	2	19	15	9	9	7	6	750	750	750	750	W3	W3	W2	W2	NIL	NIL	NIL	NIL	2.5	2.5	2.5	2.5
2	2	25	15	10	10	10	10	325	325	300	300	S4	S4	S4	S4	CHM	CHM	CHM	CHM	0.5	0.5	0.5	0.5
3	9	2	15	10	10	10	10	750	750	750	750	S2	S2	S1	S1	NIL	NIL	NIL	NIL	3	3	3	3

97. There were 13 target species (**Table 9.24**) recorded inside the survey area and 500 m buffer during the wintering period; buzzard, cormorant, golden plover, heron, hen harrier, kestrel, lesser black-backed gull, merlin, peregrine, raven sparrowhawk, snipe and woodcock. The occurrence rate of the detected species ranged from 0.7% - 65.2% with only two species which were recorded more than 5% of total observation time namely buzzard (7.1%) and raven (65.2%) (**Tables 9.24 & 9.25**) and detection rates varied across the season (**Table 9.26**). As requested by NIEA (see **Chapter 9**) buzzard, kestrel and raven flights were additionally mapped (**Figures 9.14; 9.15 & 9.16**, see also Section 9.3.3.4).

Table 9.24 – Wintering vantage point sightings records recorded within the survey area and 500 m buffer.

VP No	Month	Day	Year	Target	Species	Number	Time Detected	Number of 5 min intervals	Comments
3	9	2	2014	1	HH	1	08:55	1	Female hunting flight along contours
3	9	2	2014	1	HH	1	09:35	1	Female mobbed by HC
3	9	2	2014	2	RN	1	09:50	1	
3	9	2	2014	2	RN	1	09:55	1	
3	9	2	2014	1	HH	1	10:10	1	Female
1	9	2	2014	2	RN	1	11:35	1	
1	9	2	2014	2	RN	2	12:05	1	
1	9	2	2014	2	RN	1	12:25	1	
1	9	2	2014	2	RN	2	12:55	1	
4	9	10	2014	2	RN	1	10:30	1	
4	9	10	2014	2	RN	1	10:55	1	
1	9	17	2014	2	RN	1	09:20	1	
1	9	17	2014	2	RN	1	09:45	1	
1	9	17	2014	2	RN	1	10:20	1	
1	9	17	2014	2	RN	2	11:10	1	
4	9	24	2014	2	RN	2	15:45	1	
4	9	24	2014	2	RN	2	16:05	1	
4	9	24	2014	2	RN	7	16:15	1	Tumbling over Knockagallan
4	9	24	2014	2	SN	1	16:30	1	Alarming, landed in field north of vp
4	9	24	2014	2	K.	1	17:10	2	Hover hunting along Moneyneagh, prey strike
4	9	24	2014	1	PE	1	18:25	1	Female
2	9	29	2014	2	RN	5	12:20	1	
2	9	29	2014	2	SN	1	14:55	1	
3	9	30	2014	2	LB	2	07:35	1	
3	9	30	2014	1	HH	1	07:50	1	Female
3	9	30	2014	2	H.	1	08:20	1	
3	9	30	2014	2	RN	1	08:50	1	
3	10	10	2014	2	RN	1	07:35	1	
3	10	10	2014	1	HH	1	07:45	1	Male
3	10	10	2014	2	RN	2	08:45	1	
1	10	10	2014	2	RN	3	10:45	1	
1	10	10	2014	2	H.	1	11:10	1	
1	10	10	2014	2	RN	1	11:20	1	
1	10	10	2014	2	K.	1	11:35	1	
2	10	17	2014	2	SN	1	10:15	1	
2	10	17	2014	1	GP	1	10:45	1	
2	10	17	2014	2	RN	2	11:20	1	
2	10	17	2014	2	RN	2	11:45	1	
4	10	22	2014	2	RN	1	12:15	1	
4	10	22	2014	2	RN	1	12:25	1	
4	10	22	2014	2	K.	1	12:55	1	
4	10	22	2014	2	BZ	1	13:00	1	
4	10	22	2014	2	RN	1	13:10	1	
4	10	22	2014	2	LB	1	13:50	1	
1	10	24	2014	2	SH	1	12:50	2	Male passed vp, up gully / fence along

VP No	Month	Day	Year	Target	Species	Number	Time Detected	Number of 5 min intervals	Comments
									road. Perched on 2 gate posts then continued along roadside gully.
1	10	24	2014	2	RN	1	13:10	1	
2	10	27	2014	2	SN	1	08:10	1	
2	10	27	2014	2	RN	1	08:50	1	Heard calling
2	10	27	2014	2	SN	1	10:10	1	
4	10	27	2014	2	WK	1	11:30	1	Flew from ground
4	10	27	2014	2	RN	1	11:50	1	
4	10	27	2014	2	RN	2	11:55	1	
4	10	27	2014	2	RN	1	12:10	1	
4	10	27	2014	2	RN	3	12:40	1	
4	10	27	2014	2	RN	2	12:50	1	
4	10	27	2014	2	RN	1	13:40	1	
4	10	27	2014	2	RN	2	13:55	1	
3	10	29	2014	2	RN	1	10:20	1	
3	10	29	2014	2	RN	2	11:45	1	
3	10	29	2014	2	RN	1	12:00	1	
3	10	29	2014	1	ML	1	12:45	2	Female
4	11	4	2014	2	RN	5	10:35	1	
4	11	4	2014	2	RN	1	10:50	1	
4	11	4	2014	2	BZ	1	11:50	1	
4	11	4	2014	2	RN	2	12:05	1	
2	11	6	2014	2	RN	1	10:55	1	
2	11	6	2014	2	RN	2	11:45	1	
1	11	11	2014	2	RN	5	07:55	1	
1	11	11	2014	2	RN	2	08:30	1	
1	11	11	2014	2	H.	1	08:45	1	
1	11	11	2014	2	RN	4	09:30	1	
1	11	11	2014	2	RN	1	09:55	1	
1	11	11	2014	2	RN	1	10:05	1	
3	11	18	2014	2	RN	1	08:50	1	
3	11	18	2014	2	RN	2	10:25	1	Tumbling and chasing each other between

VP No	Month	Day	Year	Target	Species	Number	Time Detected	Number of 5 min intervals	Comments
									Gruig and Corkey turbines
3	11	25	2014	2	RN	2	10:50	1	Calling and flying east to west
1	11	25	2014	2	RN	1	12:45	1	All 3 flew from windfarm east over reservoir into forest, calling
1	11	25	2014	2	RN	2	12:45	1	All 3 flew from windfarm east over reservoir into forest, calling
4	11	27	2014	1	GP	23	10:45	1	Came off high ground, high flight over improved grass disappeared behind hill.
4	12	3	2014	2	RN	1	14:05	1	Flew across site north-west to south-east
1	12	18	2014	2	RN	1	15:20	1	
4	12	18	2014	2	RN	2	13:15	1	Along ridge line of windfarm
4	12	18	2014	2	RN	3	14:10	1	Flying over Gruig between turbines
4	12	18	2014	2	BZ	1	14:40	1	Male low from west, north past turbine
4	12	18	2014	2	RN	3	15:05	2	North end of windfarm, down through improved grassland and flew west
2	12	18	2014	2	RN	1	09:55	1	
2	12	18	2014	2	RN	2	10:00	1	
2	12	18	2014	2	RN	1	10:05	1	

VP No	Month	Day	Year	Target	Species	Number	Time Detected	Number of 5 min intervals	Comments
2	12	18	2014	2	RN	1	10:50	1	Heard calling north-east of vp
2	12	30	2014	2	RN	1	12:00	1	Flying north to east calling
2	12	30	2014	1	GP	7	12:40	1	Flying south-east to north-east calling
2	12	30	2014	2	RN	2	13:40	1	Flying south to north through windfarm calling
1	1	5	2015	2	RN	4	13:05	1	
1	1	5	2015	2	RN	1	13:50	1	
1	1	5	2015	2	RN	1	14:10	1	
2	1	16	2015	2	SN	1	08:25	1	
2	1	16	2015	2	RN	1	09:10	1	
4	1	16	2015	2	RN	1	11:20	1	
4	1	16	2015	2	RN	4	11:50	1	
4	1	16	2015	2	LB	1	12:25	1	
4	1	16	2015	2	RN	2	12:45	1	
4	1	16	2015	2	BZ	1	13:55	1	
1	1	19	2015	2	RN	4	11:45	1	
1	1	19	2015	2	RN	1	12:25	1	
4	1	24	2015	2	H.	1	11:15	1	
4	1	24	2015	2	RN	1	11:30	3	
4	1	24	2015	2	BZ	1	11:50	1	
4	1	24	2015	2	BZ	1	11:55	1	
4	1	24	2015	2	RN	1	12:10	1	
4	1	24	2015	1	PE	1	12:35	1	Female low over hill top
4	1	24	2015	2	RN	1	13:15	1	
2	1	26	2015	1	GP	11	13:10	1	
2	1	26	2015	2	RN	2	13:30	1	
2	1	26	2015	2	BZ	1	13:40	1	
2	1	26	2015	2	K.	1	14:30	1	
2	1	26	2015	2	BZ	1	14:50	1	
1	2	3	2015	2	RN	1	08:50	1	
1	2	3	2015	2	CA	2	09:40	1	
4	2	3	2015	2	RN	1	11:05	1	
4	2	3	2015	2	RN	1	11:25	1	
4	2	3	2015	2	RN	1	11:35	1	
4	2	3	2015	2	BZ	1	12:10	1	
3	2	10	2015	2	RN	1	08:20	1	
2	2	10	2015	2	SN	2	11:00	1	
2	2	10	2015	2	RN	2	11:40	1	
2	2	10	2015	1	GP	1	12:00	1	Heard calling from ground
2	2	10	2015	1	GP	10	12:25	1	
2	2	10	2015	2	RN	1	13:00	1	
2	2	10	2015	2	BZ	1	13:15	1	
4	2	18	2015	2	RN	1	12:50	1	
4	2	18	2015	2	RN	2	13:25	1	
4	2	18	2015	2	RN	1	14:35	1	
3	2	19	2015	2	RN	1	07:55	1	
3	2	19	2015	2	RN	1	09:30	1	
2	2	25	2015	1	GP	1	13:00	1	Heard calling from ground

Table 9.25 – Wintering vantage point aggregated species sightings records within the survey area and 500 m buffer.

Species	Number of detections	%	Number of five minute intervals	%
BZ	10	7.4	10	7.1
CA	1	0.7	1	0.7
GP	7	5.2	7	5.0
H.	4	3.0	4	2.8
HH	5	3.7	5	3.5
K.	4	3.0	5	3.5
LB	3	2.2	3	2.1
ML	1	0.7	2	1.4

Species	Number of detections	%	Number of five minute intervals	%
PE	2	1.5	2	1.4
RN	89	65.9	92	65.2
SH	1	0.7	2	1.4
SN	7	5.2	7	5.0
WK	1	0.7	1	0.7
TOTAL	135		141	

Table 9.26 – Wintering vantage point aggregated species sightings records within the survey area and 500 m buffer by month

Species	Sep	Oct	Nov	Dec	Jan	Feb	TOTAL
BZ		1	1	1	5	2	10
CA						1	1
GP		1	1	1	1	3	7
H.	1	1	1		1		4
HH	4	1					5
K.	1	2			1		4
LB	1	1			1		3
ML		1					1
PE	1				1		2
RN	17	21	15	11	13	12	89
SH		1					1
SN	2	3			1	1	7
WK		1					1
TOTAL	27	34	18	13	24	19	135

98. Four target 1 species flights (**Table 9.1**) were recorded (**Table 9.26**); hen harrier (n = 5), golden plover (n = 7), merlin (n = 1) and peregrine (n = 2) and had flying height(s) recorded (**Table 9.27**) and were mapped (**Figures 9.18**).

99. The hen harrier flights were detected in the early autumn part of the winter from vantage point locations and one additional female was observed on 19/02/2015 but was beyond the 500 m survey area. There was further evidence of hen harriers roosting in the wider area (see Section 9.3.3.7) during the winter period.

100. Hen harriers flights, comprised 363 seconds of flight primarily during September with the majority (75.2%) recorded below potential collision risk height (<15m) and 24.8% recorded within potential collision risk height (15 – 140 m), although all flights were below 25 m. Peregrine flights were recorded only occasionally and compared to the breeding period there were 123 seconds of flight observed with 10.6% below rotor height (<15m) and the remainder 89.4% within potential collision risk height (15m – 140m).

Table 9.27 – Breeding vantage point flying height and duration of Target 1 species records inside the survey area and 500 m buffer

VP No	Month	Day	Year	Species	No	Time 1st detected	Duration (secs)	<15m	15-25 m	25-50 m	50-75 m	50-100 m	100-125 m	125-140 m	>140 m	Notes
3	9	2	2014	HH	1	08:53	130	100	30							Female slow undulating / gliding hunting flight
3	9	2	2014	HH	1	09:34	38	23	15							Female mobbed by HC
3	9	2	2014	HH	1	10:08	57	57								Female slow, low hunting flight
4	9	24	2014	PE	1	18:23	50			50						Female
3	9	30	2014	HH	1	07:48	89	59	30							Female
3	10	10	2014	HH	1	07:43	49	34	15							Male
2	10	17	2014	GP	1	10:42	37	5	5	5	5	17				Lifted from field by quad
3	10	29	2014	ML	1	12:43	105	80	25							Female part of a 7 minute 15 second observation which was mostly beyond the survey area and 500 m buffer. Bird spent 105 seconds within the survey area
4	11	27	2014	GP	23	10:42	55			5	5	5	10	15	15	
2	12	30	2014	GP	7	12:38	16			16						
4	1	24	2015	PE	1	12:33	73	13	5	40	5	10				Female
2	1	26	2015	GP	11	13:06	13	13								Low flight
2	2	10	2015	GP	10	12:23	42	15	10	17						Calling in flight

101. Cumulative data for all species detected during winter and summer vantage points (**Table 9.28**) over the 12-month study shows that buzzard (6.8%), lesser black-backed gull (11.4%) and raven (58.6%) were the most frequently detected species. Only one species (raven) was recorded throughout every month of the study (**Table 9.28**), although were recorded less frequently in the breeding season. Buzzards were detected in all months except September whilst curlew and peregrine activity declined between summer and winter. Hen harriers and golden plover were observed more often during the winter (**Table 9.28**).

102. There were four species recorded in the winter which were not recorded during the breeding season, namely golden plover, hen harrier, merlin and woodcock, whilst three species seen during the breeding season, curlew, common gull and red grouse were not recorded during the wintering vantage point surveys within the survey area and 500 m buffer.

Table 9.28 – Cumulative breeding and wintering vantage point aggregated species sightings records within the survey area and 500 m buffer by month

Species	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	TOTAL	% of detections
BZ	1	1	1	1	3	2		1	1	1	5	2	19	6.8
CA		1	1		2							1	5	1.8
CM					1								1	0.4
CU			1	1	1								3	1.1
GP								1	1	1	1	3	7	2.5
H.		1				1	1	1	1		1		6	2.1
HH							4	1					5	1.8
K.	1	1	2	2	1		1	2			1		11	3.9
LB	2	4	5	8	7	3	1	1			1		32	11.4
ML								1					1	0.4
PE				1	2	1	1				1		6	2.1
RG						2							2	0.7
RN	15	10	8	8	9	25	17	21	15	11	13	12	164	58.6
SH		1		1				1					3	1.1
SN		1	4	1		1	2	3			1	1	14	5.0
WK								1					1	0.4
TOTAL	**19**	**20**	**22**	**23**	**26**	**35**	**27**	**34**	**18**	**13**	**24**	**19**	**280**	

3.3.5. Migration Vantage Point Surveys

103. There were 36 hours observation completed at each vantage point in the spring (SMVP) between January 2014 and April 2014 and in the autumn (AMVP) between September 2014 and November 2014 (**Tables 9.29 & 9.30**) with a total of 72 hours completed during migration seasons. Survey times ranged from 06.50hrs to 18.30hrs (**Table 9.29**) and covered a wide range of weather conditions (**Table 9.31).**

Table 9.29 – Migration season vantage point survey effort

Type	VP No	Observer	Month	Day	Year	Start	End	Duration
SMVP	MIG	AM	1	30	2014	09:25	12:25	03:00
SMVP	MIG	AM	1	30	2014	12:30	15:30	03:00
SMVP	MIG	AM	2	11	2014	08:35	11:35	03:00
SMVP	MIG	AM	2	18	2014	12:20	15:20	03:00
SMVP	MIG	AM	2	26	2014	07:55	10:55	03:00
SMVP	MIG	MR	2	28	2014	12:20	15:20	03:00
SMVP	MIG	AM	3	7	2014	07:15	10:15	03:00
SMVP	MIG	AM	3	13	2014	11:30	14:30	03:00
SMVP	MIG	AM	3	19	2014	08:15	11:15	03:00
SMVP	MIG	DCR	3	26	2014	10:00	13:00	03:00
SMVP	MIG	AM	4	7	2014	08:35	11:35	03:00
SMVP	MIG	KH	4	15	2014	11:10	14:10	03:00
AMVP	MIG	DCR	9	10	2014	06:55	09:55	03:00
AMVP	MIG	DCR	9	17	2014	11:30	14:30	03:00
AMVP	MIG	DCR	9	24	2014	15:30	18:30	03:00
AMVP	MIG	DCR	9	30	2014	09:50	12:50	03:00
AMVP	MIG	DCR	10	6	2014	07:35	10:35	03:00
AMVP	MIG	DCR	10	17	2014	07:10	10:10	03:00
AMVP	MIG	DCR	10	24	2014	12:00	15:00	03:00
AMVP	MIG	DCR	10	29	2014	14:15	17:15	03:00
AMVP	MIG	DCR	11	4	2014	06:50	09:50	03:00
AMVP	MIG	DCR	11	11	2014	10:35	13:35	03:00
AMVP	MIG	AM	11	25	2014	08:10	11:10	03:00
AMVP	MIG	MR	11	27	2014	14:15	17:15	03:00

Table 9.30 – Migration vantage point survey effort by month

VP No.	Jan	Feb	Mar	Apr		Sep	Oct	Nov	TOTAL
Spring Migration	6	12	12	6					36
Autumn Migration	-	-	-	-		12	12	12	36
TOTAL	6	12	12	6		12	12	12	72

Table 9.31 – Migration vantage point weather conditions

VP & DATE				Cloud Cover				Cloud Height (m)				Wind - Direction & Speed				Precipitation				Visibility (km)			
VP No.	M	D	Y	0	+1	+2	+3	0	+1	+2	+3	0	+1	+2	+3	0	+1	+2	+3	0	+1	+2	+3
M	1	30	14	10	10	10	10	550	500	600	600	SE4	SE4	SE4	SE4	NIL	ILR	NIL	NIL	5	2.5	4	5
M	1	30	14	10	10	9	9	600	650	650	650	SE4	SE4	SE4	SE4	NIL	NIL	NIL	NIL	5	5	5	5
M	2	11	14	2	3	3	4	400	400	400	450	SW4	SW5	SW5	SW5	NIL	NIL	NIL	NIL	5	5	5	5
M	2	18	14	10	10	10	10	300	300	300	300	SW4	SW3	SW3	SW3	CLR	ILR	ILR	NIL	0.5	0.5	1	0.5
M	2	26	14	10	10	10	10	300	450	450	450	SW5	SW5	SW5	SW5	NIL	CLR	ILR	ILR	0.5	2.5	4	4
M	2	28	14	5	5	5	5	900	900	900	1500	S4	S4	S4	S4	NIL	NIL	NIL	NIL	2	2	2	2
M	3	7	14	9	10	4	5	600	600	600	650	W5	W5	W5	W5	ILR	ILR	NIL	NIL	5	5	5	5
M	3	13	14	10	10	10	10	150	200	300	420	SW2	SW1	SW1	SW2	NIL	NIL	NIL	NIL	0.5	0.5	1	2
M	3	19	14	10	10	10	10	550	600	600	600	S5	S5	S5	S5	NIL	NIL	NIL	NIL	5	5	5	5
M	3	26	14	10	10	10	10	250	450	400	450	N2	N2	N2	N2	IHM	ILM	CLM	ILM	0.5	2.5	1.5	2.5
M	4	7	14	9	10	10	10	600	600	650	700	S4	S4	S4	S4	NIL	NIL	NIL	NIL	5	5	5	5
M	4	15	14	3	3	3	3	900	900	900	900	SE4	SE4	SE4	SE4	NIL	NIL	NIL	NIL	5	5	5	5

VP & DATE				Cloud Cover				Cloud Height (m)				Wind - Direction & Speed				Precipitation				Visibility (km)			
VP No.	M	D	Y	0	+1	+2	+3	0	+1	+2	+3	0	+1	+2	+3	0	+1	+2	+3	0	+1	+2	+3
M	9	10	14	3	3	3	5	750	750	750	650	SE2	SE2	SE2	SE2	NIL	NIL	NIL	NIL	5	5	5	5
M	9	17	14	4	5	5	4	600	600	600	600	E3	E2	E3	E4	NIL	NIL	NIL	NIL	3	3	3	3
M	9	24	14	8	8	6	6	750	700	600	600	NW3	NW3	NW2	NW2	NIL	NIL	NIL	NIL	3	3	3	3
M	9	30	14	10	10	10	10	300	410	450	450	S4	S4	S3	S3	NIL	NIL	NIL	NIL	1.5	2.5	3	3
M	10	6	14	8	10	10	10	450	400	375	400	S3	S3	SW3	W3	NIL	NIL	NIL	NIL	5	5	5	5
M	10	17	14	10	10	10	10	450	400	350	350	S3	S3	S3	S3	ILM	ILM	IHM	IHM	1.5	1	0.5	1
M	10	24	14	10	10	9	9	500	500	500	500	SW3	SW3	SW3	SW3	NIL	ILR	NIL	NIL	3	3	3	3
M	10	29	14	7	7	6	5	750	750	750	750	E3	E3	E3	E3	NIL	NIL	NIL	NIL	5	5	3	1.5
M	11	4	14	6	4	3	4	750	750	750	600	N2	N2	N2	N3	NIL	NIL	NIL	NIL	2.5	3	5	5
M	11	11	14	10	10	9	9	400	400	400	400	SE4	SE4	SE4	SE4	CLR	CLR	CLR	CLR	2.5	2.5	2.5	2.5
M	11	25	14	8	8	10	10	500	500	450	375	E1	E2	E2	E2	NIL	NIL	NIL	NIL	5	5	5	5
M	11	27	14	10	10	10	10	700	700	800	800	NE2	NE2	NE2	NE4	NIL	NIL	NIL	ILR	2	2	2	2

104. Seven target species (**Table 9.1**) were recorded inside the survey area and 500 m buffer; buzzard; greater black-backed gull, golden plover; hen harrier; kestrel; lesser black-backed gull; peregrine falcon, red grouse, raven and snipe (**Tables 9.32 & 9.33**). Raven (61.9%), buzzard (10.5%) and snipe (8.6%) were the most frequently recorded species during the migration vantage point observations. No swans or geese were recorded during migration periods and raven were the most frequently recorded species with a greater level of activity in the autumn period (**Table 9.34**) than during the spring (**Table 9.34**).

Table 9.32 – Migration vantage point sightings records recorded within the 500 m survey boundary.

VP No	Month	Day	Year	Target	Species	Number	Time Detected	Number of 5 min intervals	Comments
MIG	1	30	2014	2	BZ	1	09:50	1	Flying north-west from heather to improved grassland
MIG	1	30	2014	2	RN	1	12:15	1	Low between turbines
MIG	1	30	2014	1	GP	14	13:55	1	GP lifted briefly
MIG	1	30	2014	2	RN	1	13:55	2	Flying over horizon
MIG	1	30	2014	2	RN	1	15:25	1	
MIG	2	11	2014	2	RN	1	08:50	3	In past turbines, flying and calling over ridge line
MIG	2	11	2014	2	LB	1	09:00	1	
MIG	2	11	2014	2	LB	2	09:10	1	Flying nearly same line
MIG	2	11	2014	1	HH	1	10:05	1	Ringtail (female) hunting low through windfarm, chased by HC (1), landed briefly by control room Mobbed by HC (3).
MIG	2	26	2014	2	RN	2	10:05	1	Flying and tumbling together over fields and trees behind farm
MIG	2	26	2014	2	RN	1	10:35	1	
MIG	2	26	2014	2	RN	2	10:45	1	Same area as earlier
MIG	2	28	2014	2	RN	1	13:10	1	
MIG	2	28	2014	2	RN	1	13:40	1	Flew on to fence post
MIG	2	28	2014	1	GP	18	15:10	1	
MIG	2	28	2014	1	GP	1	15:20	1	
MIG	3	13	2014	2	RN	1	11:55	1	Heard calling west of VP
MIG	3	13	2014	1	GP	1	12:15	1	Heard calling from ground south-east of VP
MIG	3	13	2014	2	RN	2	12:35	1	Calling around VP and south to south west
MIG	3	13	2014	2	RN	2	13:50	1	Flying around VP calling
MIG	3	19	2014	2	GB	1	08:25	1	GB mobbed and chased by RN
MIG	3	19	2014	2	RN	1	08:25	1	
MIG	3	19	2014	2	GB	1	08:35	1	Over lower farmland
MIG	3	19	2014	2	RN	1	08:40	1	Through windfarm then north east
MIG	3	19	2014	2	RN	3	09:40	2	Flying and tumbling together, one flew towards Knockagallan
MIG	3	19	2014	2	RN	1	09:55	1	Mobbing HC (2)
MIG	3	19	2014	1	PE	1	09:55	1	Appeared and attacked all 3 crows, chased them north
MIG	3	19	2014	2	BZ	2	10:00	2	
MIG	3	26	2014	2	RN	1	11:40	1	
MIG	3	26	2014	2	RN	1	12:35	1	
MIG	4	7	2014	2	RN	1	10:45	1	
MIG	4	15	2014	2	BZ	1	11:45	1	Flying and hunting
MIG	4	15	2014	2	RN	2	12:35	1	Flying and calling
MIG	9	10	2014	2	BZ	1	07:35	1	
MIG	9	10	2014	2	RN	2	08:35	1	
MIG	9	17	2014	2	SN	1	11:35	1	Disturbed from ground
MIG	9	17	2014	2	RN	1	12:15	1	
MIG	9	17	2014	2	K.	1	13:40	1	Hover hunting flight, prey strike
MIG	9	24	2014	2	RN	3	15:45	1	
MIG	9	24	2014	2	RN	2	16:05	1	
MIG	9	24	2014	2	RN	7	16:15	1	

VP No	Month	Day	Year	Target	Species	Number	Time Detected	Number of 5 min intervals	Comments
MIG	9	24	2014	2	SN	3	16:30	1	Lifted from rough grazing / rushes and split into 3 flight paths
MIG	9	24	2014	2	RN	5	16:40	1	
MIG	9	24	2014	2	RN	2	16:50	1	
MIG	9	24	2014	2	BZ	1	17:05	1	
MIG	9	24	2014	2	RN	5	17:15	1	
MIG	9	24	2014	2	SN	1	17:25	1	
MIG	9	24	2014	1	GP	1	17:40	1	Heard calling from ground
MIG	9	24	2014	1	PE	1	18:25	1	Female
MIG	9	30	2014	2	RN	4	10:00	1	
MIG	9	30	2014	1	PE	1	10:15	1	Female
MIG	9	30	2014	2	RN	1	10:30	1	
MIG	9	30	2014	2	RN	1	10:55	1	
MIG	9	30	2014	1	PE	1	11:10	1	Female
MIG	9	30	2014	2	RN	1	11:10	1	
MIG	9	30	2014	2	RN	1	11:25	1	
MIG	9	30	2014	2	RN	2	11:35	1	
MIG	10	6	2014	2	RN	4	07:45	1	
MIG	10	6	2014	2	SN	1	08:00	1	
MIG	10	6	2014	2	SN	1	08:20	1	
MIG	10	6	2014	2	RN	1	09:15	1	
MIG	10	6	2014	2	RN	2	09:45	1	
MIG	10	6	2014	2	RN	2	10:15	1	
MIG	10	17	2014	2	RN	1	08:10	1	
MIG	10	17	2014	1	PE	1	09:05	1	Female
MIG	10	17	2014	2	SN	1	10:10	1	
MIG	10	24	2014	2	RN	5	12:05	1	
MIG	10	24	2014	2	RN	1	12:05	1	
MIG	10	24	2014	2	BZ	1	12:10	1	
MIG	10	24	2014	2	RN	1	12:35	1	
MIG	10	24	2014	2	RN	2	13:05	1	
MIG	10	24	2014	2	RN	2	13:35	1	
MIG	10	24	2014	2	BZ	1	13:45	1	Mobbed by 17 rooks
MIG	10	24	2014	2	BZ	1	13:55	1	
MIG	10	24	2014	2	RN	1	14:05	1	
MIG	10	24	2014	2	RN	2	14:10	1	
MIG	10	29	2014	2	RN	1	14:35	1	
MIG	10	29	2014	2	RN	3	14:50	1	
MIG	10	29	2014	2	RN	2	15:25	1	
MIG	10	29	2014	2	SN	1	15:45	1	
MIG	10	29	2014	1	PE	1	16:55	1	Female
MIG	10	29	2014	2	SN	1	17:10	1	
MIG	11	4	2014	2	RN	2	07:20	1	
MIG	11	4	2014	2	RN	1	08:10	1	
MIG	11	11	2014	2	RN	2	10:55	1	
MIG	11	11	2014	2	RN	7	11:30	1	
MIG	11	11	2014	2	BZ	1	11:55	1	
MIG	11	11	2014	2	RN	1	12:25	1	
MIG	11	11	2014	2	RN	1	12:40	1	
MIG	11	25	2014	2	RN	1	08:25	1	South-west over Moneyneagh
MIG	11	25	2014	2	RN	2	08:35	1	North-east from Moneyneagh up through turbines
MIG	11	25	2014	2	K.	1	09:20	1	Male hover hunting, prey strike, fed on pole, flew south
MIG	11	25	2014	2	RN	1	09:45	1	Calling from trees south of VP
MIG	11	25	2014	2	RN	2	10:15	1	Flying north over Corkey
MIG	11	27	2014	2	BZ	1	14:55	1	Lifted from power lines in core of site
MIG	11	27	2014	2	RN	1	15:25	1	
MIG	11	27	2014	2	RN	1	16:20	1	
MIG	11	27	2014	2	RG	2	16:30	1	Calling in flight
MIG	11	27	2014	2	RG	1	16:35	1	Calling in flight
MIG	11	27	2014	2	SN	1	16:45	1	Probably leaving for foraging

Table 9.33 – Migration vantage point aggregated species sightings records within the survey area and 500 m buffer.

Species	Number of detections	%	Number of five minute intervals	%
BZ	10	10.0	11	10.5
GB	2	2.0	2	1.9
GP	5	5.0	5	4.8
HH	1	1.0	1	1.0
K.	2	2.0	2	1.9
LB	2	2.0	2	1.9
PE	6	6.0	6	5.7
RG	2	2.0	2	1.9
RN	61	61.0	65	61.9
SN	9	9.0	9	8.6
TOTAL	**100**		**105**	

Table 9.34 – Migration vantage point aggregated species sightings records within the survey area and 500 m buffer by month

Species	Jan	Feb	Mar	Apr		Sep	Oct	Nov	TOTAL
BZ	1		1	1		2	3	2	10
GB			2						2
GP	1	2	1			1			5
HH		1							1
K.						1		1	2
LB		2							2
PE			1			3	2		6
RG								2	2
RN	3	6	9	2		14	15	12	61
SN						3	5	1	9
TOTAL	**5**	**11**	**14**	**3**		**24**	**25**	**18**	**100**

105. Three target 1 species flights (**Table 9.1**) were recorded (**Tables 9.33 & 9.34**); hen harrier (n = 1), peregrine (n = 6) and golden plover (n = 5) and had flying height(s) recorded (**Table 9.35**) and were mapped (**Figure 9.19**).

106. The hen harriers were observed quite early in the day during migration watches and follow up searches for wintering roosts were carried out in the wider area and roosts were detected (see Section 9.3.3.7). Golden plover movements were mostly recorded in the spring period although small numbers of this species were recorded to over-winter on the site roosting within close proximity to the existing turbines (see Section 9.3.3.4).

Table 9.35 – Breeding vantage point flying height and duration of Target 1 species records inside the survey area and 500 m buffer

VP No	Month	Day	Year	Species	No	Time detected	Duration (secs)	<15 m	15-25 m	25-50 m	50-75 m	50-100 m	100-125 m	125-140 m	>140 m	Notes
M	1	30	2014	GP	14	13:53	7	7								
M	2	11	2014	HH	1	10:01	123	93	30							Female
M	2	28	2014	GP	18	15:07	67	52	10	5						
M	2	28	2014	GP	1	15:17	27	23	4							
M	3	19	2014	PE	1	09:51	11			11						Chased RN and HC (2)
M	9	24	2014	PE	1	18:23	65			65						Female direct flight across site
M	9	30	2014	PE	1	10:12	80		25	25	5	10	5	10		Female perched on pole initially - seen for 3 minutes 25 seconds before flying off
M	9	30	2014	PE	1	11:05	17	17								Female mobbed by raven before going over ridge line
M	10	17	2014	PE	1	09:03	73	45	15	13						Female chasing flock of starling, kill, to ground, flew off with prey toward quarry but lost in cloud
M	10	29	2014	PE	1	16:52	39		15	14						Female direct level flight at dusk

3.3.6. Breeding Priority Species Surveys

107. There were 114 hours and 14 minutes spent searching adjacent habitats for priority species (**Table 9.1; Table 9.36**) with efforts concentrated on hen harrier, merlin, red grouse and waders during the breeding season. Survey times ranged between 07.10hrs to 23.45hrs and covered a wide range of weather conditions (**Table 9.36**).

Table 9.36 Details of breeding priority species searches (PSS), including survey effort, weather

Survey Type	Search Area	Day	Month	Year	Start time	End time	Duration	Cloud	Height	Wind dir.	Wind strength	Prec.	Vis. (km)
PSS	500 m / 800 m	21	3	2014	13:55	19:00	05:05	10	1100	SW	3	NIL	2
PSS	2 km	21	3	2014	14:20	19:05	04:45	10	400	SW	3	ILR	2
PSS	2 km	10	4	2014	11:45	15:45	04:00	10	500	SW	3	ILR	5
PSS	800 m / 2 km	15	4	2014	11:10	14:55	03:45	5	800	SE	3	NIL	5

Survey Type	Search Area	Day	Month	Year	Start time	End time	Duration	Cloud	Height	Wind dir.	Wind strength	Prec.	Vis. (km)
PSS	2 km	15	4	2014	11:20	14:55	03:35	4	900	SE	3	NIL	5
PSS	2 km	22	4	2014	10:35	13:35	03:00	10	400	E	3	NIL	5
PSS	2 km	22	4	2014	15:00	18:00	03:00	10	600	E	2	ILR	5
RGS	2 km	22	4	2014	19:50	22:15	02:25	10	420	E	2	ILR	5
RGS	500 m	22	4	2014	19:55	22:05	02:10	10	400	SE	2	ILS	1
RGS	500 m / 800 m	22	4	2014	20:00	22:00	02:00	10	400	SE	3	ILR	1
PSS	500 m	23	4	2014	10:55	19:00	08:05	10	700	SE	4	NIL	2
RGS	500 m / 800 m	23	4	2014	20:20	22:35	02:15	10	450	SE	3	ILR	3
PSS	2 km	28	4	2014	12:40	13:55	01:15	10	450	E	2	ILM	2
PSS	2 km	28	4	2014	12:40	13:55	01:15	10	450	E	2	ILM	2
PSS	500 m / 2 km	2	5	2014	14:45	17:55	03:10	7	1600	NW	3	NIL	5
PSS	500 m / 2 km	2	5	2014	15:45	17:45	02:00	8	750	SE	3	NIL	3
PSS	2 km	7	5	2014	10:00	13:00	03:00	10	300	SW	5	CHR	2
SNS	500 m / 2 km	19	5	2014	20:20	23:20	03:00	9	500	E	3	NIL	2
SNS	500 m	19	5	2014	20:30	23:00	02:30	9	600	NE	4	NIL	5
SNS	500 m	19	5	2014	20:30	23:00	02:30	10	600	E	4	NIL	5
PSS	2 km	27	5	2014	09:00	10:30	01:30	3	500	S	3	NIL	3
PSS	2 km	27	5	2014	10:40	12:10	01:30	4	500	S	2	NIL	5
PSS	500 m / 800 m	28	5	2014	20:45	22:05	01:20	7	1000	NE	2	NIL	5
PSS	500 m / 800 m	28	5	2014	20:50	22:05	01:15	6	100	NE	2	NIL	5
SNS	500 m / 2 km	28	5	2014	22:20	23:45	01:25	8	500	NE	5	NIL	2
SNS	500 m	28	5	2014	22:05	23:45	01:40	8	1000	E	4	NIL	2
SNS	500 m	28	5	2014	22:15	23:45	01:30	7	1500	NE	2	NIL	2

Survey Type	Search Area	Day	Month	Year	Start time	End time	Duration	Cloud	Height	Wind dir.	Wind strength	Prec.	Vis. (km)
PSS	800 m / 2 km	5	6	2014	08:20	11:20	03:00	10	300	NW	5	ILR	2
PSS	500 m / 2 km	12	6	2014	07:50	10:50	03:00	6	800	S	3	NIL	5
PSS	2 km / >2 km	12	6	2014	11:00	14:00	03:00	5	1000	S	2	NIL	5
PSS	2 km	24	6	2014	14:55	17:55	03:00	10	500	W	1	NIL	2
PSS	2 km / >2 km	4	7	2014	11:15	14:35	03:20	10	450	SW	3	ILR	4
PSS	>2 km	11	7	2014	12:50	16:50	04:00	10	500	W	2	NIL	5
PSS	2 km / >2 km	25	7	2014	09:05	13:05	04:00	0	-	E	1	NIL	3
PSS	2 km / >2 km	29	7	2014	10:55	14:50	03:55	10	400	W	2	ILR	1.5
PSS	2 km / >2 km	19	8	2014	07:15	13:05	05:50	5	900	SW	1	NIL	5
RGS	500 m	19	8	2014	13:50	17:05	03:15	5	900	SW	2	NIL	5
RGS	500 m	30	8	2014	07:10	09:30	02:20	5	450	SW	1	NIL	2
RGS	500 m	30	8	2014	07:10	09:30	02:20	5	450	SW	1	NIL	2
PSS	2 km / >2 km	30	8	2014	14:50	16:50	02:00	5	450	SW	1	NIL	2

108. There were 13 target species were recorded; namely buzzard, cormorant, curlew, greater black-backed, hen harrier, heron, kestrel, lesser black-backed gull, merlin, peregrine, raven, snipe and sparrowhawk (**Table 9.37**). In addition, vantage point effort was 147 hours during the breeding season and breeding bird surveys comprised 103 hours and 30 minutes. The sightings from all surveys were aggregated with priority species search effort to identify territory locations of target species (**Table 9.1**) and in particular to identify curlew, red grouse, snipe and raptor territories within the core survey areas (**Figure 9.20; Figure 9.20 CONFIDENTIAL**) and published avoidance distances (Ruddock & Whitfield, 2007[18]; Pearce-Higgins et al., 2009) (**Figure 9.21; Figure 9.21 CONFIDENTIAL**).

3.3.6.1. Raptor surveys

109. No raptors were recorded breeding within the 500 m turbine buffers for either existing or proposed turbines. There were two species which were breeding inside the survey area and 500 m buffer (peregrine and buzzard) (**Figure 9.20; Figure 9.20 CONFIDENTIAL**) whilst in the wider area buzzard (n = 5), kestrel (n = 1; fledged two young), sparrowhawk (n = 3) were recorded in the 2 km survey area.

110. Two further buzzards were identified beyond 2 km along with one merlin territory and one hen harrier territory, neither of the merlin or hen harrier pairs were recorded to be successful (**Figure 9.20 CONFIDENTIAL**). Two additional hen harrier territories were recorded beyond 5 km including where chicks were fledged from a tree nest, however these pairs were not known or observed to be foraging in the vicinity of Corkey Windfarm. Three pairs of ravens were recorded within 500 m to 900m from the survey area.

[18] Ruddock, M. & Whitfield, D.P. (2007). A review of disturbance distances in selected bird species. Report from Natural Research (Projects) Ltd. to Scottish Natural Heritage. Natural Research, Banchory, UK.

3.3.6.2. Red grouse surveys

111. Whilst some grouse were recorded within the wider 2 km survey area; these were systematically surveyed within the survey area and 500 m buffer although the much of the site boundary does not contain suitable habitat for this species in particular the improved pasture or woodland areas in the south-east portion of the site. Within the survey area and 500 m buffer there were seven red grouse territories recorded in 2014. All seven of these were within the 500 m buffer of the existing turbines whereas fewer (i.e. six) of these occur within the 500 m buffer of the proposed turbines (**Figures 9.20 & 9.21**).

3.3.6.3. Wader surveys

112. There were no curlew within the survey area and 500 m buffer; but one was recorded within the 800 m buffer. The latter pair were observed to fail in mid-season and subsequently moved to the south-east along Flisk Burn near VP1 (**Figure 9.1**) and thus the two white dots (**Figure 9.20)** within and near the 800 m buffer only represent a single territory which moved after failure, but birds did utilise the second location in the later season for a short time.

113. All territories recorded were greater than 1 km beyond both existing and proposed turbines (see Pearce-Higgins et al., 2009; **Figure 9.21**). There were two additional curlew territories recorded within the 2 km survey area. At least one additional pair of curlew were recorded towards Altaveeden during 2014 and observed displaying in April but these were considerably beyond the 2 km buffer.

114. There were extensive snipe records from the range of surveys conducted and snipe territory mapping revealed that there were five territories within the survey area and 500 m buffer, of which four were within the 500 m existing turbine and/or proposed turbine buffer (**Figure 9.20**). The 400 m buffer of snipe territory locations (see Pearce-Higgins et al., 2009) (**Figure 9.21**) shows that all of the existing turbines are within 400 m of three snipe territories, whilst only three of the proposed turbines are within the 400 m buffer of those same three snipe territories whilst two of the turbines are more than 400 m away any snipe (**Figure 9.21**).

Table 9.37 Details of breeding priority species searches (PSS), including survey dates and species detected

Survey Type	Search Area	Day	Month	Year	Species detected	Notes
PSS	500 m / 800 m	21	3	2014	RN, SN, BZ	13:58 2 RN Some chasing - from quarry or additional pair. 14:35 SN chipping briefly, Knockagallan. 15:47 BZ Flew at 5-10m in trees, freshly lined stick nest. 15:53 RN flying through turbines, flying and displaying flights 20-30m. HH male seen near usual territory perched up and flying, no female seen
PSS	2 km	21	3	2014	BZ, SH	BZ seen soaring high over Slieveanorra Forest, SH into woodlands
PSS	2 km	10	4	2014	SN, GP	11:49 SN Flushed. 11:58 68 GP flying over Skerry with occasional calls and song. 13:09 68 GP flying over Skerry with occasional calls and song. 13:52 SN chipping in damp rushy grassland area.
PSS	800 m / 2 km	15	4	2014	SN, RG	SN 13.10 calling and grouse heard calling 14.05 on PSS walkover and PSS vantage point observations
PSS	2 km	15	4	2014	CU, SH, BZ, K., RN	11:23 CU flying very high over Altaveeden, flew around met mast to north, north-west on horizon then flew south-east over forest. 12:05 SH circling over forest. 12:06 3 BZ circling (2+1) single male flew NW, stooped into forest, pair flew east. 12:45 CU heard west of VP, HC over fields. 12:47 CU 2nd bird heard shortly after north-west. 12:48 K. Found scanning for CU, perched on post, dropped to ground, scavenged on ground, preened then flew south-east, low. 13:10 2 RN along ridge line over forest. 13:14 2 BZ pair circled over reservoir and forest.
PSS	2 km	22	4	2014	RG	13:23 RG Flew in over trees and landed. 13:35 RG took off headed NW over trees.
PSS	2 km	22	4	2014	CA	17:30 CA Flying beside road. HH male and female seen on territory; and merlin pair on territory
PSS	500 m / 800 m	22	4	2014	RG, SN	20:33 RG Calling. 21:13 SN Calling, flew over vp. 21:18 SN.
RGS	500 m	22	4	2014	RG, SN	20:32 RG. 20:52 RG. 21:07 RG. 21:37 RG Not clear call. 21:40 SN brief call + flying. Bats flying around vp at 21:00 3-4 individuals
RGS	500 m / 800 m	22	4	2014	None	No priority species recorded
PSS	500 m	23	4	2014	PE, BZ, SH	12:30 PE Male alarm calling, female sitting on nest. 14:35 BZ male. 18:05 BZ male. 18:25 SH female. HH pair and displaying 17:19 - 17:38 and nest building
RGS	500 m / 800 m	23	4	2014	None	No RG heard or seen, some wind
PSS	2 km	28	4	2014	CU	12:57 CU heard
PSS	500 m / 2 km	2	5	2014	GB, LB, RN	15:47 GB. 15:48 LB. 16:59 58 LB 12 GB 150+ RO around tractor ploughing. 17:31 RN 2+ young fledged.
PSS	500 m / 2 km	2	5	2014	None	HH appear to have moved on from initial nest building location
PSS	2 km	7	5	2014	SN, RG	10:39 SN chipping. 11:24 RG calling.
SNS	500 m / 2 km	19	5	2014	None	No priority species recorded
SNS	500 m	19	5	2014	RG	22:12 RG alarming, calling and flying
SNS	500 m	19	5	2014	None	No priority species recorded
PSS	2 km	27	5	2014	LB, BZ, PE, RN	09:10 LB followed tractor activity. 09:35 BZ circled over forest. 10:05 PE shallow gliding flight before disappear behind tree/ ridge line.10:10 RN 50-150m.
PSS	2 km	27	5	2014	LB	10:55 LB 50-150m. 11:25 LB 50-150m.
PSS	500 m / 800 m	28	5	2014	PE	21:10 PE Adult female feeding young (3Y) same ledge as 2013. BZ circling over quarry nest site, sparrowhawk along edge of road
PSS	500 m / 800 m	28	5	2014	BZ, RN, RG	BZ and RN both seen over known nest sites, RG calling at north-west and merlin seen at forest edge.
SNS	500 m / 2 km	28	5	2014	SN	22:45 SN heard chipping
SNS	500 m	28	5	2014	None	No priority species recorded
SNS	500 m	28	5	2014	SN	23:18 SN
PSS	800 m / 2 km	5	6	2014	None	No priority species recorded
PSS	500 m / 2 km	12	6	2014	RG, HH	8:05 RG heard calling, 200m south-east. 8:49 HH male, Awkward low flying, carrying food towards nest site and further north perhaps due to forestry activities earlier in season. 10:05 RG calling same location as before
PSS	2 km / >2 km	12	6	2014	None	No priority species recorded
PSS	2 km	24	6	2014	None	ML walk and none located
PSS	2 km / >2 km	4	7	2014	None	No priority species recorded

Survey Type	Search Area	Day	Month	Year	Species detected	Notes
PSS	>2 km	11	7	2014	HH, BZ, K.	Second known HH nest; confirmed to have failed after hatching; BZ juveniles at three separate sites (2j; 3j, 2j). K. with 2j
PSS	2 km / >2 km	25	7	2014	H.	09:45 H. in flight below 50m, no activity at HH site
PSS	2 km / >2 km	29	7	2014	None	No priority species recorded, no signs of second attempt at HH nest, which would have been later, seemed to have failed also despite prey deliveries
PSS	2 km / >2 km	19	8	2014	HH, RG, BZ	Two flying HH juveniles, maybe active c7-10 days near tree nest site in Slieveanorra Forest, female seen and food passes observed. BZ flying juveniles recorded
RGS	500 m	19	8	2014	None	No priority species recorded
RGS	500 m	30	8	2014	HH, RG, SN	7:25 HH Female, from forest over moor seen from RGS. 8:09 RG 2A + 3Y. 8:33 RG. 8:41 RG. 9:01 SN flushed.
RGS	500 m	30	8	2014	RG, SN	8:13 RG 2A. 8:56 RG. 9:25 SN flushed beside track
PSS	2 km / >2 km	30	8	2014	None	Followed up HH sighting from am. Relocated site again confirmed that site no longer active, and confirmed to have failed after having relocated.

3.3.7. Wintering Priority Species Surveys

115. During the winter of 2014 to 2015 (September 2014 to February 2015) there were 57 hours and 40 minutes spent searching adjacent habitats (**Figure 9.1**) for priority species (**Table 9.1; Table 9.38**) with efforts concentrated on hen harrier wintering sites, merlin and whooper swan during the wintering season. Survey times ranged between 06.05hrs to 19.40hrs and covered a wide range of weather conditions (**Table 9.38**).

Table 9.38 Details of wintering priority species searches (PSS), including survey effort, weather

Survey Type	Search Area	Day	Month	Year	Start time	End time	Duration	Cloud	Height	Wind dir.	Wind strength	Prec.	Vis. (km)
PSS	500 m / 800 m	2	9	2014	07:55	10:55	03:00	10	600	S	1	NIL	5
PSS	2 km / >2 km	2	9	2014	11:00	14:00	03:00	10	600	S	1	NIL	5
PSS	500 m / 2 km	2	9	2014	07:55	13:45	05:50	10	600	SW	3	NIL	5
PSS	800 m / 2 km	29	9	2014	12:00	15:05	03:05	6	600	SW	3	NIL	5
WRW	2 km / >2 km	2	10	2014	17:25	19:00	01:35	5	600	S	2	NIL	5
PSS	500 m / 2 km	6	10	2014	09:05	10:55	01:50	10	450	SW	3	NIL	5
WRW	2 km / >2 km	10	10	2014	17:55	19:40	01:45	10	400	SW	1	ILF	2
PSS	2 km / >2 km	27	10	2014	11:10	14:10	03:00	10	360	SW	3	NIL	5
PSS	2 km / >2 km	18	11	2014	11:10	12:40	01:30	10	450	SE	3	NIL	5
PSS	2 km	18	11	2014	12:40	14:10	01:30	8	500	SE	3	NIL	5
PSS / WRW	2 km / >2 km	27	11	2014	14:55	17:35	02:40	5	800	SW	2	NIL	5
PSS / WRW	500 m / 2 km / >2 km	18	12	2014	09:35	17:25	07:50	10	500	W	3	NIL	2
WRW	2 km / >2 km	18	12	2014	16:30	17:30	01:00	10	450	W	3	NIL	5
WRW	500 m / 2 km	27	12	2014	14:10	17:10	03:00	10	400	-	-	ILS	1
WRW	2 km / >2 km	30	12	2014	16:10	17:05	00:55	4	600	SW	5	NIL	5
PSS / WRW	2 km / >2 km	5	1	2015	06:40	09:00	02:20	10	400	S	3	NIL	1.5
PSS / WRW	2 km / >2 km	24	1	2015	06:05	09:25	03:20	7	800	W	4	NIL	5
WRW	2 km / >2 km	24	1	2015	15:45	17:50	02:05	7	800	W	4	NIL	5
PSS	2 km / >2 km	19	2	2015	07:30	10:30	03:00	10	800	W	3	NIL	5
PSS	2 km / >2 km	24	2	2015	13:30	15:55	02:25	10	800	W	3	NIL	5

Survey Type	Search Area	Day	Month	Year	Start time	End time	Duration	Cloud	Height	Wind dir.	Wind strength	Prec.	Vis. (km)
PSS	2 km / >2 km	25	2	2015	12:15	15:15	03:00	10	400	S	4	CHM	1

116. There were 13 target species were recorded; namely raven, hen harrier, cormorant, golden plover, snipe, mallard, buzzard, sparrowhawk, heron, whooper swan, peregrine, greylag goose, woodcock, water rail, coot, little grebe (**Table 9.39**). In addition, vantage point effort was 144 hours during the wintering season and breeding bird surveys comprised 43 hours and 55 minutes.

117. The sightings from all surveys were aggregated with priority species search effort to identify key wintering locations of target species (**Table 9.1**) and in particular to identify hen harrier and whooper swan locations within the core survey areas (**Figure 9.20; Figure 9.20 CONFIDENTIAL**) and published avoidance distances (Ruddock & Whitfield, 2007[19]; Pearce-Higgins et al., 2009) (**Figure 9.21; Figure 9.21 CONFIDENTIAL**).

118. Wintering priority species were recorded widely within 2 km (including gulls, buzzard, kestrel, cormorants, heron, peregrine, snipe, hen harrier, red grouse and raven). Gulls and cormorants were typically associated with the nearby reservoir and there were no wintering swan or geese roosting or foraging areas recorded within 2 km.

119. Greylag geese were recorded once flying north-south direction, east of the 2 km buffer, over winter and whooper swans (20 – 45 birds) and greylag geese (± 200) were recorded roosting north-west of the 2 km buffer at Lissanoure Castle (**Table 9.39**). This is a known traditional whooper swan (and greylag goose) roost (**Figures 9.20; 9.21**). All observed goose/swan flights from this area departed or arrived to/from the north and/or north-west of the lakes more than 2 km from the survey area.

120. A hen harrier winter roost area was identified within 2 km (**Figure 9.20 & 9.21 CONFIDENTIAL**) and the maximum roost count was one bird (female only) and was used only infrequently over the winter survey period. Several other suitable areas of roosting habitat occurred within 2 km and just beyond 2 km but no hen harriers were observed. There was another roost identified north of Lissanoure (>2 km from survey area) and was recorded to have a maximum of two roosting harriers (one male, one female).

Table 9.39 Details of wintering priority species searches (PSS), including survey dates and species detected.

Survey Type	Search Area	Day	Month	Year	Species detected	Notes
PSS	500 m / 800 m	2	9	2014	CA	On reservoir; RG calling
PSS	2 km / >2 km	2	9	2014	RN, HH	11:30 RN perched on fence post beside road at junction. 12:02 HH female hunting low over fields.
PSS	500 m / 2 km	2	9	2014	None	No priority species recorded
PSS	800 m / 2 km	29	9	2014	None	No priority species recorded
WRW		2	10	2014	HH	HH female into Slieveanorra roost site 18:41
PSS	500 m / 2 km	6	10	2014	RN, GP, SN, LB, MA	4 RN flying and calling. 1 GP, no further calling heard lost in intermittent light fog. SN flushed beside track and went west flying and calling. SN flying and alarming. 2 RN flushed from heather on carrion. 2 MA flying; LB feeding on carrion
WRW	2 km / >2 km	10	10	2014	BZ, SH	Roost site to the south of the 2 km boundary - no sightings of HH. BZ and SH both seen
PSS	2 km / >2 km	27	10	2014	H., BZ, WS, SH	H. flying. 2 BZ over Lissanoure castle. 4 WS seen 2 on each lake, watched from public road only. Refused access to site but indicated that up 80 WS previously 11 in at moment about 1 week ago. Also reports SN, WK, K., BZ, SH Flying.
PSS	2 km / >2 km	18	11	2014	RN	11:20 RN both diving into forest at something out of sight. No swans recorded
PSS	2 km	18	11	2014	None	No priority species recorded
PSS / WRW	2 km / >2 km	27	11	2014		HH roosting at Slieveanorra (female 16:33) arrived and dropped into riverine area about 200m apart. Suitable area also located beyond 5 km for future watches
PSS / WRW	500 m / 2 km / >2 km	18	12	2014	RN, PE, BZ, HH, WS, GJ	9:38 RN. 10:40 PE female flying over quarry. 12:05 BZ male. 12:30 BZ female. additional, checked all published WS wintering areas - none recorded. None on Lissanoure lakes either. 2 HH at roosting north of Lissanoure 16:45 male and female. 240 GJ at Lissanoure 17:05. 45 WS at Lissanoure 17:05.
WRW	2 km / >2 km	18	12	2014	HH, GJ, WS	17:00 Male and female flew into roost. 17:30 GJ into main lake from NW. 17:30 WS.
WRW	500 m / 2 km	27	12	2014	GJ, RN, WK	14:18 3 GJ 75-100m to east towards Skerry. Ravens roosting in Slieveanorra 14:40 RN flew from trees, flew into site. 14:41 RN followed first bird, but turned. 15:25 2 RN further east. 15:46 RN 10-25m. 15:54 RN 50-75m. 16:01 RN. 16:13 RN. 16:18 RN. All into roost. 16:48 WK out from Slieveanorra.
WRW	2 km / >2 km	30	12	2014	CA; LB	On reservoir
PSS / WRW	2 km / >2 km	5	1	2015	RN	8:35 RN flying, no HH recorded
PSS / WRW	2 km / >2 km	24	1	2015	WS, GJ, CO, WA	WS 23 exited Lissanoure including 6 juveniles 08:51; c130 GJ exited Lissanoure and all flew north. MA seen on lake and CO, WA heard
WRW	2 km / >2 km	24	1	2015	BZ, SH	Near football pitches, no HH seen at roost site

[19] Ruddock, M. & Whitfield, D.P. (2007). A review of disturbance distances in selected bird species. Report from Natural Research (Projects) Ltd. to Scottish Natural Heritage. Natural Research, Banchory, UK.

Survey Type	Search Area	Day	Month	Year	Species detected	Notes
PSS	2 km / >2 km	19	2	2015	RN, H., SH, GJ, LG, MA, BZ	7:40 2 RN. 7:50 H. 9:05 RN large stick nest in mixed planting at crossroads. 9:10 SH suitable nest for SH in riverine habitat. 9:30 6 GJ on main lake at Lissanoure. 15 GJ flying into Lissanoure top lake. 4 LB main lake. 8 MA main lake. 2 LG main lake. 10:00 2 BZ pair defending territory against RN (1) over deciduous trees below quarry.
PSS	2 km / >2 km	24	2	2015	None	No priority species recorded, all published WS sites checked
PSS	2 km / >2 km	25	2	2015	RN	Feeding on carrion

3.4. Field Surveys 2015

121. There were additional priority species surveys carried out between March 2015 to August 2015 which included a series of walkover, vantage point observations and snipe surveys in particular focusing on breeding and wintering priority species particularly swans, geese, hen harrier, merlin, other raptors, curlew, snipe, other waders and red grouse.

3.4.1. Breeding Priority Species Surveys

122. There were 112 hours and 30 minutes spent searching adjacent habitats for priority species (**Table 9.1; Table 9.40**) with efforts concentrated on hen harrier, merlin, red grouse and waders during the breeding season. Survey times ranged between 07.10hrs to 23.45hrs and covered a wide range of weather conditions (**Table 9.40**).

Table 9.40 Details of breeding priority species searches (PSS), including survey effort, weather

Survey Type	Search Area	Day	Month	Year	Start time	End time	Duration	Cloud	Height	Wind dir.	Wind strength	Prec.	Vis. (km)
PSS	2 km / >2 km	22	4	2015	13:05	18:05	05:00	2	1000	W	1	NIL	5
PSS	2 km / >2 km	22	4	2015	12:50	18:05	05:15	2	1000	W	1	NIL	5
PSS	500 m	30	4	2015	07:30	10:30	03:00	2	600	NW	2	NIL	3
PSS	500 m / 2 km	6	5	2015	12:00	15:00	03:00	10	500	N	3	CLR	3
PSS	500 m / 2 km	6	5	2015	12:00	15:00	03:00	10	500	N	3	CLR	3
PSS	500 m and 2 km	14	5	2015	06:20	09:20	03:00	10	600	SE	4	NIL	3
PSS	2 km / >2 km	14	5	2015	06:20	14:20	08:00	6	600	SE	3	NIL	3
PSS	500 m and 2 km	14	5	2015	09:20	12:20	03:00	6	600	SE	3	NIL	3
PSS	2 km	20	5	2015	16:35	19:10	02:35	10	500	NW	3	NIL	5
PSS	2 km	20	5	2015	16:30	19:00	02:30	10	500	W	3	NIL	5
PSS	500 m	20	5	2015	20:20	23:10	02:50	9	500	W	2	NIL	5
	500 m / 2 km	20	5	2015	16:40	20:00	03:20	10	500	W	3	NIL	2
SNS	500 m	20	5	2015	20:30	22:55	02:25	6	500	W	3	NIL	5
SNS	500 m	20	5	2015	20:30	23:00	02:30	6	500	W	3	NIL	2.5
SNS	500 m / 800 m	26	5	2015	20:25	23:05	02:40	10	600	W	3	NIL	2
SNS	500 m / 2 km	26	5	2015	20:20	23:05	02:45	10	600	W	3	NIL	2
SNS	500 m	26	5	2015	20:15	23:00	02:45	9	650	NW	1	NIL	2
PSS	500 m / 2 km	4	6	2015	09:55	12:55	03:00	10	600	SW	2	NIL	2.5
PSS	500 m / 2 km	10	6	2015	10:35	16:35	06:00	2	750	NW	3	NIL	3
PSS	500 m / 2 km / >2 km	15	6	2015	06:05	09:05	03:00	10	1000	S	2	NIL	3
PSS	500 m / 2 km / >2 km	30	6	2015	09:40	15:40	06:00	5	600	S	4	NIL	5
PSS	2 km / >2 km	8	7	2015	13:10	17:10	04:00	9	600	NW	3	NIL	5
PSS	500 m / 2 km	16	7	2015	08:20	11:35	03:15	5	600	SE	3	NIL	5
PSS	2 km	28	7	2015	12:15	15:15	03:00	10	300	S	1	CLR	3

Survey Type	Search Area	Day	Month	Year	Start time	End time	Duration	Cloud	Height	Wind dir.	Wind strength	Prec.	Vis. (km)
PSS	500 m / 2 km / >2 km	28	7	2015	12:15	15:15	03:00	10	500	NW	2	IHR	4
PSS	500 m	28	7	2015	12:10	15:10	03:00	10	450	NW	2	IHR	2.5
PSS	2 km	29	7	2015	13:00	16:55	03:55	9	500	NW	1	ILR	3
PSS	500 m	4	8	2015	08:30	11:30	03:00	10	450	S	5	ILR	5
PSS	500 m / 2 km / >2 km	9	8	2015	06:25	09:25	03:00	10	400	W	3	CLM	2
PSS	500 m / 2 km	19	8	2015	12:40	16:40	04:00	10	400	SE	2	CHR	5
PSS	500 m / 2 km	19	8	2015	12:40	16:25	03:45	10	400	SE	2	CHR	2
PSS	500 m / 2 km	26	8	2015	08:50	11:50	03:00	10	400	SW	1	ILR	3

123. There were 15 target species were recorded; namely curlew, kestrel, buzzard, raven, sparrowhawk, lesser black-backed gull, mallard, hen harrier, peregrine, snipe, red grouse, merlin, heron, cormorant and common gull (**Table 9.41**). Although not listed as target species for the surveys, three, nevertheless locally interesting, species were also noted namely whinchat, cuckoo and greater spotted woodpecker all of which were beyond the 500 m buffer. The sightings from all surveys were aggregated to identify territory locations of target species (**Table 9.1**) and in particular to identify curlew, red grouse, snipe and raptor territories within the core survey areas (**Figure 9.22; Figure 9.22 CONFIDENTIAL**) and published avoidance distances (Ruddock & Whitfield, 2007 ; Pearce-Higgins et al., 2009) (**Figure 9.23; Figure 9.23 CONFIDENTIAL**).

3.4.1.1. Raptor surveys

124. No raptors were recorded breeding within the 500 m turbine buffers for either existing or proposed turbines. There were two pairs of buzzards breeding within the survey area and 500 m buffer and the peregrine site within the survey area and 500 m buffer was occupied again (**Figure 9.22; Figure 9.22 CONFIDENTIAL)** although no breeding activity was evident at the latter. In the wider 2 km area buzzard (n = 7) and sparrowhawk (n = 3) were recorded.

125. Beyond 2 km, three additional buzzard territories were identified along with one merlin territory and two hen harrier territories, neither of the merlin or hen harrier pairs on the eastern side were recorded to be successful despite early breeding activity and the hen harrier pair there subsequently moved slightly further north and was seen there repeatedly (**Figure 9.22 CONFIDENTIAL**). An additional male hen harrier was recorded to be apparently holding territory to the north of the 2 km boundary along with a separately seen female and the two males were recorded to interact. Neither hen harrier territories were within the survey area and 2 km buffer. Additional hen harriers were known to occur beyond 5 km away from the survey area. Two pairs of ravens were recorded within the 500 m buffer (in the quarry) and another pair circa 2 km from the survey area.

3.4.1.2. Red grouse surveys

126. Red grouse surveys within the survey area and 500 m buffer identified five red grouse territories (seven in 2014). All five of these were within the 500 m buffer of the existing turbines whereas fewer, i.e. four of these occur within the 500 m buffer of the proposed turbines (**Figures 9.22**) and one of the proposed turbines was completely outside the 500 m buffer of red grouse territories (**Figures 9.23 & 9.23**) whilst all of the existing turbines were recorded within 500 m of the red grouse during 2015.

3.4.1.3. Wader surveys

127. There were no curlew within the survey area and 500 m buffer. All curlew territories recorded were greater than 1km beyond both existing and proposed turbines (see Pearce-Higgins et al., 2009; **Figure 9.23**). There were two additional curlew territories recorded within the 2 km buffer. One to the north which was recorded to have young in June 2015 although these were suspected to be subsequently predated given the observation of a fox at the time the adult was alarm calling (**Table 9.41**). The second territory was located to the south-east, to the other side of Gruig Windfarm.

128. There were nine snipe territories within the survey area and 500 m buffer in 2015 (five in 2014), of which seven were within the 500 m existing turbine and/or proposed turbine buffer (**Figure 9.22**). The 400 m buffer of snipe territory locations (see Pearce-Higgins et al., 2009) (**Figure 9.23**) shows that nine of the ten existing turbines are within 400 m of six snipe territories, whilst only four of the five proposed turbines are within the 400 m buffer of those same six snipe territories thus one of each of the respective existing and proposed turbines are more than 400 m away any snipe (**Figure 9.23**).

Table 9.41 Details of breeding priority species searches (PSS), including survey dates and species detected.

Survey Type	Search Area	Day	Month	Year	Species detected	Notes
PSS	2 km / >2 km	22	4	2015	CU, K., BZ, RN, SH, LB, MA (WC, GS)	16:15 CU single call then flight towards Mullaghmosagh. K. flying around Corkey. RN nest at Ballynagabog, 2 adult and 3 juveniles on nest. BZ at Magheraboy. WC and CU north of Slieverush. BZ between Aganageeragh and Carnbuck. 25 LB and 2 MA south of Troopers hill. Woodpecker (GS) north of Kendals hill.
PSS	2 km / >2 km	22	4	2015	BZ, SH, HH	BZ at Corkey, Mullaghmossagh and north west of Altnahinch Dam, SH at Altmore hunting along road and carrying prey towards forest. HH male seen small, casual possible display to north of 2 km zone, disappeared from view, no female seen
PSS	500 m	30	4	2015	PE, RN, BZ, SN, LB, RG	3 RN between Corkey and Slievenahanaghan. 2 RG, SN, RN south of Slievenahanaghan. SN east of Moneyneagh. SN, LB, RN and a fox south of Moneyneagh. 2 RN north of Gruig. 9:14 PE flying at 50-100m and a RN between Moneyneagh and Ballure. BZ at Ballure.
PSS	500 m / 2 km	6	5	2015	BZ, ML	Two pairs of buzzard around Agangeeragh, not much activity in rain, brief ML sighting to east, adult male possibly carrying prey north
PSS	500 m / 2 km	6	5	2015	BZ, SH	Mallaboy BZ back on site, Carnagall SH pair circling over wood and BZ male in air defending against crows
PSS	500 m and 2 km	14	5	2015	RN, H., LB, RG, SN	SN alarming north east of Corkey. 2 RN west of Corkey. RN and H. north west of Slievenahanaghan. 3 LB north of Slievenahanaghan. 2 RN calling and 2 SN calling at Slievenahanaghan. 2 RG calling and a RN south east of Slievenahanaghan.
PSS	2 km / >2 km	14	5	2015	BZ, HH	BZ pairs present and defending territory at Caldwellstown - Carnagall, Ballyweeny and just outside Lissanoure (south) near area of bog. HH pair on site to north - no breeding evidence; second HH site just beyond 2 km; pair on nest in heather; female off for brief time and brought more nest material back on; male not seen in 2h watch
PSS	500 m and 2 km	14	5	2015	LB, RN, K., H., BZ, CA, SH (CK)	7 LB near Loughguile. 2 LB at Standing stones. 3 RN north of Gruig. H., K., RN, SH around Slievenahanaghan. CK calling west of Carnbuck. 3 BZ (2+1), H., 3 CA east of Corkey. SH and CK calling south east of Lewin bridge.

Survey Type	Search Area	Day	Month	Year	Species detected	Notes
PSS	2 km	20	5	2015	CA, LB, RN	18:13 2 CA flying NW from reservoir. 18:25 LB flying into reservoir. 19:00 RN north of VP.
PSS	2 km	20	5	2015	HH, ML	HH male seen to north, then interaction with second male to the east, ML pair to east beyond 2 km search zone
PSS	500 m	20	5	2015	SN	10:35 SN calling.
	500 m / 2 km	20	5	2015	K., RN, CU, LB, RN	16:55 K. active site at Slievenamaddy 17:10 K. in with prey 17:35 2 RN. 18:10 CU towards Slieve Rush. 18:25 2 LB. 19:15 RN.
SNS	500 m	20	5	2015	SN, RG	SN chipping and drumming 21.02; 21.19; 21.39; 22.05
SNS	500 m	20	5	2015	SN, RG	SN heard calling at 4 separate locations between 2051 - 2243. Windy and two other possible sites calling, but not clear. 1 RG 21:13
SNS	500 m / 800 m	26	5	2015	SN; RG	22:35 SN heard calling. RG calling 22:51
SNS	500 m / 2 km	26	5	2015	SN	20:31; 21:06; 21:59 SN heard calling.
SNS	500 m	26	5	2015	SN, PE (prey)	22:21 SN. 21:03 SN. PE kill at D115 / 226 (pigeon fresh).
PSS	500 m / 2 km	4	6	2015	RN, K., SN, CA	2 RN (1+1) around Mallaboy and Gruig, flyaing at 10-50m for both. RN near Moneyneagh, flying at 50-100m. K. circling, hovering flight, north east of Slievenahanaghan and a CA in that area. SN disturbed at Slievenahanaghan.
PSS	500 m / 2 km	10	6	2015	K., RN, LB, SH, H., CM, CA	8 CM north of Lislaban. SH near Drumrankin bridge. LB and RN near Rockend. 2 RN at Quarry. K. and H. around Corkey. 2 CA at reservoir. K. and RN at Carnbuck. 2 RN thorugh turbines.
PSS	500 m / 2 km / >2 km	15	6	2015	RN, BZ, PE, H., LB	PE north of Corkey. 2 BZ west of Carnbuck. RN west of Aganageeragh. 2 RN at Slievenahanaghan. 3 LB (2+1) near Carnagall. RN near Ballynagabog bridge. H. south of Loughguile.
PSS	500 m / 2 km / >2 km	30	6	2015	CU, BZ	14:43 CU alarming at something in the grass – fox at Lewin Burn. CU with young 14:47 CU flying at 20m height, calling intensely. BZ flying south east, east of Corkey.
PSS	2 km / >2 km	8	7	2015	BZ, RN	BZ female in moult with prey. 4 RN flying towards Skerry hill.
PSS	500 m / 2 km	16	7	2015	BZ, K.	K. north of Slievenahanaghan. 2 BZ 1 adult and 1 juvenile between Slievenahanaghan and Carnbuck. Several piles of RG pellets recorded, but no birds seen
PSS	2 km	28	7	2015	HH	No sightings at previous recorded HH nest site, but female recorded to the north of location perched up in tree in rain. No evidence of juveniles at either HH or ML sites
PSS	500 m / 2 km / >2 km	28	7	2015	BZ, PE	2 BZ circling over Knockagallan - seen from Slievenorra clearfell, too far to age birds. PE low flight across moor and track on way up PROW
PSS	500 m	28	7	2015	HH	Male HH seen flying at north of site boundary, hunting.
PSS	2 km	29	7	2015	None	No priority species recorded
PSS	500 m	4	8	2015	K., RG	4 RG (3+1) adult and two K. juveniles and a K. male around Slievenahanaghan from site beside reservoir.
PSS	500 m / 2 km / >2 km	9	8	2015	BZ, LB, RN, K., H., CA	CA on reservoir and K. nearby. 3 RN at Quarry. H. flying towards Lewin bridge. Rn at Gruig. SH and LB north of Carnagall. LB south of Corkey. BZ at Gallows hill.
PSS	500 m / 2 km	19	8	2015	HH	Female HH back at same location to north of failed nest location, still hanging around site. No sign of male or any juveniles
PSS	500 m / 2 km	19	8	2015	None	No priority species recorded
PSS	500 m / 2 km	26	8	2015	PE, RN, H., SH	PE seen twice, once at reservoir and the other just north of Corkey. RN flying over Slieveanorra forest. 2 RN at quarry. H. at Rockend and SH north of Carnagall.

3.5. Field Surveys 2016 – 2017

There were additional priority species surveys carried out between March 2016 to February 2017 which included a series of walkover, vantage point observations within 500 m – 2 km (and beyond 2 km for hen harrier and whooper swans) in particular focusing on breeding and wintering priority species particularly swans, geese, hen harrier, merlin, other raptors, curlew, snipe, other waders and red grouse.

3.5.1. Breeding Priority Species Surveys

129. There were 113 hours spent searching adjacent habitats for priority species (**Table 9.1; Table 9.42**) with efforts concentrated on hen harrier, merlin, red grouse and waders during the breeding season. Survey times ranged between 07.20hrs to 23.05hrs and covered a wide range of weather conditions (**Table 9.42**).

Table 9.42 Details of breeding priority species searches (PSS), including survey effort, weather

Survey Type	Search Area	Day	Month	Year	Start time	End time	Duration	Cloud	Height	Wind dir.	Wind strength	Prec.	Vis. (km)
PSS	500 m	31	3	2016	09:50	13:50	04:00	9	500	S	3	NIL	5
PSS	2 km	31	3	2016	14:00	18:00	04:00	6	500	NW	4	ILR	5
PSS	500 m / 2 km	31	3	2016	08:00	12:00	04:00	5	600	SW	2	NIL	5

Survey Type	Search Area	Day	Month	Year	Start time	End time	Duration	Cloud	Height	Wind dir.	Wind strength	Prec.	Vis. (km)
PSS	500 m / 2 km / >2 km	31	3	2016	12:15	18:15	06:00	5	600	SW	2	NIL	5
PSS	>2 km	12	4	2016	08:00	10:00	02:00	10	250	N	4	CLR	0.5
PSS	>2 km	12	4	2016	10:25	12:25	02:00	10	350	NE	4	CLR	3
PSS	>2 km	12	4	2016	12:45	14:45	02:00	10	250	NE	4	CLR	1
PSS	2 km / >2 km	12	4	2016	14:55	18:45	03:50	10	250	NE	4	CLR	1
PSS	500 m / 2 km	19	4	2016	14:30	18:30	04:00	8	700	SW	1	NIL	2
RGS	500 m	19	4	2016	18:45	21:50	03:05	6	800	NE	1	NIL	2
PSS	2 km	19	4	2016	14:05	18:35	04:30	7	900	SW	1	NIL	5
RGS	500 m / 800 m	19	4	2016	18:55	22:10	03:15	7	700	N	1	NIL	5
PSS	500 m	5	5	2016	07:45	09:45	02:00	2	750	S	3	NIL	5
PSS	500 m	5	5	2016	09:50	11:50	02:00	6	600	SW	3	NIL	5
PSS	>2 km	5	5	2016	12:15	14:15	02:00	8	600	SW	4	NIL	5
PSS	500 m / 2 km	5	5	2016	07:30	11:30	04:00	2	600	SW	3	NIL	5
PSS	2 km / >2 km	5	5	2016	12:00	14:00	02:00	4	1000	SW	3	NIL	5
PSS	2 km / >2 km	25	5	2016	16:55	19:55	03:00	9	750	E	2	NIL	3
SNS	500 m	25	5	2016	20:35	23:05	02:30	8	750	SE	3	NIL	3
SNS	500 m	25	5	2016	16:40	22:50	06:10	5	800	E	5	NIL	5
PSS	2 km / >2 km	15	6	2016	07:45	12:15	04:30	10	500	E	2	NIL	5
PSS	500 m	15	6	2016	07:55	11:55	04:00	10	390	NE	2	NIL	5
PSS	500 m / 2 km / >2 km	15	6	2016	12:05	15:05	03:00	10	450	E	2	NIL	5
PSS	2 km / >2 km	15	6	2016	12:30	15:25	02:55	10	500	E	3	NIL	5
PSS	500 m	22	6	2016	07:20	10:50	03:30	8	700	SW	2	NIL	5
PSS	500 m / 2 km / >2 km	22	6	2016	07:40	10:40	03:00	9	400	SW	3	NIL	4
PSS	500 m / 2 km	7	7	2016	09:45	11:00	01:15	4	800	SE	2	NIL	5
PSS	2 km	7	7	2016	11:00	15:00	04:00	4	800	SE	2	NIL	5
PSS	500 m / 2 km	7	7	2016	12:35	15:30	02:55	7	8	NW	2	NIL	5
PSS	2 km / >2 km	7	7	2016	15:30	17:00	01:30	8	800	NW	2	ILR	5
PSS	500 m / 2 km	27	7	2016	08:15	10:15	02:00	5	800	NW	2	NIL	5
PSS	500 m / 2 km	27	7	2016	08:15	10:15	02:00	7	800	N	2	NIL	5
PSS / RGS	500 m / 2 km	11	8	2016	11:35	14:35	03:00	10	300	W	3	CLM	1
PSS / RGS	500 m / 2 km	11	8	2016	11:35	14:35	03:00	10	300	W	3	CHM	1
PSS / RGS	500 m	23	8	2016	08:05	11:05	03:00	10	500	E	3	NIL	5
PSS / RGS	500 m / 2 km	23	8	2016	08:00	11:05	03:05	10	500	E	3	NIL	5

130. There were 17 target species were recorded; namely buzzard, raven, golden plover, snipe, cormorant, herring gull, sparrowhawk, curlew, red grouse, hen harrier, peregrine, lesser black-backed gull, kestrel, heron, graylag goose, greater black-backed gull and merlin (**Table 9.43**). The sightings from all surveys were aggregated to identify territory locations of target species (**Table 9.1**) and in particular to identify curlew, red grouse, snipe and raptor territories within the core survey areas (**Figure 9.24; Figure 9.24 CONFIDENTIAL**) and to review published avoidance distances (Ruddock & Whitfield, 2007; Pearce-Higgins et al., 2009) (**Figure 9.25; Figure 9.25 CONFIDENTIAL**). Two non-breeding species recorded were the

golden plover (seen in March and April only) and the greylag geese may have been feral birds or ones that had not migrated as they were observed in June in a field grazing.

3.5.1.1. Raptor surveys

131. There were no raptors recorded breeding within the 500 m turbine buffers for either existing or proposed turbines. There was one pair of buzzards breeding within 500 m survey area and the peregrine site within the survey area and 500 m buffer was occupied again by a single adult (**Figures 9.24 & 9.24 CONFIDENTIAL**). Two pairs of ravens were recorded within the survey area and 500 m buffer one in the quarry to the north-west and another in a small copse of trees to the south-west. In the wider 2 km area buzzard (n = 7) and sparrowhawk (n = 3) along with two kestrel territories and an additional raven were recorded (**Figures 9.24 & 9.24 CONFIDENTIAL**).

132. Beyond 2 km, five additional buzzard territories were identified along with one merlin territory and one hen harrier territory which was recorded at two locations. The merlin were recorded to have young successfully but the hen harrier pair did not successfully breed. The hen harrier were recorded at the eastern site (**Figure 9.24 CONFIDENTIAL**) and then after mid-April were recorded to relocate to the northern site and the male was seen there on a number of occasions. The female was seen to move between both the northern and eastern site to meet the male; there was no breeding evidence and the hen harrier male was subsequently seen on a number of occasions to the north (**Figure 9.24 CONFIDENTIAL**). Thus, whilst two locations were observed to be used (**Figure 9.24 CONFIDENTIAL**) by the pair, in the early season they initially showed an interest in the eastern and subsequently moved north. Only one pair was present and this was confirmed by flight observations of the birds moving between the two locations (**Table 9.43**). Additional hen harriers were known to occur beyond 5 km away from the survey area but no foraging or movement connectivity to the Site was observed.

3.5.1.2. Red grouse surveys

133. Red grouse surveys within the survey area and 500 m buffer identified three red grouse territories (7 in 2014; 5 in 2015). All three of these were within the 500 m buffer of the existing turbines and the proposed turbines (**Figure 9.24**) and two of the existing turbines were completely outside the 500 m buffer of red grouse territories (**Figures 9.25 & 9.25 CONFIDENTIAL**) whilst all of the proposed turbines were recorded within 500 m of the red grouse during 2016.

3.5.1.3. Wader surveys

134. There were no curlew within the survey area and 800 m buffer. All curlew territories recorded were greater than 1km beyond both existing and proposed turbines (see Pearce-Higgins et al., 2009; **Figure 9.24**). Only one curlew territory was recorded within the 2 km survey area beyond Gruig (**Table 9.43**). An additional pair of curlew was noted more than 5 km away during extended hen harrier monitoring searches to the east.

135. There were 10 snipe territories within the survey area and 500 m buffer in 2016 (5 in 2014; 9 in 2015), of which eight were within the 500 m existing turbine and/or proposed turbine buffer (**Figure 9.24**). The 400 m buffer of snipe territory locations (see Pearce-Higgins et al., 2009) (**Figure 9.25**) shows that the ten existing turbines are within 400 m of six snipe territories and the five proposed turbines are also within the 400 m buffer of eight snipe territories (**Figure 9.25**).

Table 9.43 Details of breeding priority species searches (PSS), including survey dates and species detected.

Survey Type	Search Area	Day	Month	Year	Species Detected	Notes
PSS	500 m	31	3	2016	BZ, RN, GP, SN, CA, HG,	BZ flying north-west to south-west at 10m. RN flew loop through windfarm at 10m. GP flew over windfarm at 20m calling. SN flushed and flew west alarm calling. SN flushed flew short distance west 1m height. BZ flying soaring and calling at 40m. CA flew from reservoir west at 20m height. HG flew into field foraged briefly flew west at 10m. CA flew from reservoir north at 20m. RN flying through windfarm at 20m. RN flying south-east to north-west calling at 10m height.
PSS	2 km	31	3	2016	BZ, GP , RN	BZ flying soaring and calling at 30m. GP flying and calling at 40m. BZ flying calling and perched in trees at 20m.RN flying soaring and calling at 50m. RN flying and calling at 20m.
PSS	500 m / 2 km	31	3	2016	BZ, CA, RN, HG, SN, GP, SH	2 BZ (1+1) AND 2 CA (1+1) around reservoir. RN flying north west past Corkey. HG around quarry. 2 RN (1+1), 3 SN, 21 GP and a SH in and around turbines.
PSS	500 m / 2 km / >2 km	31	3	2016	RN, BZ, GP	3 BZ (2+1) and 2 RN flying over Slieveanorra forest. RN flying beside forest towards Skerry hill. 26 GP flying around wind farm and Moneyneagh.
PSS	>2 km	12	4	2016	CU	Displaying flight beyond 2 km survey area
PSS	>2 km	12	4	2016	None	No priority species recorded
PSS	>2 km	12	4	2016	None	No priority species recorded
PSS	2 km / >2 km	12	4	2016	RG, SN	RG flying and calling bird heard. SN chipping bird on north side
PSS	500 m / 2 km	19	4	2016	BZ, GP, RN	RN around Altmore Burn, BZ at Knockagallan and behind Corkey. BZ and RN at Mallaboy with aggressive BZ pair present east of Mount Hamilton (>2 km) and near Black Hill
RGS	500 m	19	4	2016	SN, RG, GP	SN, RG calling between 20:38 - 21:16 and then silent; low wind good conditions. GP (5) seen on south side and GP (3) seen on north side and roosting up near turbines
PSS	2 km	19	4	2016	HH, RN, BZ, PE	HH female from north of boundary flew hunting towards single turbine, then flew towards eastern site; where met by male; brief interaction but no breeding behaviours observed. Connected to the same site. RN and PE seen at Corkey. Single Adult PE only appears to be colour-ringed (not read). Different adult to previous year
RGS	500 m / 800 m	19	4	2016	SN, RG	SN 21:06; RG 21:13; RG 21:23; SN 21:48; RG 21:46
PSS	500 m	5	5	2016	RN, SN, LB	8:05 RN flying at 10-25m. 8:20 SN flying at 0-10m disturbed. 9:05 RN flying at 10-25m. 9:25 3 LB flying at 0-10m.
PSS	500 m	5	5	2016	CA, RN, BZ	9:55 CA flying at 10-25->150m. 10:20 2 RN. 10:35 BZ flying at >150m
PSS	>2 km	5	5	2016	RN	12:25 RN. 13:05 RN.

Survey Type	Search Area	Day	Month	Year	Species Detected	Notes
PSS	500 m / 2 km	5	5	2016	BZ, K., RN	BZ, 2 RN, K. near turbines, came direction of Slieveanorra nest site at Aganageeragh. RN at Moneyneagh.
PSS	2 km / >2 km	5	5	2016	BZ	BZ at Lough Guile / Lissanoure and Knockagallan active
PSS	2 km / >2 km	25	5	2016	RN, H.	17:55 RN flying at 25-50m. 18:15 H. flying at 25-50m.
SNS	500 m	25	5	2016	SN	22:05 SN heard calling
SNS	500 m	25	5	2016	BZ, RN, K.	Male K. flying north of Slievenahanaghan. 2 RN in around turbines. 2 BZ (1+1) just outside of windfarm to the south east side. 3 RN flying and calling near Mallaboy. RG pellets found and heard calling
PSS	2 km / >2 km	15	6	2016	HH, BZ, SH, K.	Male HH seen over eastern site 09:04; then female seen separately at 11:51; no interaction and no indication of nesting. BZ site and K. site and SH site all active
PSS	500 m	15	6	2016	K., RN, PE	K. flying towards Corkey. 2 RN around northern turbines. 4 RN flying from quarry towards site. 2 PE sightings, one near Moneyneagh and the other slightly further north towards Slievenahanaghan.
PSS	500 m / 2 km / >2 km	15	6	2016	K., BZ, RN, GJ, SH, CU	BZ and SH calling and flying east of Lewin bridge. K. at Corkey. 4 RN and 2 GJ west of Drumrankin bridge in a field grazing. 3 RN between Slieverush and Skerry hill and 2 RN at Skerry hill. CU heard calling west of Skerry Hill near traditional site. 2+ juvenile BZ heard calling from nest at Carnbuck and a SH kill near Carnbuck near active nest. SM holes near quarry.
PSS	2 km / >2 km	15	6	2016	BZ, SH	Two BZ sites active near Altmore and also SH seen entering wood with food. Additional active BZ site beyond 2 km at Altdoo Bridge
PSS	500 m	22	6	2016	CA, SN, RN	8:05 CA on water then flew. 8:07 2 CA. 9:44 SN chipping 10:45 2 RN.
PSS	500 m / 2 km / >2 km	22	6	2016	RN, BZ, SH, K., H.	8:05 RN flying at 25-50m. 8:15 K. flying at 25-50m. 8:30 SH flying at 25-0m. 9:05 H. flying at 90m. 9:15 BZ flying at 100m. 9:35 RN flying at 25-50m. 9:50 2 RN flying at 10-25m. 10:05 BZ flying at 0-10m. 10:15 BZ flying at >100m. 10:30 BZ flying at 50-75m.
PSS	500 m / 2 km	7	7	2016	BZ, RN, GB, LB	10:01 BZ adult soaring (from Carnbuck). 10:19 2 RN, GB (200m south of road) dead sheep in field scavenged by RN + GB + 12 HC. 10:37 LB flying at 25-50m. 10:38 LB flying at 25-50m. 2 RN at quarry.
PSS	2 km	7	7	2016	ML	No HH seen at eastern site, ML young to east (2 possibly 3)
PSS	500 m / 2 km	7	7	2016	BZ, SH, K.	BZ calling with flying juveniles at 2 of the 4 sites checked including juveniles at quarry site along with SH juveniles calling there too in small woodland near quarry; K. pair hanging in quarry but no sign of young; BZ at Mallaboy
						with 1 + young also; None at Caldwellstown site 1 adult only seen
PSS	2 km / >2 km	7	7	2016	HH, RN, H., BZ	16:04 HH male flying over restock area 10-25m. 16:25 RN flying at 25-50m. 16:40 RN flying at 25-50m and H. flying at 10-25m. 16:50 BZ flying at 50-75m. 16:55 BZ flying at 10-25m landed in small deciduous copse.
PSS	500 m / 2 km	27	7	2016	GB, SN, RN, BZ	GB north of Moneyneagh. SN south of Moneyneagh. RN north of Gruig. BZ at Knockagallon.
PSS	500 m / 2 km	27	7	2016	BZ, RN, LB, GB	LB near turbines. GB north of Moneyneagh. RN north of Gruig. BZ male and 7 RN near Knockagallon.
PSS / RGS	500 m / 2 km	11	8	2016	BZ	14:05 BZ flying at 50-100m.
PSS / RGS	500 m / 2 km	11	8	2016	BZ	BZ flying and calling east of quarry. No RG detected
PSS / RGS	500 m	23	8	2016	BZ, RN, SN	BZ flying at 50-100m. RN flying at 25-50m. RN flying at 25-50m. SN heard calling. No RG detected
PSS / RGS	500 m / 2 km	23	8	2016	BZ, RN, SN	BZ east of Slievenahanaghan. 2 RN south east of Slievenahanaghan. SN alarming and flying in around turbines.

3.5.2. Wintering Priority Species Surveys 2016 - 2017

136. During the winter of 2016 to 2017 (September 2016 to February 2017) there were 74 hours and 35 minutes spent searching adjacent habitats within the survey areas (**Figure 9.1**) for priority species (**Table 9.1; Table 9.44**) with efforts concentrated on hen harrier wintering sites, merlin and whooper swan during the wintering season. Survey times ranged between 06.20hrs to 18.45hrs and covered a wide range of weather conditions (**Table 9.44**).

Table 9.44 Details of wintering priority species searches (PSS), including survey dates and species detected.

Survey Type	Search Area	Day	Month	Year	Start time	End time	Duration	Cloud	Height	Wind dir.	Wind strength	Prec.	Vis. (km)
PSS	2 km	13	9	2016	09:00	12:00	03:00	7	900	NE	2	NIL	2
PSS / WRW	2 km+	23	9	2106	06:20	09:30	03:10	10	250	SE	2	CLM	1
PSS	2 km	30	9	2016	15:00	17:00	02:00	8	800	SW	3	NIL	5
PSS	2 km	30	9	2016	15:00	17:00	02:00	6	600	SW	3	NIL	5

Survey Type	Search Area	Day	Month	Year	Start time	End time	Duration	Cloud	Height	Wind dir.	Wind strength	Prec.	Vis. (km)
PSS	2 km	30	9	2016	15:00	17:00	02:00	6	600	SW	3	NIL	5
PSS	500 m / 2 km / >2 km	11	10	2016	06:45	09:45	03:00	6	500	E	3	NIL	5
PSS	2 km	17	10	2016	12:00	15:00	03:00	8	800	SW	3	ILR	3
PSS	500 m / 2 km	25	10	2016	12:35	15:35	03:00	6	600	S	3	NIL	5
PSS	2 km	25	10	2016	12:35	15:55	03:20	6	700	S	3	NIL	5
PSS	500 m / 2 km / >2 km	9	11	2016	06:40	09:40	03:00	10	500	SW	2	NIL	5
PSS	500 m / 2 km	22	11	2016	12:05	15:05	03:00	6	700	NE	3	NIL	5
PSS	500 m / 2 km	22	11	2016	12:05	15:30	03:25	6	900	NE	3	NIL	5
PSS	500 m / 2 km / >2 km	29	11	2016	11:15	14:15	03:00	10	800	SW	2	NIL	5
PSS	500 m / 2 km / >2 km	15	12	2016	09:45	12:45	03:00	10	600	S	2	NIL	5
PSS	2 km	19	12	2016	13:15	17:00	03:45	5	400	N	2	NIL	2
PSS	500 m / 2 km / >2 km	30	12	2016	13:25	15:05	01:40	10	600	SW	3	NIL	5
PSS / WRW	2 km / >2 km	30	12	2016	15:20	17:40	02:20	10	600	SW	3	NIL	5
PSS / WRW	500 m / 2 km / >2 km	4	1	2017	12:30	16:30	04:00	3	800	N	2	NIL	5
PSS / WRW	500 m / 2 km / >2 km	17	1	2017	14:30	17:30	03:00	10	600	S	2	NIL	5
PSS / WRW	500 m / 2 km / >2 km	25	1	2017	12:35	18:15	05:40	8	900	S	4	NIL	5
PSS / WRW	500 m / 2 km	25	1	2017	12:50	18:00	05:10	8	1000	S	4	NIL	5
PSS / WRW	500 m / 2 km / >2 km	2	2	2017	06:45	09:55	03:10	10	400	SE	3	CLM	2.5
PSS / WRW	2 km	21	2	2016	15:50	18:45	02:55	8	500	SW	2	ILR	2
PSS / WRW	500 m / 2 km / >2 km	22	2	2016	06:50	09:50	03:00	6	500	W	3	NIL	5

137. There were 20 target species recorded; namely raven, hen harrier, cormorant, golden plover, snipe, mallard, buzzard, sparrowhawk, heron, whooper swan, mute swan, peregrine, greylag goose, greater black-backed gull, woodcock, tufted duck, lesser black-backed gull, coot, little grebe and merlin (**Table 9.45**).

138. The sightings from all surveys were aggregated to identify key wintering locations of target species (**Table 9.1**) and in particular to identify hen harrier and whooper swan locations within the survey area and 500 m buffer (**Figure 9.26; Figure 9.26 CONFIDENTIAL**).

139. Wintering priority species were recorded widely within 2 km including buzzard, merlin, sparrowhawk and kestrel in various locations (**Figure 9.26**) including near known breeding locations (**Figure 9.24**) and ravens including which were roosting within Slieveanorra forest and were also recorded scavenging on carrion at a number of localities. Gulls and cormorants were typically associated with water bodies in the area and any movements to / from such features were evident.

140. The Lissanoure / Lough Guile area continued to host a range of waterbirds including greylag geese, mute swan and whooper swan (**Table 9.45**; **Figures 9.26**). There were no flights towards the Site, similar to previous winters (2014 – 2015), and numbers of whoopers swans were smaller (n = 7) in 2016 – 2017 than previously recorded (see Section 9.3.3.7). As before all observed goose/swan flights from this area departed or arrived to/from the north and/or north-west of the lakes more than 2 km from the survey area and did not travel towards or away from the Site.

141. A single male hen harrier was observed over Slieveanorra forest, although no roosting was recorded there. However, hen harrier winter roost areas were identified just beyond 2 km (**Figure 9.26 & 9.26 CONFIDENTIAL**) and the maximum roost count was one bird (male only) and was recorded to be used only once over the winter survey period. Several other suitable areas of roosting habitat occurred within 2 km and just beyond 2 km but no hen harriers were observed. The previously roost identified north of Lissanoure (>5 km from the survey area) and was recorded to have a maximum of two roosting harriers (two males (**Table 9.45**).

Table 9.45 Details of wintering priority species searches (PSS), including survey dates and species detected.

Survey Type	Search Area	Day	Month	Year	Species detected	Notes
PSS	2 km	13	9	2016	BZ, HH	BZ soaring over forest; HH male seen circling over forest
PSS / WRW	2 km+	23	9	2106	CO, MA, LG, GJ, RN, BZ	6:55 7 CO and 32 MA on lough, mixed flocks interacting/ feeding. 7:00 2 LG. 7:05 4 CO and 8 MA, mixed flocks interacting/ feeding. 7:10 32 GJ heard earlier but to lift off from lough. In 2 groups (21 / 11). 7:40 3 RN flying at 25-50m. 8:05 BZ flying at 25-50m.
PSS	2 km	30	9	2016	ML, RN, H., BZ	15:35 RN NW of Carnbuck. 16:20 RN west of Skerry hill. 16:42 ML at Slievenamaddy. 16:35 H. flying along raod at Lewin bridge. 16:48 5 RN flying over road at Lewin bridge. 16:50 BZ flying over Slievenorra forest. 17:00 2 RN near Knockagallan.
PSS	2 km	30	9	2016	RN, BZ, H.	15:19 2 RN flying together. 15:22 13 RN all flying together. 16:23 BZ flying in Slievenorra forest. 16:27 RN same area as BZ. 16:41 H. flying over reservoir.
PSS	2 km	30	9	2016	None	No priority species observed
PSS	500 m / 2 km / >2 km	11	10	2016	WS, RN, K., MA, CA	RN and CA at reservoir. K. at Corkey. RN at quarry. MA south of Tully. RN at Toopers hill. MA and 7 WS at Lough Guile.
PSS	2 km	17	10	2016	None	No priority species observed
PSS	500 m / 2 km	25	10	2016	RN, GP, RG, SN	RN near reservoir. 2 RG (1+1), 2 SN and 11 GP in around turbines.
PSS	2 km	25	10	2016	CA	CA 3 observed on reservoir
PSS	500 m / 2 km / >2 km	9	11	2016	WS, MS, T., BZ, RN, CO, H., K., CA	K. and RN near Aganaageeragh. CA on reservoir. H. at Lewin bridge. 3 RN at Knockagallan. 2 RN at quarry. BZ north of Black hill. 3 WS (1+2), 1 MS, 6 T., 12 CO and a MA at Lough guile.
PSS	500 m / 2 km	22	11	2016	SN, PE, RN, BZ	SN and PE around Corkey. BZ around Mallaboy. RN and SN near quarry.
PSS	500 m / 2 km	22	11	2016	BZ	No priority species observed
PSS	500 m / 2 km / >2 km	29	11	2016	SH, CA, H., RN, BZ, MS, MA, CA, GJ	2 RN east of Slievenahanaghan. CA on reservoir and H. near by. SH male near Lewin bridge. RN at quarry. 2 RN at Knockagallan. BZ near Islegom. MA, CA, GJ and 2 MS on Lough Guile.
PSS	500 m / 2 km / >2 km	15	12	2016	ML, CA, RN, SH, BZ, MA, TU	CA, ML and RN around reservoir. 4 RN (2+1+1) around quarry. SH at Knockagallan being mobbed by RO and JD's. SH female west of Carnagall. RN at Checker hall. SH female near Lavin lower. BZ at Kendal hill. BZ near lough Guile and 4 TU, 10 MA on lough Guile.
PSS	2 km	19	12	2016	HH, RN	Roost active to the south of the site, with single male HH at 16:41, circled briefly before into rush / bog area with some scrub first time recorded there despite number of watches, no BZ seen, but several HC and 2 RN
PSS	500 m / 2 km / >2 km	30	12	2016	LB, BZ, H., RN, SH	3 LB near Ballyweeny. BZ near quarry. H., 2 RN, and female SH flying around Slievenorra forest near reservoir. RN flying over Slievenorra forest near Carnbuck. 2 RN south west of Skerry hill.
PSS / WRW	2 km / >2 km	30	12	2016	BZ, HH	No WS seen going into Lough Guile, HH male x 2 seen going into roost to north of Lough Guile and beyond 2 km boundary
PSS / WRW	500 m / 2 km / >2 km	4	1	2017	RN, CA, H., BZ, TU, GJ, MA, GB, WS	RN at Carnbuck. CA flying out of reservoir. H. north of Corkey. RN at quarry. BZ near Islegom. 2 TU, CA, GJ, 6 MA, GB and 3 WS at Lough Guile.
PSS / WRW	500 m / 2 km / >2 km	17	1	2017	BZ, K., LB, RN, MA, H., MS	BZ east of Lewin bridge. H. north west of reservoir. 3 LB north of Corkey. K. male near Slievenahanaghan. 4 RN at quarry. LB and BZ near Mallaboy. 7 MA, H. and 2 MS on Lough Guile.
PSS / WRW	500 m / 2 km	25	1	2017	BZ, WK	No HH recorded at previously recorded roost site within 2 km; BZ observed and WK seen to exit woodland onto open habitats at dusk (x2)
PSS / WRW	500 m / 2 km	25	1	2017	RN, SN	RN at quarry. RN and 2 SN (1+1) around Slievenahanaghan.
PSS / WRW	500 m / 2 km / >2 km	2	2	2017	RN, BZ, MA, TU, CO, CA, H.	CA at reservoir. H. south of Lewin bridge. 2 RN (1+1) around Slievenahanghan. 4 RN at quarry. BZ at Gruig. 3 LB near Ballyweeny. BZ at Black hill. 9 MA, 4 TU and CO on Lough Guile.
PSS / WRW	2 km	21	2	2016	BZ, RN	No HH recorded, 2 BZ seen circling; 9 RN into roost in Slieveanorra forest
PSS / WRW	500 m / 2 km / >2 km	22	2	2016	RN, CA, SH, MA, TU, H., SN	TU, MA, H. T Lough Guile; RN over Knockagallan and Slievenahanaghan scavenging, SH near Lewin Bridge and 6 RN perched up at Altmore Burn, CA flying into dam and SN seen in flight and calling east of Knockagallan. 2 RN circling over turbines on site

3.6. Field Surveys 2018 – 2019

3.6.1. Breeding Bird Surveys

142. Breeding season transect surveys were carried out between during April 2018 and August 2018 (**Table 9.46**). There were 96 hours and 25 minutes undertaken in transect surveys covering both the survey area and 500 m buffer for all species and priority species (curlew) within the 800 m buffer (see also Section 9.3.6.1). Two parts of the survey area remained inaccessible (**Figure 9.7**) for walkover surveys, but both of these parcels were surveyed using visual and auditory observations from the adjacent landownership areas. As previously noted, there were not considered to be any constraints to species detection. Survey times ranged from 05.00 hrs to 20.20 hrs (**Table 9.46**) and covered a wide range of weather conditions (**Table 9.46**).

Table 9.46 Summary of survey effort and weather during breeding bird surveys

Month	Day	Year	Obs	Start	End	Dur	Cloud Cover	Cloud Height (m)	Wind - Dir & Speed	Precip	Vis (km)
MR	04	19	2018	08:45	13:00	04:15	5	900	SW1	NIL	5
DR	04	23	2018	11:35	13:35	02:00	9	600	SW2	ILM	5
MR	04	25	2018	08:45	14:55	06:10	5	1500	SW2	ILR	2
MR	04	29	2018	05:00	13:05	08:05	5	1000	SW1	NIL	5
DR	04	30	2018	10:10	11:10	01:00	5	900	NW2	NIL	5
DR	04	30	2018	17:30	20:20	02:50	6	900	NW2	NIL	5
DR	05	11	2018	05:45	07:05	01:20	10	600	SE4	NIL	5
DR	05	11	2018	10:05	10:45	00:40	10	600	SE4	ILR	5
DR	05	11	2018	13:45	17:15	03:30	10	600	SE4	IHR	5
KM	05	23	2018	15:20	19:40	04:20	0	-	S2	NIL	5
KM	05	24	2018	11:40	16:40	05:00	0	-	SE3	NIL	30
KM	05	29	2018	14:25	16:25	02:00	0	-	E4	NIL	30
KM	05	30	2018	09:30	10:15	00:45	1	1000	E4	NIL	30
KM	05	30	2018	13:15	14:45	01:30	1	1000	E4	NIL	30
KM	06	8	2018	06:45	08:45	02:00	2	2000	NW1	NIL	3
KM	06	8	2018	11:45	14:15	02:30	2	2000	NW1	NIL	3
KM	06	21	2018	08:50	14:15	05:25	5	1000	NW4	NIL	10
KM	06	26	2018	10:15	11:15	01:00	8	2000	S2	NIL	20
KM	06	26	2018	14:15	16:50	02:35	8	2000	S2	NIL	20
DR	07	20	2018	05:05	08:20	03:15	10	300	SW2	ILR	1.5
MR	07	21	2018	05:05	08:50	03:45	5	400	NW2	ILF	1
KM	07	24	2018	09:30	16:00	06:30	8	1000	SW2	NIL	20
DR	08	20	2018	10:05	13:05	03:00	10	400	E1	ILR	5
KM	08	28	2018	09:30	10:30	01:00	10	600	S4	NIL	10
KM	08	28	2018	13:30	15:30	02:00	10	600	S4	NIL	10

143. There were 46 species recorded (**Table 9.47**) within the survey area and 500 m buffer (**Figure 9.1**) of which only five were red-listed species in Ireland (grey wagtail; herring gull; meadow pipit; red grouse and wigeon (Colhoun & Cummins, 2013) and nine UK red-listed species (Eaton et al., 2014; grey wagtail, herring gull, house sparrow; linnet; lesser redpoll; skylark; starling; song thrush; and tree sparrow).

144. There were fewer species (n = 14) recorded within the existing 500 m turbine buffer (**Table 9.48**) including two red-listed species (Colhoun & Cummins, 2013; meadow pipit and red grouse) and three UK red-listed species (Eaton et al., 2014; lesser redpoll, skylark and starling). There were 17 species recorded within the proposed 500 m turbine buffer (**Table 9.49**) including two red-listed species (Colhoun & Cummins, 2013; meadow pipit and red grouse) and three UK red-listed species (Eaton et al., 2014; lesser redpoll, skylark and starling).

145. Behavioural analysis for all the species within the survey area and 500 m buffer indicates that there were 46 extant species recorded and/or exhibiting breeding behaviours. There were 16 confirmed breeding species and another 26 probable and one possible breeding species respectively (**Table 9.47**; **Figures 9.27; 9.28 & 9.29**). There were fewer confirmed breeding species in the existing (n = 2) and proposed (n = 3) 500 m turbine buffers; and an additional seven and six respectively probable and one and two possible breeding species respectively.

146. Meadow pipits and skylarks were widespread across parts of the survey area and 500 m buffer (**Figure 9.30**) and the habitat associations of these species were evident from the distribution with a scarcity in areas of improved pasture and / or afforested habitats and wider presence on the semi-improved / semi-natural habitats (**Figure 9.31**).

147. Analyses of breeding bird transect surveys for waders indicates that there was evidence of two to four snipe territories within the survey area and 500 m buffer of which two were located within either the 500 m existing or 500 m proposed turbine buffers. Additional territories were detected during other surveys (Sections 9.3.6.1) where cumulative analyses are undertaken.

148. There were no curlew territories inside the survey area and 500 m buffer and no territories were recorded within the 800 m buffer, either, during 2018 although curlew were recorded in the wider 2 km buffer. Curlew were more than 1km from any existing or proposed turbines but wider cumulative curlew (and other priority species) analyses are undertaken later (Section 9.3.6.1).

149. There were four red grouse territories recorded during breeding bird surveys within the survey area and 500 m buffer but further priority species surveys were undertaken to identify the full distribution and abundance of these species in the survey areas (see **Section 9.3.6.1**). There were three territories within 500 m of existing turbines but only two were within 500 m of the proposed turbines.

150. A confirmed pair of sparrowhawks and two buzzard territories were recorded within the survey area and 500 m buffer , and although peregrine were recorded this was only defined as a possible territory since only a single adult was ever seen.

Table 9.47 – Summary of numbers of territories of each species detected during breeding bird surveys inside the survey area and 500 m buffer including conservation status

Species	Confirmed	Probable	Possible	Non-breeding	TOTAL	BOCCI3	BOCC4
B.	2	8	6		16	GREEN	GREEN
BC		1			1	GREEN	GREEN
BT		8	4		12	GREEN	GREEN
BZ	2			10	12	GREEN	GREEN
CD		4	3		7	GREEN	GREEN
CH		33	6		39	GREEN	GREEN
CT		3			3	GREEN	GREEN
D.		8			8	GREEN	AMBER
FP	2		4		6	GREEN	GREEN
GL			1		1	RED	RED
GT		6	1		7	GREEN	GREEN
HC	10			17	27	GREEN	GREEN
HG				1	1	RED	RED
HM		11	1		12	AMBER	AMBER
HS	2	4	6		12	AMBER	RED
JD	4	10	10	8	32	GREEN	GREEN
K.				2	2	AMBER	AMBER
LB				5	5	AMBER	AMBER

Species	Confirmed	Probable	Possible	Non-breeding	TOTAL	BOCCI3	BOCC4
LI		2			2	AMBER	RED
LR		3	3		6	GREEN	RED
M		2	2		4	GREEN	GREEN
MG	2	8	7		17	GREEN	GREEN
MP	23	230	13		266	RED	AMBER
PE				1	1	GREEN	GREEN
PH		1			1	GREEN	GREEN
PW		5	9		14	GREEN	GREEN
R.		16	3		19	AMBER	GREEN
RB		3	2		5	GREEN	AMBER
RG		4			4	RED	AMBER
RN	1			28	29	GREEN	GREEN
RO	2	4		7	13	GREEN	GREEN
S.	1	129	4		134	AMBER	RED
SC	1	6	6		13	AMBER	GREEN
SG	4	3	7	7	21	AMBER	RED
SH	1				1	AMBER	GREEN
SI		1			1	AMBER	AMBER
SK		1			1	GREEN	GREEN
SL		9	6	13	28	AMBER	GREEN
SN		2	2		4	AMBER	AMBER
ST		1			1	GREEN	RED
TS		1			1	AMBER	RED
W.		2	5		7	AMBER	GREEN
WN		1			1	RED	AMBER
WP		4	7		11	GREEN	GREEN
WR	1	32			33	GREEN	GREEN
WW		17			17	GREEN	AMBER
TOTAL	**58**	**583**	**118**	**99**	**858**		

Table 9.48 – Summary of numbers of territories of each species detected during breeding bird surveys inside the existing 500 m turbine area including conservation status

Species	Confirmed	Probable	Possible	Non-breeding	TOTAL	BOCCI3	BOCC4
BZ				4	4	GREEN	GREEN
HC	1			8	9	GREEN	GREEN
K.				2	2	AMBER	AMBER
LR			1		1	GREEN	RED
MP	12	112	3		127	RED	AMBER
PW		2			2	GREEN	GREEN
RB		1			1	GREEN	AMBER
RG		3			3	RED	AMBER
RN				11	11	GREEN	GREEN
S.		44			44	AMBER	RED
SC		2	1		3	AMBER	GREEN
SG				2	2	AMBER	RED
SN		1	2		3	AMBER	AMBER
WR		3			3	GREEN	GREEN
TOTAL	13	168	7	27	215		

Table 9.49 – Summary of numbers of territories of each species detected during breeding bird surveys inside the proposed 500 m turbine area including conservation status

Species	Confirmed	Probable	Possible	Non-breeding	TOTAL	BOCCI3	BOCC4
BZ				5	5	GREEN	GREEN
HC	1			8	9	GREEN	GREEN
JD				1	1	GREEN	GREEN
K.				2	2	AMBER	AMBER
LR			1		1	GREEN	RED
MP	14	116	4		134	RED	AMBER
PW		2			2	GREEN	GREEN
RB		1			1	GREEN	AMBER
RG		2			2	RED	AMBER
RN				10	10	GREEN	GREEN
S.	1	64	2		67	AMBER	RED
SC		2	2		4	AMBER	GREEN
SG				2	2	AMBER	RED
SL				1	1	AMBER	GREEN
SN		1	2		3	AMBER	AMBER
W.			1		1	AMBER	GREEN
WR		4			4	GREEN	GREEN
TOTAL	16	192	12	29	249		

3.6.1.1. Comparison of breeding bird surveys between 2014 and 2018

151. There was some evidence of change between survey years 2014 to 2018 (**Table 9.50**) although broadly a similar suite and abundance of species were recorded between years. Some species increased considerably between years (e.g. buzzard, perhaps due to the number of nesting pairs between years). Meadow pipit and skylark remain the two dominant species between years although these numbers have changed by circa 23-28% between years.

Table 9.50 – Summary of numbers of territories of each species detected during breeding bird surveys inside the survey area and 500 m buffer including conservation status showing change between surveys 2014 - 2018

Species	2014	2018	Change 2014 - 2018	Percentage change %	BOCCI3	BOCC4
B.	27	16	-11	-40.7	GREEN	GREEN
BC	3	1	-2	-66.7	GREEN	GREEN
BT	22	12	-10	-45.5	GREEN	GREEN
BZ	1	12	11	1100.0	GREEN	GREEN
CA	1	0	-1	-100.0	AMBER	GREEN
CD	4	7	3	75.0	GREEN	GREEN
CH	70	39	-31	-44.3	GREEN	GREEN
CT	11	3	-8	-72.7	GREEN	GREEN
D.	15	8	-7	-46.7	GREEN	AMBER
FP	3	6	3	100.0	GREEN	GREEN
GB	2	0	-2	-100.0	AMBER	AMBER
GC	3	0	-3	-100.0	AMBER	GREEN
GF	1	0	-1	-100.0	GREEN	GREEN
GH	2	0	-2	-100.0	GREEN	RED
GL	4	1	-3	-75.0	RED	RED
GO	9	0	-9	-100.0	GREEN	GREEN
GP	1	0	-1	-100.0	RED	GREEN
GR	7	0	-7	-100.0	AMBER	GREEN
GT	13	7	-6	-46.2	GREEN	GREEN
H.	2	0	-2	-100.0	GREEN	GREEN
HC	7	27	20	285.7	GREEN	GREEN
HG	1	1	0	0.0	RED	RED
HM	10	12	2	20.0	AMBER	AMBER
HS	18	12	-6	-33.3	AMBER	RED
JD	39	32	-7	-17.9	GREEN	GREEN
K.	1	2	1	100.0	AMBER	AMBER
LB	7	5	-2	-28.6	AMBER	AMBER
LI	15	2	-13	-86.7	AMBER	RED
LR	1	6	5	500.0	GREEN	RED
LT	1	0	-1	-100.0	GREEN	GREEN
M.	3	4	1	33.3	AMBER	RED
MG	24	17	-7	-29.2	GREEN	GREEN
MP	371	266	-105	-28.3	RED	AMBER
PE	1	1	1	0.0	GREEN	GREEN
PH	1	1	0	0.0	GREEN	GREEN
PW	15	14	-1	-6.7	GREEN	GREEN
R.	44	19	-25	-56.8	AMBER	GREEN
RB	12	5	-7	-58.3	GREEN	AMBER
RG	3	4	1	33.3	RED	AMBER
RN	7	29	22	314.3	GREEN	GREEN
RO	17	13	-4	-23.5	GREEN	GREEN
S.	174	134	-40	-23.0	AMBER	RED
SC	13	13	0	0.0	AMBER	GREEN
SG	45	21	-24	-53.3	AMBER	RED
SH	1	1	0	0.0	AMBER	GREEN

Species	2014	2018	Change 2014 - 2018	Percentage change %	BOCCI3	BOCC4
SI	0	1	1	100.0	AMBER	AMBER
SK	3	1	-2	-66.7	GREEN	GREEN
SL	48	28	-20	-41.7	AMBER	GREEN
SM	1	0	-1	-100.0	AMBER	GREEN
SN	4	4	0	0.0	AMBER	AMBER
ST	5	1	-4	-80.0	GREEN	RED
TS	1	1	0	0.0	AMBER	RED
W.	10	7	-3	-30.0	AMBER	GREEN
WC	2	0	-2	-100.0	RED	RED
WN		1	1	100.0	RED	AMBER
WP	17	11	-6	-35.3	GREEN	GREEN
WR	54	33	-21	-38.9	GREEN	GREEN
WW	25	17	-8	-32.0	GREEN	AMBER

3.6.2. Wintering Bird Surveys

152. Wintering season transect surveys were carried out between September 2018 and February 2019 inclusive (**Table 9.51**). There were 37 hours and 40 minutes completed in wintering walkover surveys. Survey times ranged from 08.05 hrs to 18.00 hrs (**Table 9.51**) and covered a wide range of weather conditions (**Table 9.51**).

Table 9.51 Summary of survey effort and weather during wintering bird surveys

Month	Day	Year	Obs	Start	End	Dur	Cloud Cover	Cloud Height (m)	Wind - Dir & Speed	Precip	Vis (km)
CS	09	18	2018	11:50	13:00	01:10	8	600	SW4	NIL	5
CS	09	18	2018	16:00	18:00	02:00	8	600	SW4	NIL	5
KM	09	24	2018	09:35	11:00	01:25	9	1000	SW2	NIL	30
KM	09	24	2018	14:00	16:30	02:30	9	1000	SW2	NIL	30
KM	10	06	2018	08:40	09:10	00:30	10	1500	N2	NIL	40
KM	10	06	2018	15:10	15:40	00:30	5	1000	N3	NIL	40
KM	10	08	2018	08:45	10:00	01:15	10	400	SW4	ILR	10
KM	10	08	2018	13:00	15:45	02:45	10	1000	SW4	ILR	20
KM	10	23	2018	08:30	09:00	00:30	10	600	W3	NIL	10
KM	10	23	2018	12:00	12:30	00:30	10	600	W3	ILR	5
KM	11	12	2018	08:20	10:40	02:20	7	500	S3	NIL	20
KM	11	12	2018	13:40	15:20	01:40	6	800	S4	NIL	50
CS	11	26	2018	08:05	09:40	01:35	3	700	E1	NIL	5
CS	11	26	2018	12:40	14:10	01:30	3	700	E1	NIL	5
KM	12	06	2018	09:15	10:15	01:00	10	300	W3	ILR	0.2
KM	12	06	2018	13:15	15:15	02:00	9	1000	W3	NIL	30
KM	12	19	2018	09:00	12:00	03:00	8	1000	SSE2	NIL	20
KM	01	04	2018	13:15	15:15	02:00	10	2000	SW3	NIL	20
KM	01	22	2018	09:00	11:00	02:00	6	400	NW1	NIL	20
KM	01	22	2018	14:00	15:30	01:30	7	400	NW2	IHS	1
KM	02	01	2018	10:45	13:45	03:00	2	2000	N2	NIL	40
KM	02	20	2018	08:45	11:45	03:00	10	600	SW4	NIL	10

153. There were 329 observation of 787 individuals from 38 species recorded (**Tables 9.52; Figure 9.32**) within the survey area and 500 m buffer (**Figure 9.1**) of which four were red-listed species in Ireland (golden plover, meadow pipit, red grouse and woodcock; Colhoun & Cummins, 2013) and seven UK red-listed species (hen harrier, house sparrow, mistle thrush, skylark, starling, song thrush and woodcock; Eaton et al., 2014).

154. There were fewer species (49 observations of 147 individuals from 12 species) recorded within the 500 m existing turbine buffer (**Tables 9.53**) including four red-listed species (Colhoun & Cummins, 2013; golden plover, meadow pipit, red grouse, and woodcock) and one UK red-listed species (Eaton et al., 2014; woodcock).

155. Whilst within the proposed turbine 500 m buffer there were 72 detections of 198 individuals from 15 species (**Table 9.54**) including four red-listed species (Colhoun & Cummins, 2013; golden plover, meadow pipit, red grouse, and woodcock) and two UK red-listed species (Eaton et al., 2014; mistle thrush and woodcock).

Table 9.52 Summary of numbers of each species detected during wintering bird surveys inside the survey area and 500 m buffer including conservation status

Species	No. of detections	No. of individuals	BOCCI3	BOCC4
B.	7	7	GREEN	GREEN
BT	7	7	GREEN	GREEN
BZ	4	7	GREEN	GREEN
CH	7	10	GREEN	GREEN
CT	5	5	GREEN	GREEN
D.	3	3	GREEN	AMBER
FP	1	2	GREEN	GREEN
GC	2	2	AMBER	GREEN
GO	1	1	GREEN	GREEN
GP	4	24	RED	GREEN
GT	2	3	GREEN	GREEN
H.	2	2	GREEN	GREEN
HC	43	81	GREEN	GREEN
HH	2	2	AMBER	RED
HS	7	18	AMBER	RED
JD	19	132	GREEN	GREEN
JP	1	2	GREEN	GREEN
K.	1	1	AMBER	AMBER

Species	No. of detections	No. of individuals	BOCCI3	BOCC4
LB	1	3	AMBER	AMBER
M.	2	3	AMBER	RED
MG	21	28	GREEN	GREEN
MP	70	116	RED	AMBER
PE	1	1	GREEN	GREEN
PW	10	14	GREEN	GREEN
R.	16	16	AMBER	GREEN
RG	2	6	RED	AMBER
RN	26	63	GREEN	GREEN
RO	18	129	GREEN	GREEN
S.	1	3	AMBER	RED
SC	4	6	AMBER	GREEN
SG	9	45	AMBER	RED
SH	1	1	AMBER	GREEN
SN	6	7	AMBER	AMBER
ST	1	1	GREEN	RED
W.	4	5	AMBER	GREEN
WK	1	1	RED	RED
WR	5	18	GREEN	GREEN
WP	12	12	GREEN	GREEN
TOTAL	329	787		

Table 9.53 – Summary of numbers of each species detected during wintering bird surveys inside the existing 500 m turbine area including conservation status

Species	No. of detections	No. of individuals	BOCCI3	BOCC4
GP	4	24	RED	GREEN
HC	6	13	GREEN	GREEN
K.	1	1	AMBER	AMBER
MG	1	1	GREEN	GREEN
MP	19	34	RED	AMBER
RG	1	2	RED	AMBER
RN	10	41	GREEN	GREEN
RO	1	23	GREEN	GREEN
SC	1	2	AMBER	GREEN
SN	3	4	AMBER	AMBER
WK	1	1	RED	RED
WR	1	1	GREEN	GREEN
Grand Total	49	147		

Table 9.54 – Summary of numbers of each species detected during wintering bird surveys inside the proposed 500 m turbine area including conservation status

Species	No. of detections	No. of individuals	BOCCI3	BOCC4
GP	4	24	RED	GREEN
HC	10	22	GREEN	GREEN
JD	1	15	GREEN	GREEN
K.	1	1	AMBER	AMBER
M.	1	1	AMBER	RED
MG	1	1	GREEN	GREEN
MP	33	56	RED	AMBER
PW	1	2	GREEN	GREEN
RG	1	2	RED	AMBER
RN	10	40	GREEN	GREEN
RO	1	23	GREEN	GREEN
SC	3	5	AMBER	GREEN
SN	3	4	AMBER	AMBER
WK	1	1	RED	RED
WR	1	1	GREEN	GREEN
TOTAL	72	198		

3.6.3. Breeding Vantage Point Surveys

156. There were 36 to 42 hours observation completed at each of the four vantage points between March 2018 and August 2018 (**Tables 9.55 & 9.56**). Cumulative observation time from all vantage points over the survey area was 153 hours during the study period (**Table 9.56**). Survey times ranged from 05.50 hrs to 22.10 hrs (**Table 9.55**) and covered a wide range of weather conditions (**Table 9.57**).

Table 9.55 – Breeding vantage point survey effort

Type	VP No	Observer	Month	Day	Year	Start	End	Duration
BVP	3	DR	3	4	2018	07:25	10:25	03:00
BVP	1	DR	3	4	2018	10:35	13:35	03:00
BVP	2	CS	3	6	2018	11:40	14:40	03:00
BVP	1	DR	3	6	2018	11:30	14:30	03:00
BVP	3	DR	3	10	2018	07:50	10:50	03:00
BVP	2	CS	3	20	2018	09:30	12:30	03:00
BVP	4	CS	3	20	2018	15:50	18:50	03:00
BVP	4	CS	3	27	2018	11:20	14:20	03:00
BVP	1	DR	4	3	2018	06:55	09:55	03:00
BVP	3	DR	4	3	2018	10:25	13:25	03:00
BVP	4	CS	4	4	2018	10:40	13:40	03:00
BVP	2	CS	4	17	2018	09:45	12:45	03:00
BVP	3	DR	4	18	2018	10:50	13:50	03:00

Type	VP No	Observer	Month	Day	Year	Start	End	Duration
BVP	1	DR	4	20	2018	06:35	09:35	03:00
BVP	4	MR	4	25	2018	14:55	17:55	03:00
BVP	2	DR	4	30	2018	11:10	14:10	03:00
BVP	2	DR	4	30	2018	14:30	17:30	03:00
BVP	1	DR	5	3	2018	06:15	09:15	03:00
BVP	3	DR	5	3	2018	11:35	14:35	03:00
BVP	4	DR	5	11	2018	07:05	10:05	03:00
BVP	2	DR	5	11	2018	10:45	13:45	03:00
BVP	1	DR	5	14	2018	06:15	09:15	03:00
BVP	3	DR	5	14	2018	09:30	12:30	03:00
BVP	4	DR	5	24	2018	06:45	09:45	03:00
BVP	4	KM	5	29	2018	11:05	14:05	03:00
BVP	2	CS	5	29	2018	19:10	22:10	03:00
BVP	2	KM	5	30	2018	10:15	13:15	03:00
BVP	1	DR	6	6	2018	05:55	08:55	03:00
BVP	3	DR	6	6	2018	09:15	12:15	03:00
BVP	2	KM	6	8	2018	08:45	11:45	03:00
BVP	4	KM	6	13	2018	11:15	14:15	03:00
BVP	2	KM	6	26	2018	11:15	14:15	03:00
BVP	1	DR	6	28	2018	05:50	08:50	03:00
BVP	3	DR	6	28	2018	09:05	12:05	03:00
BVP	4	DR	6	28	2018	12:35	15:35	03:00
BVP	1	DR	7	5	2018	07:05	10:05	03:00
BVP	3	DR	7	5	2018	10:15	13:15	03:00
BVP	4	DR	7	20	2018	08:25	11:25	03:00
BVP	2	MR	7	21	2018	08:50	11:50	03:00
BVP	1	DR	7	23	2018	07:10	10:10	03:00
BVP	3	DR	7	25	2018	09:40	12:40	03:00
BVP	4	DR	7	30	2018	08:05	11:05	03:00
BVP	2	DR	7	31	2018	10:40	13:40	03:00
BVP	1	DR	8	3	2018	06:10	09:10	03:00
BVP	2	CS	8	7	2018	15:50	18:50	03:00
BVP	3	DR	8	7	2018	13:20	16:20	03:00
BVP	4	DR	8	15	2018	09:45	12:45	03:00
BVP	3	DR	8	20	2018	06:55	09:55	03:00
BVP	1	DR	8	22	2018	07:50	10:50	03:00
BVP	2	KM	8	28	2018	10:30	13:30	03:00
BVP	4	DR	8	30	2018	11:20	14:20	03:00

Table 9.56 – Breeding vantage point survey effort by month

VP No.	Mar	Apr	May	Jun	Jul	Aug	TOTAL
1	6	6	6	6	6	6	36
2	6	9	9	6	6	6	42
3	6	6	6	6	6	6	36
4	6	6	9	6	6	6	39
TOTAL	24	27	30	24	24	24	153

Table 9.57 – Breeding vantage point weather conditions

VP & DATE				Cloud Cover				Cloud Height (m)				Wind - Direction & Speed				Precipitation				Visibility (km)			
VP No.	M	D	Y	0	+1	+2	+3	0	+1	+2	+3	0	+1	+2	+3	0	+1	+2	+3	0	+1	+2	+3
3	3	4	18	10	10	10	10	600	600	600	800	E2	E2	E2	E3	NIL	NIL	NIL	NIL	5	3	5	3
1	3	4	18	10	10	10	10	800	600	600	600	E2	E3	E3	E2	NIL	NIL	ILR	ILR	5	5	5	3
2	3	6	18	10	10	10	10	600	600	600	600	SW2	SW2	SW2	SW3	ILR	NIL	NIL	NIL	5	5	5	5
1	3	6	18	10	10	10	10	400	600	600	600	SE2	S2	SW2	SW3	NIL	NIL	NIL	NIL	5	5	5	5
3	3	10	18	10	10	10	10	600	600	600	600	SE3	SE2	SE2	SE3	NIL	ILR	NIL	CLR	5	3	5	5
2	3	20	18	3	3	3	3	900	900	900	900	NW2	NW2	W2	W2	NIL	NIL	NIL	NIL	5	5	5	5
4	3	20	18	2	2	1	2	1000	1000	1000	1000	W2	W2	W3	W3	NIL	NIL	NIL	NIL	5	5	5	5
4	3	27	18	10	10	9	10	600	600	600	700	SW4	SW5	SW4	SW4	ILR	ILR	ILR	NIL	5	5	5	5
1	4	3	18	10	10	10	10	400	400	400	400	NE2	NE2	NE2	NE2	NIL	ILR	ILR	ILR	5	5	5	5
3	4	3	18	10	10	10	10	400	400	400	400	NE3	NE3	NE3	N3	IHR	CLR	NIL	NIL	5	5	5	5
4	4	4	18	10	10	10	10	380	380	380	380	NE3	NE4	NE4	NE4	CLR	CLR	CLR	CLS	5	5	5	5
2	4	17	18	9	8	10	9	600	600	550	500	SW5	SW6	SW6	SW6	NIL	NIL	NIL	ILR	5	5	5	5
3	4	18	18	10	9	10	10	800	800	800	800	SE2	SE3	SE3	SE3	NIL	NIL	ILR	NIL	5	5	5	5
1	4	20	18	8	8	8	6	800	800	800	800	SW2	SW2	SW2	SW2	NIL	NIL	NIL	NIL	5	5	5	5
4	4	25	18	8	7	8	8	1500	1500	1500	1500	SW2	SW3	SW2	SW2	ILR	ILR	NIL	NIL	2	2	2	2
2	4	30	18	6	6	8	6	800	800	600	600	NW2	NW2	NW2	NW2	NIL	NIL	NIL	NIL	5	5	5	5
2	4	30	18	5	5	5	5	800	800	800	800	N2	N2	N2	N2	NIL	NIL	NIL	NIL	5	5	5	5
1	5	3	18	10	10	10	10	600	450	450	450	SW2	SW3	SW3	SW3	NIL	ILR	ILR	CLR	5	3	3	3
3	5	3	18	10	10	10	10	500	500	600	600	SW3	SW3	SW3	SW3	NIL	NIL	NIL	NIL	5	5	5	5
4	5	11	18	10	10	10	10	600	600	600	600	SE4	SE4	SE4	SE4	NIL	NIL	ILR	NIL	5	5	5	5
2	5	11	18	10	10	10	10	600	600	600	600	SE4	SE4	SE5	SE4	NIL	NIL	CLM	CHR	5	5	3	3
1	5	14	18	10	9	9	10	800	800	800	800	S2	S2	S2	S2	NIL	NIL	NIL	NIL	5	5	5	5
3	5	14	18	10	10	10	10	800	800	800	800	S3	S3	S3	S3	NIL	NIL	NIL	NIL	5	5	5	5

VP & DATE				Cloud Cover				Cloud Height (m)				Wind - Direction & Speed				Precipitation				Visibility (km)			
VP No.	M	D	Y	0	+1	+2	+3	0	+1	+2	+3	0	+1	+2	+3	0	+1	+2	+3	0	+1	+2	+3
4	5	24	18	0	0	0	1	-	-	-	1000	SE2	SE2	SE3	SE3	NIL	NIL	NIL	NIL	5	5	5	5
4	5	29	18	0	0	0	0	-	-	-	-	SE3	SE4	SE4	SE4	NIL	NIL	NIL	NIL	5	5	5	5
2	5	29	18	2	3	2	2	700	700	700	700	E3	E4	E4	E4	NIL	NIL	NIL	NIL	5	5	5	5
2	5	30	18	1	1	1	1	1000	1000	1000	1000	E4	E4	E4	E4	NIL	NIL	NIL	NIL	5	5	5	5
1	6	6	18	5	5	8	8	1000	1000	1000	1000	SE1	SE1	SE1	SE2	NIL	NIL	NIL	NIL	5	5	5	5
3	6	6	18	8	8	6	6	1000	1000	1000	1000	SE2	SE2	SE2	SE2	NIL	NIL	NIL	NIL	5	5	5	5
2	6	8	18	2	1	1	1	2000	2000	2000	2000	NIL	N1	NW2	NW3	NIL	NIL	NIL	NIL	5	5	5	5
4	6	13	18	10	10	10	10	1000	1000	500	500	SW3	SW3	SW4	SW4	ILR	ILR	ILR	ILR	5	5	5	5
2	6	26	18	9	8	8	8	2000	2000	2000	2000	S3	S3	S3	S3	NIL	NIL	NIL	NIL	5	5	5	5
1	6	28	18	4	4	4	4	1000	1000	1000	1000	SW1	SW1	W1	W1	NIL	NIL	NIL	NIL	5	5	5	5
3	6	28	18	3	3	1	2	1000	1000	1000	1000	W1	W1	NW1	NW1	NIL	NIL	NIL	NIL	5	5	5	5
4	6	28	18	2	1	1	1	1000	1000	1000	1000	NW2	NW2	N2	N2	NIL	NIL	NIL	NIL	5	5	5	5
1	7	5	18	8	10	10	9	800	800	800	800	NW2	NW2	NW2	NW2	NIL	NIL	NIL	NIL	5	5	5	5
3	7	5	18	10	8	8	6	800	800	800	800	NW2	NW2	NW3	NW2	NIL	NIL	NIL	NIL	5	5	5	5
4	7	20	18	10	10	10	10	300	300	300	300	SW2	SW2	SW2	SW2	CLR	CLR	CHR	CLR	2.5	2.5	1.5	2.5
2	7	21	18	10	10	10	10	420	480	750	900	NW2	NW2	W2	W2	ILF	ILF	NIL	NIL	1	2	2	2
1	7	23	18	6	8	8	8	500	400	400	400	SW1	SW1	SW1	SW2	NIL	NIL	ILM	ILM	5	5	3	3
3	7	25	18	6	6	8	8	1000	1000	1000	1000	SW3	SW3	SW3	SW3	NIL	NIL	NIL	NIL	5	5	5	5
4	7	30	18	5	6	8	8	800	600	600	600	S3	S3	S3	S3	NIL	NIL	NIL	NIL	5	5	5	5
2	7	31	18	10	10	10	10	600	600	600	600	S3	S4	S4	SW4	ILR	NIL	NIL	NIL	5	5	5	5
1	8	3	18	10	10	10	10	350	400	400	400	SW1	W1	W1	W1	ILM	NIL	NIL	NIL	3	3	3	3
2	8	7	18	9	9	10	9	600	600	600	600	SW2	SW3	SW3	SW2	NIL	NIL	NIL	NIL	5	5	5	5
3	8	7	18	8	8	10	8	800	800	800	800	SW2	SW3	SW2	SW2	NIL	NIL	ILR	NIL	5	5	5	5
4	8	15	18	10	9	10	10	600	800	800	800	SW2	SW2	SW3	SW3	NIL	NIL	NIL	NIL	5	5	5	5
3	8	20	18	10	10	9	10	400	400	500	500	NE1	NE1	NE2	NE2	ILR	ILR	NIL	ILR	5	5	5	5
1	8	22	18	10	10	10	10	500	400	500	500	NW2	NW2	NW2	NW2	NIL	ILM	NIL	NIL	5	3	5	5
2	8	28	18	10	10	10	10	1000	1500	1500	1500	S4	S4	S4	S4	NIL	NIL	NIL	NIL	5	5	5	5
4	8	30	18	8	9	9	9	600	600	600	600	SW1	SW2	SW2	SW2	NIL	NIL	NIL	NIL	5	5	5	5

157. There were 16 target species (**Table 9.58**) were recorded inside the survey area and 500 m buffer; buzzard, cormorant, common gull, greater black-backed gull, golden plover, heron, hen harrier, kestrel, lesser black-backed gull, mallard, merlin, peregrine, red grouse, raven, sparrowhawk and snipe (**Tables 9.58 & 9.59**). The occurrence rate of the detected species was less than 3% of total observation time for five species, and greater than 3% for species (**Table 9.59**) buzzard, cormorant, lesser black-backed gull and raven. Most frequently recorded were raven and buzzard accounting for 67% of the observation duration. A comparative analysis with 2014 to 2015 results is shown in Section 9.3.6.4.1. As requested by NIEA (see **Chapter 9**) buzzard, kestrel and raven flights were additionally mapped (**Figures 9.33; 9.34 & 9.35**).

Table 9.58 – Breeding vantage point sightings records recorded within the 500 m survey boundary.

VP No	Month	Day	Year	Target	Species	Number	Time Detected	Number of 5 min intervals	Comments
1	3	4	2018	2	RN	1	11:15	1	
1	3	4	2018	2	CA	2	11:55	1	
2	3	6	2018	2	BZ	1	11:40	1	BZ from post
2	3	6	2018	2	RN	6	11:55	1	6 RN flying in area
2	3	6	2018	2	GB	3	11:55	1	3 GB taking off and landed in same area
2	3	6	2018	2	SH	1	12:35	1	Female flying low chased by 2 RN
3	3	10	2018	2	RN	2	08:50	1	
3	3	10	2018	2	RN	1	09:50	1	
2	3	20	2018	2	BZ	1	09:40	1	1 BZ circling
2	3	20	2018	1	GP	38	09:55	1	Approximately 38 GP flying together
2	3	20	2018	2	RN	1	10:40	1	
2	3	20	2018	2	BZ	3	10:55	1	
2	3	20	2018	2	BZ	1	12:05	1	
4	3	20	2018	2	RG	1	15:50	1	
4	3	20	2018	2	RN	1	16:45	1	
4	3	20	2018	2	RN	1	17:30	1	
4	3	20	2018	2	BZ	1	17:55	1	
4	3	27	2018	1	GP	1	11:30	1	Heard calling / on ground
4	3	27	2018	2	LB	2	11:40	1	
4	3	27	2018	2	BZ	1	11:45	1	Flew over vp
4	3	27	2018	2	RN	1	12:35	1	
4	3	27	2018	2	LB	1	12:45	1	
4	3	27	2018	2	BZ	2	13:05	1	
4	3	27	2018	2	BZ	1	13:15	1	
1	4	3	2018	2	CA	1	07:40	1	
1	4	3	2018	2	RN	2	08:45	1	
3	4	3	2018	2	SH	1	11:40	1	Female
4	4	4	2018	2	LB	1	11:00	1	
4	4	4	2018	2	LB	1	11:15	1	
4	4	4	2018	2	RN	2	11:35	1	Flying and calling

VP No	Month	Day	Year	Target	Species	Number	Time Detected	Number of 5 min intervals	Comments
4	4	4	2018	1	GP	1	11:50	1	Heard calling / on ground
2	4	17	2018	2	SN	1	09:50	1	From ground
2	4	17	2018	2	RN	1	10:05	1	Flying low over fields
2	4	17	2018	2	RN	1	10:45	1	Flying and calling
2	4	17	2018	2	BZ	1	12:25	1	Hunting
3	4	18	2018	1	HH	1	11:35	1	Female hunting
3	4	18	2018	2	RN	1	12:35	1	
3	4	18	2018	2	LB	2	13:40	1	
1	4	20	2018	2	CA	1	07:25	1	Climbing off dam.
1	4	20	2018	2	RN	1	07:40	1	
1	4	20	2018	2	RN	1	09:00	1	
4	4	25	2018	1	PE	1	15:05	1	Female over quarry
4	4	25	2018	2	RN	1	15:55	1	
4	4	25	2018	2	GB	1	16:05	1	Immature moving west
4	4	25	2018	2	RN	2	16:10	1	
4	4	25	2018	2	BZ	1	16:20	1	Short flight and perched up in trees calling
4	4	25	2018	2	RN	1	16:25	1	
4	4	25	2018	2	BZ	3	16:50	2	Birds fighting & displaying
4	4	25	2018	2	BZ	2	16:55	1	
4	4	25	2018	2	BZ	1	16:55	1	
4	4	25	2018	2	BZ	1	17:05	1	
4	4	25	2018	2	RN	1	17:25	1	Over quarry / active nest
4	4	25	2018	2	BZ	1	17:35	1	Beyond quarry
2	4	30	2018	2	BZ	1	12:30	1	Circling / mobbed by HC's.
2	4	30	2018	2	LB	3	13:35	1	
2	4	30	2018	2	RN	2	14:10	1	
2	4	30	2018	2	BZ	2	15:25	1	Soaring / circling
2	4	30	2018	2	RG	1	15:50	1	Heard calling
1	5	3	2018	2	CA	1	08:05	1	
3	5	3	2018	2	RN	1	12:45	1	
3	5	3	2018	2	RN	1	13:00	1	
4	5	11	2018	2	RN	2	08:05	1	
4	5	11	2018	2	RN	1	08:25	1	
4	5	11	2018	2	RN	1	09:35	1	
1	5	14	2018	2	RN	1	07:10	1	
1	5	14	2018	2	RN	1	07:15	1	
1	5	14	2018	2	RN	2	07:30	1	
1	5	14	2018	2	CA	1	08:45	1	
3	5	14	2018	2	RN	1	09:55	1	
3	5	14	2018	2	SH	1	10:10	1	Male chasing CK into forest
3	5	14	2018	2	H.	1	11:10	1	
4	5	24	2018	2	RN	1	07:15	1	
4	5	24	2018	2	LB	1	07:45	1	
4	5	24	2018	2	RN	2	08:15	1	
4	5	24	2018	2	BZ	1	08:20	1	Landed in conifers (probable nest)
4	5	29	2018	2	BZ	1	12:55	2	Soaring then descends to clump of trees
2	5	30	2018	2	RN	1	12:15	1	Flying low, lands twice
1	6	6	2018	2	RN	1	07:10	1	
1	6	6	2018	2	RN	1	07:35	1	
3	6	6	2018	2	RN	1	09:40	1	
3	6	6	2018	2	RN	2	10:00	1	
3	6	6	2018	2	RN	1	10:35	1	
3	6	6	2018	2	CA	1	11:40	1	
2	6	8	2018	2	RN	1	10:00	1	
2	6	8	2018	2	RN	1	10:15	1	

VP No	Month	Day	Year	Target	Species	Number	Time Detected	Number of 5 min intervals	Comments
2	6	8	2018	2	RN	1	11:10	5	Land on met mast
2	6	8	2018	2	RN	1	11:10	2	Land on met mast
2	6	8	2018	2	RN	1	11:15	1	Left met mast
2	6	8	2018	2	RN	1	11:20	3	Land on met mast
2	6	8	2018	2	RN	2	11:30	1	2 RN leave met mast
4	6	13	2018	2	LB	1	13:10	2	
4	6	13	2018	2	RN	1	13:15	1	Interacting with LB
2	6	26	2018	2	RN	1	11:40	1	
2	6	26	2018	2	ML	1	11:45	1	Flying
2	6	26	2018	2	ML	1	13:20	1	Hunting
1	6	28	2018	2	CA	1	06:50	1	Descending
1	6	28	2018	2	RN	2	08:20	1	
3	6	28	2018	2	RN	1	09:50	1	
3	6	28	2018	2	SH	1	10:20	1	Male into trees
4	6	28	2018	2	BZ	1	13:35	1	Came in low and up into copse
4	6	28	2018	2	BZ	1	13:35	1	Came out from top of copse and circled then landed on dead tree pole
4	6	28	2018	1	PE	1	14:05	1	Male
4	6	28	2018	2	RN	1	14:30	1	
1	7	5	2018	2	MA	3	08:05	1	
1	7	5	2018	2	RN	2	08:40	1	
2	7	21	2018	2	RG	1	09:05	1	Calling near met mast, brief flight
2	7	21	2018	1	PE	1	10:25	1	Over quarry
2	7	21	2018	1	HH	1	11:00	1	Male no avoidance or direction change near turbines
2	7	21	2018	2	RN	2	11:40	1	Quarry and back up to rock face
1	7	23	2018	2	RN	2	08:15	1	
1	7	23	2018	2	RN	1	08:55	1	
3	7	25	2018	2	RN	1	10:30	1	
3	7	25	2018	2	BZ	1	11:35	1	
4	7	30	2018	2	CM	1	09:35	1	CM mobbed by RN over recently ploughed field.
4	7	30	2018	2	RN	1	09:35	1	
4	7	30	2018	2	K.	1	10:05	1	Hover hunting
4	7	30	2018	2	RN	2	10:30	1	
4	7	30	2018	2	BZ	1	10:40	1	
4	7	30	2018	2	RN	2	10:40	1	2 RN Mobbing BZ
2	7	31	2018	2	RN	1	11:30	1	
2	7	31	2018	2	LB	5	11:55	1	
2	7	31	2018	2	BZ	1	13:05	1	
2	7	31	2018	2	RN	2	13:05	1	Mobbing BZ
2	7	31	2018	2	SN	1	13:15	1	Heard calling
1	8	3	2018	1	ML	1	07:40	1	On fence post then hunting
1	8	3	2018	2	RN	1	08:40	1	
1	8	3	2018	2	MA	2	08:55	1	
2	8	7	2018	2	RN	3	15:50	1	
2	8	7	2018	2	RN	4	15:50	1	
2	8	7	2018	2	K.	1	16:00	1	Hunting male
2	8	7	2018	2	K.	1	16:00	1	Hunting female
2	8	7	2018	2	K.	1	16:35	1	Hunting
2	8	7	2018	2	RN	4	16:50	1	Flying and calling
2	8	7	2018	2	K.	1	17:45	1	Hunting female
3	8	7	2018	2	RN	1	14:00	1	
3	8	7	2018	2	BZ	1	14:25	1	
4	8	15	2018	2	BZ	1	09:50	1	Juvenile. Feeding on prey

VP No	Month	Day	Year	Target	Species	Number	Time Detected	Number of 5 min intervals	Comments
									(rabbit) flew off and dropped prey
4	8	15	2018	2	RN	4	10:40	1	Tumbling together.
4	8	15	2018	2	BZ	1	10:55	1	Juvenile. Landed in top of conifer copse. Calling continuously
4	8	15	2018	2	BZ	1	11:00	1	Juvenile.
4	8	15	2018	2	RN	4	11:20	1	
4	8	15	2018	2	LB	1	12:20	1	
3	8	20	2018	2	CA	2	08:30	1	
3	8	20	2018	2	K.	1	09:05	1	
2	8	28	2018	2	RN	1	12:45	1	Flying
4	8	30	2018	2	BZ	1	11:25	1	Perched on top tree. Then disturbed and flew off over ridge.
4	8	30	2018	2	K.	1	12:10	1	Hover hunting flight
4	8	30	2018	2	RN	1	12:40	1	
4	8	30	2018	2	LB	1	13:05	1	Circling over silage cutting

Table 9.59 – Breeding vantage point aggregated species sightings records within the 500 m survey boundary.

Species	Number of detections	%	Number of five minute intervals	%
BZ	29	19.5	31	19.5
CA	8	5.4	8	5.0
CM	1	0.7	1	0.6
GB	2	1.3	2	1.3
GJ	0	0.0	0	0.0
GP	3	2.0	3	1.9
H.	1	0.7	1	0.6
HH	2	1.3	2	1.3
K.	7	4.7	7	4.4
LB	11	7.4	12	7.5
MA	2	1.3	2	1.3
ML	3	2.0	3	1.9
PE	3	2.0	3	1.9
RG	3	2.0	3	1.9
RN	68	45.6	75	47.2
SH	4	2.7	4	2.5
SN	2	1.3	2	1.3
TOTAL	149		159	

158. Four target 1 species (**Table 9.1**) were recorded (**Tables 9.58 & 9.59**); golden plover (n = 1), hen harrier (n = 2), merlin (n = 2) and peregrine (n = 3), and had flying height(s) recorded (**Table 9.61**) and were mapped (**Figures 9.36**).

159. There were two hen harrier observed including one which flew through the operational turbine area and one additional male hen harrier flight was observed from vantage points but which was outside the survey area and 500 m buffer on the 18/4/2018. Curlew were not recorded within the survey area and 500 m buffer during vantage point observations but a single observation was made of a bird to the east of the site boundary from vantage point four on the 29/5/2018; but was beyond the survey area and 500 m buffer and towards the known breeding territory within the 2 km buffer. One other merlin was observed on 03/08/2018 outside the survey area and 500 m buffer.

160. The most frequently recorded target 1 species flights was peregrine with three flights (**Tables 9.60 & 9.61; Figure 9.36**), whilst golden plover were recorded in the early season this species was also observed to undertake specific avoidance actions when flying through the windfarm and operational turbines during 2018 (see also Section 9.3.6.4). Two other golden plover detections were recorded during the breeding season (27/3/2018 and 4/4/2018) but were detected on the ground only and not in flight. There were no breeding golden plover recorded and all sightings in the breeding season were migrant and/or late over-wintering birds.

161. Peregrine and hen harrier flights (**Figure 9.36**) were considered to have originated from known breeding sites nearby although neither of these sites were recorded to fledge any young in 2018 (see also Section 9.3.6.6). All observed hen harrier and

merlin flights were below the height of potential collision risk (<15m) and breeding season peregrine flights were all recorded within the potential rotor swept area 25 m to 75m (72.7%).

Table 9.60 – Breeding vantage point aggregated species sightings records within the survey area and 500 m buffer by month

Species	Mar	Apr	May	Jun	Jul	Aug	TOTAL
BZ	8	9	2	2	3	5	29
CA	1	2	2	2		1	8
CM					1		1
GB	1	1					2
GP	2	1					3
H.			1				1
HH		1			1		2
K.					1	6	7
LB	2	4	1	1	1	2	11
MA					1	1	2
ML				2		1	3
PE		1		1	1		3
RG	1	1			1		3
RN	8	12	12	17	10	9	68
SH	1	1	1	1			4
SN		1			1		2
TOTAL	24	34	19	26	21	25	149

Table 9.61 – Breeding vantage point flying height and duration of Target 1 species records inside the survey area and 500 m buffer

VP No	Month	Day	Year	Species	No	Time 1st detected	Duration (secs)	<15m	15-25m	25-50m	50-75m	50-100m	100-125m	125-140m	>140m	Notes
2	3	20	2018	GP	38	09:52	42					42				
3	4	18	2018	HH	1	11:33	96	96								Female hunting
4	4	25	2018	PE	1	15:04	39				39					Female over quarry
2	6	26	2018	ML	1	11:44	45	45								Hunting
2	6	26	2018	ML	1	13:17	75	75								Hunting
4	6	28	2018	PE	1	14:03	23			23						Male
2	7	21	2018	PE	1	10:23	17			17						Over quarry
2	7	21	2018	HH	1	10:57	15	15								Male. No avoidance or direction change near turbines
1	8	3	2018	ML	1	07:40	85	85								On fence post then hunting
1	9	26	2018	PE	1	12:18	86	45	30	11						
4	9	29	2018	GP	8	11:28	43		15		28					Undulating / circling flight. Disappeared over ridge line
2	10	6	2018	GP	1	12:11	15	15								Flew then landed again
2	10	6	2018	GP	6	13:22	270		75	180	15					6 GP flying near met mast & turbine and changed direction near turbines

3.6.4. Wintering Vantage Point Surveys

162. There were 39 hours observation completed at each of the four vantage points between September 2018 and March 2019 (**Tables 9.62 & 9.63**). Cumulative observation time from all vantage points over the survey area was 156 hours during the study period (**Table 9.63**). Survey times ranged from 06.25hrs to 19.00hrs (**Table 9.62**) and covered a wide range of weather conditions (**Table 9.64).**

Table 9.62 – Wintering vantage point survey effort

Type	VP No	Observer	Month	Day	Year	Start	End	Duration
WVP	1	DR	9	14	2018	06:25	09:25	03:00
WVP	3	DR	9	14	2018	09:35	12:35	03:00
WVP	4	DR	9	17	2018	11:40	14:40	03:00
WVP	2	CS	9	18	2018	13:00	16:00	03:00
WVP	2	KM	9	24	2018	11:00	14:00	03:00
WVP	1	DR	9	26	2018	10:35	13:35	03:00
WVP	3	DR	9	26	2018	13:45	16:45	03:00
WVP	4	DR	9	29	2018	08:50	11:50	03:00
WVP	1	DR	10	1	2018	06:50	09:50	03:00
WVP	3	DR	10	1	2018	10:05	13:05	03:00
WVP	2	KM	10	6	2018	12:10	15:10	03:00
WVP	4	DR	10	10	2018	08:05	11:05	03:00
WVP	1	DR	10	14	2018	07:40	10:40	03:00

Type	VP No	Observer	Month	Day	Year	Start	End	Duration
WVP	3	DR	10	21	2018	07:35	10:35	03:00
WVP	2	KM	10	23	2018	09:00	12:00	03:00
WVP	4	KM	10	23	2018	12:30	15:30	03:00
WVP	1	DR	11	1	2018	08:15	11:15	03:00
WVP	3	DR	11	1	2018	11:25	14:25	03:00
WVP	4	DR	11	7	2018	11:05	14:05	03:00
WVP	2	KM	11	15	2018	08:45	11:45	03:00
WVP	1	DR	11	22	2018	08:10	11:10	03:00
WVP	3	DR	11	25	2018	10:35	13:35	03:00
WVP	2	CS	11	26	2018	09:40	12:40	03:00
WVP	4	DR	11	27	2018	09:45	12:45	03:00
WVP	1	DR	12	3	2018	07:40	10:40	03:00
WVP	3	DR	12	3	2018	10:50	13:50	03:00
WVP	2	KM	12	6	2018	10:15	13:15	03:00
WVP	4	DR	12	10	2018	08:20	11:20	03:00
WVP	3	DR	12	16	2018	08:25	11:25	03:00
WVP	1	KM	12	19	2018	12:10	15:10	03:00
WVP	4	DR	12	31	2018	07:55	10:55	03:00
WVP	2	DR	12	31	2018	11:20	14:20	03:00
WVP	1	DR	1	2	2019	08:45	11:45	03:00
WVP	3	DR	1	2	2019	11:55	14:55	03:00
WVP	4	KM	1	8	2019	09:15	12:15	03:00
WVP	3	DR	1	15	2019	08:05	11:05	03:00
WVP	1	DR	1	15	2019	11:15	14:15	03:00
WVP	2	KM	1	17	2019	08:45	11:45	03:00
WVP	2	KM	1	22	2019	11:00	14:00	03:00
WVP	4	DR	1	29	2019	08:25	11:25	03:00
WVP	1	DR	2	2	2019	07:25	10:25	03:00
WVP	3	DR	2	2	2019	10:40	13:40	03:00
WVP	2	KM	2	12	2019	09:10	12:10	03:00
WVP	4	KM	2	12	2019	12:30	15:30	03:00
WVP	4	CS	2	22	2019	09:20	12:20	03:00
WVP	2	CS	2	25	2019	16:00	19:00	03:00
WVP	3	CS	2	28	2019	15:45	18:45	03:00
WVP	1	KM	2	20	2019	11:45	14:45	03:00
WVP	3	DR	3	3	2019	07:45	10:45	03:00
WVP	2	KM	3	7	2019	14:00	17:00	03:00
WVP	1	DR	3	17	2019	08:35	11:35	03:00
WVP	4	KM	3	26	2019	13:20	16:20	03:00

Table 9.63 – Wintering vantage point survey effort by month

VP No.	Sep	Oct	Nov	Dec	Jan	Feb	Mar	TOTAL
1	6	6	6	6	6	6	3	39
2	6	6	6	6	6	6	3	39
3	6	6	6	6	6	6	3	39
4	6	6	6	6	6	6	3	39
TOTAL	24	24	24	24	24	24	12	156

Table 9.64 – Wintering vantage point weather conditions

VP & DATE				Cloud Cover				Cloud Height (m)				Wind - Direction & Speed				Precipitation				Visibility (km)			
VP No.	M	D	Y	0	+1	+2	+3	0	+1	+2	+3	0	+1	+2	+3	0	+1	+2	+3	0	+1	+2	+3
1	9	14	18	10	10	9	10	350	350	350	350	W2	W2	W2	SW2	ILR	NIL	NIL	ILM	3	5	5	3
3	9	14	18	10	8	9	9	350	500	500	500	SW2	SW2	SW2	W3	ILM	NIL	NIL	NIL	3	5	5	5
4	9	17	18	10	10	10	10	350	400	450	450	S2	S3	S3	S3	CLR	NIL	NIL	NIL	1.5	5	5	5
2	9	18	18	7	8	8	6	500	600	600	600	SW4	SW4	SW4	SW4	NIL	NIL	NIL	NIL	5	5	5	5
2	9	24	18	9	8	6	6	1000	1000	1000	1000	W3	W3	W3	NW3	NIL	NIL	NIL	NIL	5	5	5	5
1	9	26	18	10	10	10	9	800	800	600	600	SW3	SW3	SW3	SW3	NIL	NIL	NIL	NIL	5	5	5	5
3	9	26	18	9	9	9	9	600	600	600	600	SW3	SW3	SW3	SW3	NIL	NIL	NIL	NIL	5	5	5	5
4	9	29	18	10	10	10	10	800	800	800	800	SW2	SW3	SW3	SW3	NIL	NIL	NIL	NIL	5	5	5	5
1	10	1	18	10	10	10	10	400	350	400	400	W2	W2	W2	W2	ILM	ILM	ILM	ILM	3	3	3	3
3	10	1	18	10	8	8	10	400	400	500	600	W2	W2	SW2	SW2	ILM	ILM	ILM	NIL	3	3	5	5
2	10	6	18	4	5	6	5	1000	1000	1000	1000	N3	N4	N4	N3	NIL	NIL	ILR	NIL	5	5	5	5
4	10	10	18	10	10	6	4	400	450	500	800	SE2	SE3	SE3	SE3	ILM	ILM	NIL	NIL	3	3	5	5
1	10	14	18	8	8	6	6	800	800	800	800	SW2	SW2	SW2	SW2	NIL	NIL	NIL	NIL	5	5	5	5
3	10	21	18	10	10	10	10	400	400	400	400	SW2	SW3	W2	W2	ILR	NIL	IHM	NIL	1.5	2.5	0.5	5
2	10	23	18	10	10	10	10	600	600	400	300	W3	W3	W3	W3	ILR	ILR	ILR	ILR	5	5	1	0.1
4	10	23	18	10	10	10	10	300	350	300	300	W3	W3	W3	W3	ILR	NIL	ILR	ILR	5	5	5	5
1	11	1	18	4	4	6	6	400	400	600	800	SW2	SW2	SW2	W2	NIL	NIL	NIL	NIL	3	3	3	5
3	11	1	18	6	6	6	8	800	800	800	800	W2	W2	NW2	NW2	NIL	NIL	NIL	NIL	5	5	5	5
4	11	7	18	10	10	10	10	350	350	400	350	NW2	NW2	NW2	W2	NIL	IHR	IHR	IHR	3	3	3	3
2	11	15	18	4	3	3	6	600	800	1000	1000	SSE4	SSE5	S5	S6	NIL	NIL	NIL	NIL	5	5	5	5
1	11	22	18	9	9	8	8	600	600	600	600	SE2	SE2	SE3	SE3	NIL	NIL	NIL	NIL	5	5	5	5
3	11	25	18	4	6	6	6	600	600	600	600	E2	E3	E2	E2	NIL	ILR	NIL	NIL	5	5	5	5

VP & DATE				Cloud Cover				Cloud Height (m)				Wind - Direction & Speed				Precipitation				Visibility (km)			
VP No.	M	D	Y	0	+1	+2	+3	0	+1	+2	+3	0	+1	+2	+3	0	+1	+2	+3	0	+1	+2	+3
2	11	26	18	3	2	3	1	700	800	800	800	E2	E2	E2	E2	NIL	NIL	NIL	NIL	5	5	5	5
4	11	27	18	10	10	10	10	500	500	400	350	SE4	SE5	SE4	SE4	CHR	CHR	CHR	CHR	3	3	3	3
1	12	3	18	4	4	4	6	400	350	400	400	NW2	NW2	NW3	NW3	ILR	NIL	NIL	NIL	2	5	5	5
3	12	3	18	6	6	7	9	400	400	400	400	NW3	NW3	NW2	NW2	NIL	NIL	CLR	CLR	5	5	3	5
2	12	6	18	10	9	9	9	400	800	800	1000	W3	W3	W3	W3	ILR	NIL	NIL	NIL	1	5	5	5
4	12	10	18	10	10	10	10	600	600	600	600	SW2	SW2	SW1	SW1	NIL	NIL	NIL	NIL	3	5	5	5
3	12	16	18	10	10	9	9	350	350	350	400	SW2	SW2	S2	S2	CLM	ILM	ILM	NIL	1.5	1.5	2.5	5
1	12	19	18	10	9	10	10	600	800	800	800	SSW5	SSW5	SSW5	S5	ILR	NIL	NIL	NIL	5	5	5	5
4	12	31	18	10	10	10	10	500	500	500	500	SW2	SW2	SW2	SW2	NIL	NIL	NIL	NIL	2	5	5	5
2	12	31	18	10	7	9	10	500	600	600	600	SW3	SW3	SW3	SW3	NIL	NIL	NIL	NIL	5	5	5	5
1	1	2	19	10	10	10	10	600	600	600	600	SE2	SE2	SE2	SE2	NIL	NIL	NIL	NIL	5	5	5	5
3	1	2	19	10	10	10	10	600	600	600	600	SE2	SE3	SE2	SE2	NIL	NIL	NIL	NIL	5	5	5	5
4	1	8	19	5	6	4	4	2000	2000	2000	2000	N3	N4	N4	NW4	NIL	NIL	NIL	NIL	5	5	5	5
3	1	15	19	10	10	10	10	500	400	400	400	SW2	SW3	SW3	SW2	NIL	NIL	NIL	ILR	3	5	5	5
1	1	15	19	10	9	8	8	400	600	600	600	SW2	SW2	SW2	SW2	ILR	NIL	NIL	NIL	5	5	5	5
2	1	17	19	1	1	1	4	1000	1000	1000	1000	NE3	NE3	NE3	NE3	ILS	NIL	NIL	NIL	5	5	5	5
2	1	22	19	10	7	4	7	400	350	400	400	NW2	NW3	NW3	NW3	ILS	NIL	NIL	ILS	1	0.5	5	5
4	1	29	19	10	9	10	10	350	350	400	400	W1	W2	W2	W2	NIL	ILS	NIL	NIL	5	5	5	5
1	2	2	19	3	3	4	4	800	800	800	800	NW1	NW1	NW2	NW2	NIL	NIL	NIL	NIL	5	5	5	5
3	2	2	19	4	4	2	2	800	800	800	800	NW2	NW2	NW2	NW2	NIL	NIL	NIL	NIL	5	5	5	5
2	2	12	19	10	10	10	10	450	450	450	500	SW4	SW5	SW5	SW5	NIL	ILR	NIL	NIL	5	5	5	5
4	2	12	19	10	9	6	5	500	500	600	600	SW5	SW5	W4	W4	NIL	NIL	NIL	NIL	5	5	5	5
1	2	20	19	10	10	10	10	600	400	350	350	SW4	SW3	SW3	SW3	NIL	NIL	ILR	ILR	5	5	3	3
4	2	22	19	10	10	10	10	700	700	700	700	SE3	SE4	SE4	SE4	NIL	NIL	NIL	NIL	5	5	5	5
2	2	25	19	9	8	8	9	800	800	800	800	S3	S4	S4	S4	NIL	NIL	NIL	NIL	5	5	5	1
3	2	28	19	10	10	10	10	350	350	430	350	SW1	SW1	SW1	SW1	NIL	NIL	NIL	NIL	1	1	2	1
3	3	3	19	5	5	7	7	800	800	800	800	SW2	SW2	SW3	SW2	NIL	NIL	NIL	NIL	5	5	5	5
2	3	7	19	9	10	9	8	700	700	700	700	N4	N4	N4	N4	NIL	NIL	NIL	NIL	5	5	5	5
1	3	17	19	10	10	9	9	350	350	500	500	SW2	SW3	SW3	SW2	NIL	IHS	NIL	NIL	5	2	5	3
4	3	26	19	10	10	10	10	1000	1000	1000	1000	NW4	NW4	NW4	NW4	NIL	NIL	NIL	NIL	5	5	5	5

163. There were 12 target species (**Table 9.65**) recorded inside the survey area and 500 m buffer during the wintering period; buzzard, cormorant, greylag goose, golden plover, heron, kestrel, lesser black-backed gull, peregrine, red grouse, raven sparrowhawk, and snipe. The occurrence rate of the detected species ranged from 0.8% - 54.5% with only two species which were recorded more than 5% of total observation time namely buzzard (22.7%) and raven (54.5%) (**Tables 9.65 & 9.66**).

164. There was some variation in detection rates across the wintering period (**Table 9.67**) although only buzzard and raven were seen throughout the wintering period (**Table 9.67**). As requested by NIEA (see **Chapter 9**) buzzard, kestrel and raven flights were additionally mapped (**Figures 9.34; 9.35 & 9.36**, see also Section 9.3.3.3).

Table 9.65 – Wintering vantage point sightings records recorded within the survey area and 500 m buffer

VP No	Month	Day	Year	Target	Species	Number	Time Detected	Number of 5 min intervals	Comments
1	9	14	2018	2	H.	1	07:35	1	
1	9	14	2018	2	CA	1	08:25	1	
3	9	14	2018	2	RN	1	09:45	1	Landed on fence post
3	9	14	2018	2	RN	1	10:25	1	
3	9	14	2018	2	RN	1	10:35	1	
4	9	17	2018	2	SH	1	12:55	1	Female flew from beech tree over improved grassland into conifers. Mobbed by MG
4	9	17	2018	2	LB	3	13:20	1	
4	9	17	2018	2	LB	1	13:35	1	
4	9	17	2018	2	RN	2	13:50	1	
2	9	18	2018	2	RN	2	13:10	1	2 RN flying together
2	9	18	2018	2	BZ	1	13:55	1	BZ and RN mobbing each other
2	9	18	2018	2	RN	1	13:55	1	BZ and RN mobbing each other
2	9	18	2018	2	BZ	1	14:15	1	
2	9	18	2018	2	RN	2	14:45	1	2 flying together
2	9	18	2018	2	K.	1	14:55	1	Hunting near vp
2	9	18	2018	2	RN	1	15:40	1	1 RN flying and calling
2	9	24	2018	2	BZ	3	11:45	1	3 BZ flying together
2	9	24	2018	2	RN	2	12:05	1	2 RN interacting

VP No	Month	Day	Year	Target	Species	Number	Time Detected	Number of 5 min intervals	Comments
2	9	24	2018	2	RN	2	12:30	1	2 RN interacting
2	9	24	2018	2	RN	6	12:40	1	6 RN interacting
2	9	24	2018	2	RN	2	12:40	1	2 RN interacting
2	9	24	2018	2	BZ	1	13:10	1	Soaring
2	9	24	2018	2	RN	2	13:25	1	2 RN interacting
2	9	24	2018	2	RN	6	13:30	1	6 RN interacting
2	9	24	2018	2	RN	3	13:45	1	3 RN interacting
2	9	24	2018	2	RN	2	13:55	1	2 RN interacting
1	9	26	2018	2	RN	1	11:45	1	
1	9	26	2018	2	RN	1	11:45	1	
1	9	26	2018	1	PE	1	12:20	1	
1	9	26	2018	2	H.	1	13:30	1	
3	9	26	2018	2	RN	1	15:10	1	
4	9	29	2018	2	SH	1	10:05	1	Female hunting along tree lined gully, strike but no kill
4	9	29	2018	2	RN	1	10:45	1	RN mobbing BZ then RN diverted over south-west of site
4	9	29	2018	2	RN	1	10:45	1	RN mobbing BZ then RN diverted over south-west of site
4	9	29	2018	2	BZ	1	10:45	1	
4	9	29	2018	1	GP	8	11:30	1	Undulating / circling flight. Disappeared over ridge line
1	10	1	2018	2	CA	2	07:45	1	
1	10	1	2018	2	RN	1	09:05	1	

VP No	Month	Day	Year	Target	Species	Number	Time Detected	Number of 5 min intervals	Comments
3	10	1	2018	2	RN	1	10:55	1	
3	10	1	2018	2	CA	1	11:35	1	
2	10	6	2018	1	GP	1	12:15	1	Flushed and landed
2	10	6	2018	1	GP	6	13:25	2	Flock flying
4	10	10	2018	2	BZ	1	08:10	1	In conifers. Low Flight
4	10	10	2018	2	RN	2	08:35	1	Undulating flight over gully
4	10	10	2018	2	RN	1	08:45	1	
4	10	10	2018	2	LB	1	09:35	1	
4	10	10	2018	2	BZ	1	10:05	1	On ridgeline. Undulating flight.
4	10	10	2018	2	RN	2	10:10	1	Playing.
1	10	14	2018	2	CA	1	09:05	1	
3	10	21	2018	2	RN	1	08:50	1	
3	10	21	2018	2	BZ	1	09:25	1	
3	10	21	2018	2	H.	1	09:55	1	
3	10	21	2018	2	RN	2	10:30	1	
4	10	23	2018	2	RN	2	13:25	1	Flying
4	10	23	2018	2	RN	2	13:35	1	Flying
4	10	23	2018	2	RN	1	13:40	1	Flying
4	10	23	2018	2	RN	1	14:25	1	
3	11	1	2018	2	RN	2	11:55	1	
4	11	7	2018	2	RN	1	11:30	2	
4	11	7	2018	2	SH	1	12:10	1	Female
4	11	7	2018	2	BZ	2	12:50	1	
4	11	7	2018	2	RN	2	13:25	1	
3	11	25	2018	2	BZ	1	10:50	1	
2	11	26	2018	2	RN	1	10:10	1	
2	11	26	2018	2	RN	2	11:35	1	
1	12	3	2018	2	RN	1	08:50	2	
3	12	3	2018	2	RN	1	11:25	1	
3	12	3	2018	2	RN	2	12:05	2	
2	12	6	2018	2	RN	1	12:10	1	Flying to land on post
2	12	6	2018	2	RN	1	12:10	1	Flies from post

VP No	Month	Day	Year	Target	Species	Number	Time Detected	Number of 5 min intervals	Comments
4	12	10	2018	2	BZ	1	09:20	1	
4	12	10	2018	2	RN	2	10:45	1	
3	12	16	2018	2	RN	1	08:55	1	Heard calling
3	12	16	2018	2	H.	1	10:45	1	
4	12	31	2018	2	BZ	1	07:55	1	
4	12	31	2018	2	SN	1	09:25	1	Heard calling
4	12	31	2018	2	RN	1	09:55	1	
2	12	31	2018	2	RN	1	11:35	1	
2	12	31	2018	2	RN	1	12:45	1	
2	12	31	2018	2	BZ	1	14:00	1	
1	1	2	2019	2	CA	2	09:05	1	
1	1	2	2019	2	RN	1	10:10	1	
3	1	2	2019	2	RN	2	12:30	1	
4	1	8	2019	2	RN	1	11:45	1	Flying west of VP
4	1	8	2019	2	BZ	1	11:50	1	Calling west of VP
1	1	15	2019	2	RN	2	11:55	1	
1	1	15	2019	2	CA	2	13:25	1	
1	1	15	2019	2	K.	1	13:50	2	Male
2	1	22	2019	2	BZ	1	12:50	1	Calling
2	1	22	2019	2	RN	1	13:25	1	Calling
2	1	22	2019	2	RN	2	13:45	1	Flying through windfarm.
4	1	29	2019	2	SN	1	09:35	1	
4	1	29	2019	2	RN	2	10:25	1	
1	2	2	2019	2	RN	1	08:00	1	
1	2	2	2019	2	GJ	34	08:25	1	

VP No	Month	Day	Year	Target	Species	Number	Time Detected	Number of 5 min intervals	Comments
1	2	2	2019	2	RN	1	09:45	1	
3	2	2	2019	2	BZ	1	12:20	1	
2	2	12	2019	2	RN	2	11:20	1	Flying in windfarm.
2	2	12	2019	2	RN	2	12:05	1	Flying in windfarm.
4	2	12	2019	2	RN	2	12:45	1	Flying in windfarm.
4	2	12	2019	2	RN	1	13:10	1	Flying west of windfarm.
4	2	12	2019	2	RN	1	13:20	2	Flying in windfarm.
4	2	12	2019	2	BZ	1	14:00	1	Flying south-west of windfarm.
4	2	12	2019	2	BZ	1	14:10	2	Hunting in windfarm.
4	2	12	2019	2	BZ	1	14:15	3	Hunting at west end of windfarm.
4	2	12	2019	2	BZ	1	14:55	2	Hunting west of windfarm.
4	2	12	2019	2	BZ	1	15:15	2	Hunting north-west end of windfarm.
4	2	22	2019	2	BZ	1	09:55	1	
4	2	22	2019	2	RN	2	10:20	1	
4	2	22	2019	2	LB	1	10:20	1	
3	2	28	2019	2	RN	2	17:30	1	
3	2	28	2019	2	RG	1	18:35	1	Calling
3	2	28	2019	2	RG	1	18:40	1	Calling
2	3	7	2019	2	RN	2	16:35	1	Flying near quarry.

VP No	Month	Day	Year	Target	Species	Number	Time Detected	Number of 5 min intervals	Comments
1	3	17	2019	2	BZ	1	10:40	1	
1	3	17	2019	2	RN	1	10:55	1	
4	3	26	2019	2	RN	1	13:40	1	Flying in windfarm.
4	3	26	2019	2	BZ	1	14:55	2	Flying in windfarm/ surroundings.
4	3	26	2019	2	RN	1	15:10	2	Flying in windfarm.

Table 9.66 – Wintering vantage point aggregated species sightings records within the survey area and 500 m buffer

Species	Number of detections	%	Number of five minute intervals	%
BZ	24	20.2	30	22.7
CA	6	5.0	6	4.5
CM	0	0.0	0	0.0
GB	0	0.0	0	0.0
GJ	1	0.8	1	0.8
GP	3	2.5	4	3.0
H.	4	3.4	4	3.0
HH	0	0.0	0	0.0
K.	2	1.7	3	2.3
LB	4	3.4	4	3.0
MA	0	0.0	0	0.0
ML	0	0.0	0	0.0
PE	1	0.8	1	0.8
RG	2	1.7	2	1.5
RN	67	56.3	72	54.5
SH	3	2.5	3	2.3
SN	2	1.7	2	1.5
TOTAL	119		132	

Table 9.67 – Wintering vantage point aggregated species sightings records within the survey area and 500 m buffer by month

Species	Sep	Oct	Nov	Dec	Jan	Feb	Mar	TOTAL
BZ	5	3	2	3	2	7	2	24
CA	1	3			2			6
GJ						1		1
GP	1	2						3
H.	2	1		1				4
K.	1				1			2
LB	2	1				1		4
PE	1							1
RG						2		2
RN	21	11	5	10	7	9	4	67
SH	2		1					3
SN				1	1			2
TOTAL	36	21	8	15	13	20	6	119

165. Two target 1 species flights (**Table 9.1**) were recorded (**Table 9.67**); golden plover (n = 3) and peregrine (n = 1) and had flying height(s) recorded (**Table 9.68**) and were mapped (**Figures 9.37**).

166. No hen harriers were recorded within the 500 m survey boundary during the winter but three male hen harrier flights were detected in September outside the survey boundary on the 14/9/2018 and 26/9/2018 (n = 2) (**Figure 9.37**). There was further evidence of hen harriers roosting in the wider area beyond 2 km (see Section 9.3.6.7) during the winter period.

167. Peregrine flights were recorded only occasionally and compared to the breeding period there were 86 seconds of flight observed with 52.3% below rotor height (<15 m) and the remainder 47.7% within potential collision risk height although at relatively low level within the range 15 m to 50 m.

Table 9.68 – Wintering vantage point flying height and duration of Target 1 species records inside the survey area and 500 m buffer

VP No	Month	Day	Year	Species	No	Time 1st detected	Duration (secs)	<15 m	15-25 m	25-50 m	50-75 m	50-100 m	100-125 m	125-140 m	>140 m	Notes
1	9	26	2018	PE	1	12:18	86	45	30	11						
4	9	29	2018	GP	8	11:28	43		15		28					Undulating / circling flight. Disappeared over ridge line
2	10	6	2018	GP	1	12:11	15	15								Flew then landed again
2	10	6	2018	GP	6	13:22	270		75	180	15					6 GP flying near met mast & turbine and changed direction near turbines

168. Cumulative data for all species detected during winter and summer vantage points (**Table 9.69**) over the 12-month study shows that raven (50.4%), buzzard (19.8%), lesser black-backed gull (5.6%) and cormorant (5.2%) were the most frequently detected species throughout the 2018 – 2019 seasons.

169. Both raven and buzzard were recorded throughout every month of the study (**Table 9.69**), although both were recorded less frequently in the breeding season. Cormorants were recorded more frequently over the summer but relatively consistently between season and the majority of activity in the same area with movements largely towards / from the reservoir at the north of the survey area at Altnahinch Dam.

170. There was one species recorded in the winter which was not recorded during the breeding season, namely greylag goose, whilst five species seen during the breeding season, common gull, greater black-backed gull, hen harrier, mallard and merlin were not recorded during the wintering vantage point surveys within the survey area and 500 m buffer.

Table 9.69 – Cumulative breeding and wintering vantage point aggregated species sightings records within the survey area and 500 m buffer by month

Species	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb		TOTAL	% of detections
BZ	8	9	2	2	3	5	5	3	2	3	2	7	2	53	19.8
CA	1	2	2	2		1	1	3			2			14	5.2
CM					1									1	0.4
GB	1	1												2	0.7
GJ												1		1	0.4
GP	2	1					1	2						6	2.2
H.			1				2	1		1				5	1.9
HH		1			1									2	0.7
K.					1	6	1				1			9	3.4
LB	2	4	1	1	1	2	2	1				1		15	5.6
MA					1	1								2	0.7
ML				2		1								3	1.1
PE		1		1	1		1							4	1.5
RG	1	1			1							2		5	1.9
RN	8	12	12	17	10	9	21	11	5	10	7	9	4	135	50.4
SH	1	1	1	1			2		1					7	2.6
SN		1			1					1	1			4	1.5
TOTAL	24	34	19	26	21	25	36	21	8	15	13	20	6	268	

Comparison of breeding and wintering vantage point surveys between 2014 and 2018

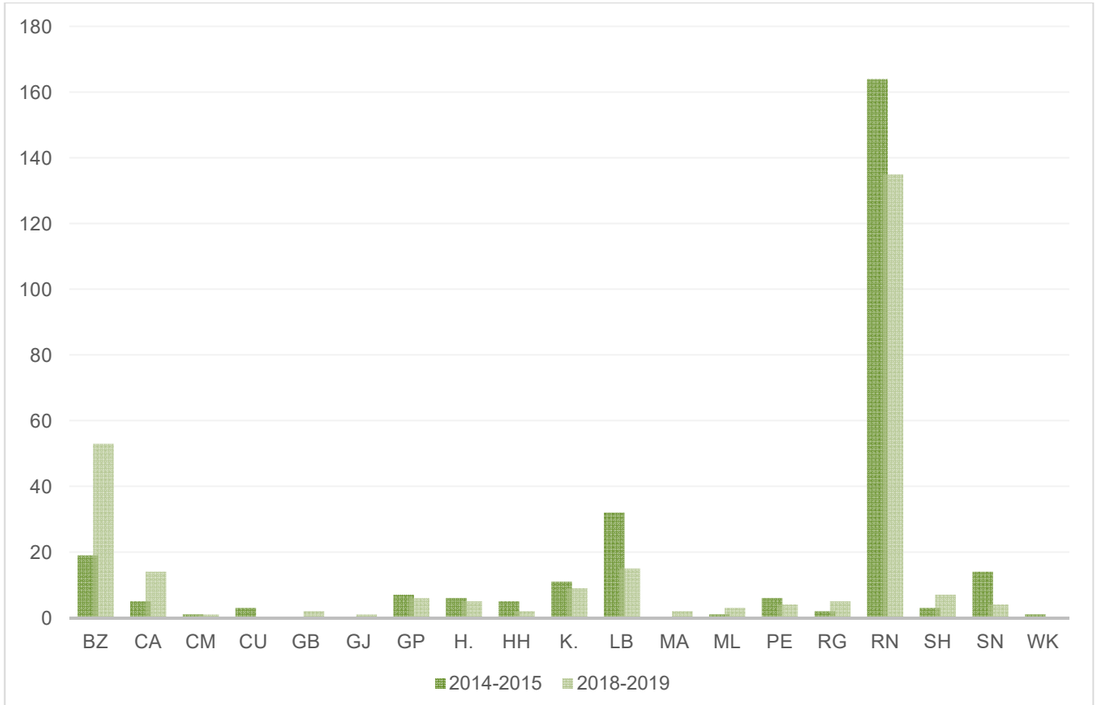
171. Between the two years of survey (2014 – 2015 and 2018 – 2019) there were some changes noted in species detection rates (**Table 9.70**). There was an increase in buzzard activity between years perhaps due to the presence of two nesting pairs in closer proximity to the 500 m survey buffer.

172. There was a noted decrease in curlew activity with no detections in 2018 or 2019 surveys and there was an apparent loss of breeding pairs in the wider area (Section 9.3.6.6). Snipe detections on vantage points were also lower in 2018 – 2019 than in 2014 – 2015 and may be indicative of the general wader declines nationally. Whilst slightly reduced between years, the relative activity of golden plover (and kestrel) were similar between the survey years.

173. Raven were the principal species recorded in both years and seasons of survey and all vantage point observations series including during breeding, wintering or migration periods. However raven and lesser black-backed gull both declined in more recent years (**Table 9.70**).

Table 9.70 – Cumulative breeding and wintering vantage point aggregated species sightings records within the survey area and 500 m buffer between 2014 / 2015 and 2018 / 2019. Showing species detections and proportions and direction of change between surveys in 2014-2015 and 2018-2019 (tabulated and graphed).

Species	TOTAL 2014 - 2015	% of detections	TOTAL 2018 - 2019	% of detections	Direction of change
BZ	19	6.8	53	19.8	↑
CA	5	1.8	14	5.2	↑
CM	1	0.4	1	0.4	=
CU	3	1.1	0	0.0	↓
GB	0	0.0	2	0.7	↑
GJ	0	0.0	1	0.4	↑
GP	7	2.5	6	2.2	↓
H.	6	2.1	5	1.9	↓
HH	5	1.8	2	0.7	↓
K.	11	3.9	9	3.4	↓
LB	32	11.4	15	5.6	↓
MA	0	0.0	2	0.7	↑
ML	1	0.4	3	1.1	↑
PE	6	2.1	4	1.5	↓
RG	2	0.7	5	1.9	↑
RN	164	58.6	135	50.4	↓
SH	3	1.1	7	2.6	↑
SN	14	5	4	1.5	↓
WK	1	0.4	0	0.0	↓



3.6.5. Migration Vantage Point Surveys

174. There were 36 hours observation completed at each vantage point in the spring (SMVP) between January 2018 and April 2018 and in the autumn (AMVP) between September 2018 and November 2018 (**Tables 9.71 & 9.72**) with a total of 72 hours completed during migration seasons. Survey times ranged from 06.40hrs to 20.20hrs (**Table 9.71**) and covered a wide range of weather conditions (**Table 9.73**).

Table 9.71 – Migration season vantage point survey effort

Type	VP No	Observer	Month	Day	Year	Start	End	Duration
SMVP	MIG	DR	1	31	2018	10:45	13:45	03:00
SMVP	MIG	DR	2	4	2018	06:40	09:40	03:00
SMVP	MIG	DR	2	18	2018	06:50	09:50	03:00
SMVP	MIG	CS	2	20	2018	15:40	18:40	03:00
SMVP	MIG	DR	2	24	2018	07:40	10:40	03:00
SMVP	MIG	CS	2	28	2018	09:40	12:40	03:00
SMVP	MIG	CS	3	8	2018	16:15	19:15	03:00
SMVP	MIG	CS	3	20	2018	12:35	15:35	03:00
SMVP	MIG	CS	3	23	2018	09:20	12:20	03:00
SMVP	MIG	CS	3	27	2018	14:40	17:40	03:00
SMVP	MIG	CS	4	4	2018	14:00	17:00	03:00
SMVP	MIG	CS	4	16	2018	08:45	11:45	03:00
AMVP	MIG	CS	9	14	2018	17:20	20:20	03:00
AMVP	MIG	CS	9	18	2018	17:00	20:00	03:00
AMVP	MIG	CS	9	25	2018	17:05	20:05	03:00
AMVP	MIG	KM	10	6	2018	09:10	12:10	03:00
AMVP	MIG	KM	10	8	2018	10:00	13:00	03:00
AMVP	MIG	DR	10	22	2018	14:50	17:50	03:00
AMVP	MIG	KM	10	25	2018	09:10	12:10	03:00
AMVP	MIG	DR	10	31	2018	15:05	18:05	03:00
AMVP	MIG	DR	11	7	2018	14:25	17:25	03:00
AMVP	MIG	KM	11	12	2018	10:40	13:40	03:00
AMVP	MIG	KM	11	15	2018	11:45	14:45	03:00
AMVP	MIG	CS	11	26	2018	14:10	17:10	03:00

Table 9.72 – Migration vantage point survey effort by month

VP No.	Jan	Feb	Mar	Apr		Sep	Oct	Nov	TOTAL
Spring Migration	3	15	12	6					36
Autumn Migration	-	-	-	-		9	15	12	36
TOTAL	3	15	12	6		9	15	12	72

Table 9.73 – Migration vantage point weather conditions

VP & DATE				Cloud Cover				Cloud Height (m)				Wind - Direction & Speed				Precipitation				Visibility (km)			
VP No.	M	D	Y	0	+1	+2	+3	0	+1	+2	+3	0	+1	+2	+3	0	+1	+2	+3	0	+1	+2	+3
M	1	31	18	10	10	10	10	400	600	400	400	W3	W3	W3	W3	NIL	ILS	NIL	NIL	5	5	5	5
M	2	4	18	4	6	6	4	800	800	800	800	SW2	SW2	SW2	SW2	NIL	NIL	NIL	NIL	1.5	5	5	5
M	2	18	18	8	10	10	10	600	600	400	400	SW2	SW2	SW2	SW2	NIL	IHM	ILR	NIL	1.5	5	5	5
M	2	20	18	8	7	4	2	600	600	600	800	N3	N3	N2	N1	NIL	NIL	NIL	NIL	5	5	5	5
M	2	24	18	8	10	10	10	800	800	800	800	SE2	SE2	SE3	SE3	NIL	NIL	NIL	NIL	5	5	5	5
M	2	28	18	10	10	10	9	700	700	700	700	NE6	NE6	NE6	NE5	NIL	ILS	ILS	NIL	5	5	5	5
M	3	8	18	4	5	5	5	700	700	700	700	NW1	NW1	NW1	NW1	NIL	NIL	NIL	NIL	5	5	5	5
M	3	20	18	3	2	2	2	900	1000	1000	1000	W2	W2	NW2	W2	NIL	NIL	NIL	NIL	5	5	5	5
M	3	23	18	10	10	10	9	380	450	500	500	NW3	NW3	NW3	NW3	CLR	CLR	ILR	ILR	2	5	5	5
M	3	27	18	9	10	9	9	600	600	600	600	SW3	SW4	SW4	SW3	NIL	ILR	ILR	ILR	5	5	5	5
M	4	4	18	10	10	10	7	380	390	440	600	NE4	NE4	NE3	NE3	CLR	CLR	CLR	NIL	5	5	5	5
M	4	16	18	7	5	8	9	600	600	600	600	SW4	SW4	SW4	SW4	NIL	NIL	NIL	NIL	5	5	5	5
M	9	14	18	10	8	7	6	600	400	400	500	SW3	SW3	W4	W4	ILR	ILR	NIL	NIL	5	5	5	5
M	9	18	18	9	7	6	7	600	600	600	600	SW4	SW4	SW4	SW4	ILR	IHR	NIL	NIL	5	5	5	5
M	9	25	18	10	10	10	10	550	600	600	600	SW4	SW4	SW5	SW5	NIL	NIL	NIL	NIL	5	5	5	1

VP & DATE				Cloud Cover				Cloud Height (m)				Wind - Direction & Speed				Precipitation				Visibility (km)			
VP No.	M	D	Y	0	+1	+2	+3	0	+1	+2	+3	0	+1	+2	+3	0	+1	+2	+3	0	+1	+2	+3
M	10	6	18	1	3	4	4	1500	1000	1000	1000	N2	N3	N3	N3	NIL	NIL	NIL	NIL	5	5	5	5
M	10	8	18	10	10	10	10	500	500	500	1000	SW4	SW4	SW4	SW4	NIL	NIL	NIL	NIL	5	5	5	5
M	10	22	18	10	8	8	5	700	700	700	700	W3	W3	W3	W4	NIL	NIL	NIL	NIL	5	5	5	5
M	10	25	18	10	10	10	10	350	300	300	400	W2	W2	W2	W3	NIL	NIL	ILR	NIL	1	2	1	5
M	10	31	18	9	9	10	10	400	400	350	350	SW2	SW2	SW2	SW2	NIL	ILM	ILM	CHM	5	5	3	0.5
M	11	7	18	10	8	10	10	400	600	550	450	W2	W2	SW3	SW3	IHR	NIL	ILR	NIL	3	5	3	1
M	11	12	18	10	9	10	6	500	500	600	800	S4	S3	S4	S4	NIL	NIL	NIL	NIL	5	5	5	5
M	11	15	18	6	8	6	10	1000	1000	1000	700	S6	S6	S6	S6	NIL	NIL	NIL	NIL	5	5	5	5
M	11	26	18	2	2	2	4	800	800	800	800	E2	E2	E2	E2	NIL	NIL	NIL	NIL	5	5	5	1

175. There were 12 target species (**Table 9.1**) recorded inside the survey area and 500 m buffer; buzzard; cormorant, goosander, golden plover; heron, hen harrier; kestrel; lesser black-backed gull; mallard, red grouse, raven and snipe (**Tables 9.74 & 9.75**).

176. Raven (44.2%) were the most frequently detected species during the migration surveys with similar detection frequencies for buzzard (11.7%), cormorant (11.7%) and golden plover followed by snipe (6.5%). There was a similar level of activity of species in the autumn period (**Table 9.76**) and the spring period (**Table 9.76**). Goosander were detected for the first time at this site and these birds, similar to the cormorants were observed to fly in to the Altnahinch reservoir.

177. There was one flock of 11 whooper swans recorded on the 24/02/2018 beyond the survey area and 500 m buffer (**Figure 9.38**) at very high elevation (circa 250m a.g.l) during the migration period. Similar to other vantage point observations both during breeding and wintering season raven were the most frequently recorded species.

Table 9.74 – Migration vantage point sightings records recorded within the survey area and 500 m buffer

VP No	Month	Day	Year	Target	Species	Number	Time Detected	Number of 5 min intervals	Comments
SMIG	1	31	2018	2	H.	1	12:05	1	
SMIG	1	31	2018	2	LB	7	12:30	1	
SMIG	2	4	2018	2	CA	5	06:50	1	Onto dam
SMIG	2	4	2018	2	RN	2	07:55	1	
SMIG	2	18	2018	2	RN	3	08:40	1	
SMIG	2	20	2018	2	RN	2	16:15	1	2 RN flying and calling
SMIG	2	20	2018	2	MA	6	16:30	1	3 male 3 female on reservoir
SMIG	2	20	2018	2	RN	2	16:40	1	2 RN being mobbed by 2 K.
SMIG	2	20	2018	2	K.	2	16:40	1	
SMIG	2	20	2018	2	RN	4	17:30	1	4 RN flying together
SMIG	2	20	2018	2	RN	12	17:40	1	12 RN flying near wind farm
SMIG	2	20	2018	2	GD	3	17:50	1	1 male 2 female onto reservoir
SMIG	2	24	2018	2	CA	2	08:25	1	Onto reservoir
SMIG	2	24	2018	2	CA	4	09:30	1	4 in total (+2 on water) landed on reservoir
SMIG	2	24	2018	2	MA	1	10:00	1	
SMIG	2	28	2018	2	CA	8	10:10	1	8 CA onto reservoir
SMIG	2	28	2018	2	RN	3	11:40	1	3 RN flying together
SMIG	3	8	2018	2	CA	3	16:20	1	3 CA onto lake
SMIG	3	8	2018	2	BZ	1	16:45	1	1 BZ flying over forest
SMIG	3	8	2018	2	RN	4	16:50	1	4 RN flying together
SMIG	3	8	2018	2	BZ	1	17:25	1	1 BZ hover hunting
SMIG	3	8	2018	2	RN	2	18:25	1	2 RN
SMIG	3	20	2018	2	CA	1	12:35	1	
SMIG	3	20	2018	2	RN	4	13:19	1	
SMIG	3	20	2018	2	BZ	1	14:09	1	
SMIG	3	20	2018	1	GP	32	14:31	1	
SMIG	3	23	2018	1	GP	52	09:25	1	52 in field, on ground
SMIG	3	23	2018	2	CA	3	09:25	1	3 CA onto reservoir
SMIG	3	23	2018	1	GP	1	09:40	1	Calling on ground
SMIG	3	23	2018	1	GP	1	09:45	1	Calling on ground
SMIG	3	23	2018	2	RN	1	10:25	1	1 RN flying
SMIG	3	27	2018	1	GP	1	14:45	1	On ground
SMIG	3	27	2018	2	RN	3	15:25	1	3 RN
SMIG	3	27	2018	2	RN	1	16:00	1	
SMIG	3	27	2018	2	BZ	1	16:15	1	

VP No	Month	Day	Year	Target	Species	Number	Time Detected	Number of 5 min intervals	Comments
SMIG	4	4	2018	2	CA	1	14:15	1	Flying over reservoir
SMIG	4	4	2018	1	GP	1	14:40	1	GP calling on ground
SMIG	4	4	2018	2	RN	1	16:10	1	1 RN flying towards reservoir
SMIG	4	16	2018	2	CA	1	10:38	1	Flew into one side of the reservoir then to other
AMIG	9	14	2018	2	SN	2	17:13	1	2 from ground
AMIG	9	14	2018	2	RN	2	17:45	1	2 RN flying together calling
AMIG	9	14	2018	2	RN	2	18:20	1	2 RN flying together
AMIG	9	18	2018	2	BZ	2	17:36	1	1 BZ flying, as it got close to wind farm it got mobbed by 4 HC
AMIG	9	18	2018	2	RN	2	17:44	1	1 RN flying with 4 HC
AMIG	9	25	2018	2	RN	1	17:30	1	1 RN flying
AMIG	9	25	2018	2	K.	1	17:55	1	Female hunting
AMIG	9	25	2018	1	HH	1	19:00	1	Male hunting
AMIG	10	6	2018	1	GP	5	09:10	1	Near vp
AMIG	10	6	2018	2	RN	2	09:43	1	East side of windfarm
AMIG	10	6	2018	1	GP	1	11:23	1	Landed with previous GP flock
AMIG	10	6	2018	1	GP	1	11:32	1	Took off & landed
AMIG	10	6	2018	2	RN	1	12:05	1	South end of windfarm
AMIG	10	18	2018	2	RN	1	14:56	1	
AMIG	10	18	2018	2	RN	17	15:05	1	Flight across ridge line
AMIG	10	18	2018	2	RN	2	15:42	1	
AMIG	10	18	2018	2	BZ	1	16:11	1	BZ soaring/ hovering flight across hill slope, mobbed by RNs, turned
									and returned across slope. Mobbed again.
AMIG	10	18	2018	2	RN	5	16:11	1	
AMIG	10	18	2018	2	RN	30	16:15	1	Over quarry
AMIG	10	18	2018	2	RN	3	16:42	1	
AMIG	10	18	2018	2	BZ	1	17:12	1	Mobbed by RNs
AMIG	10	25	2018	2	BZ	1	09:47	1	
AMIG	10	25	2018	2	RN	2	09:56	1	
AMIG	10	25	2018	2	RN	1	10:36	1	
AMIG	10	25	2018	2	SN	1	11:52	1	
AMIG	10	31	2018	2	BZ	1	15:23	1	Landed in tree
AMIG	10	31	2018	2	RN	1	15:56	1	Undulating flight
AMIG	10	31	2018	2	SN	1	15:59	1	Disturbed
AMIG	10	31	2018	2	RN	2	16:03	1	
AMIG	10	31	2018	2	SN	1	17:59	1	Heard calling
AMIG	11	7	2018	2	SN	1	14:25	1	Disturbed
AMIG	11	7	2018	2	RG	1	14:27	1	Disturbed
AMIG	11	7	2018	2	RG	1	14:56	1	
AMIG	11	7	2018	2	RN	1	15:30	1	
AMIG	11	7	2018	2	RG	2	16:22	1	
AMIG	11	12	2018	2	RN	2	11:05	1	
AMIG	11	12	2018	2	RN	1	11:45	1	
AMIG	11	12	2018	2	RN	1	11:52	1	

Table 9.75 – Migration vantage point aggregated species sightings records within the survey area and 500 m buffer

Species	Number of detections	%	Number of five minute intervals	%
BZ	9	11.7	9	11.7
CA	9	11.7	9	11.7
GD	1	1.3	1	1.3
GP	9	11.7	9	11.7
H.	1	1.3	1	1.3
HH	1	1.3	1	1.3
K.	2	2.6	2	2.6

Species	Number of detections	%	Number of five minute intervals	%
LB	1	1.3	1	1.3
MA	2	2.6	2	2.6
RG	3	3.9	3	3.9
RN	34	44.2	34	44.2
SN	5	6.5	5	6.5
TOTAL	77		77	

Table 9.76 – Migration vantage point aggregated species sightings records within the survey area and 500 m buffer by month

Species	Jan	Feb	Mar	Apr		Sep	Oct	Nov	TOTAL
BZ			4			1	4		9
CA		4	3	2					9
GD		1							1
GP			5	1			3		9
H.	1								1
HH						1			1
K.		1				1			2
LB	1								1
MA		2							2
RG								3	3
RN		7	6	1		4	12	4	34
SN						1	3	1	5
TOTAL	**2**	**15**	**18**	**4**		**8**	**22**	**8**	**77**

178. Two target 1 species flights (**Table 9.1**) were recorded (**Tables 9.74, 9.75 & 9.76**); hen harrier (n = 1) and golden plover (n = 4) and had flying height(s) recorded (**Table 9.77**) and were mapped (**Figures 9.38**).

179. The hen harriers were observed in September similar to other timings from previous sightings (see Section 9.3.3.4). Golden plover movements were mostly recorded in the autumn migration although this species is known to over-winter on the site within close proximity to the existing turbines and also on fields below the existing windfarm within the survey area. No peregrines were recorded.

Table 9.77 – Breeding vantage point flying height and duration of Target 1 species records inside the survey area and 500 m buffer

VP No	Month	Day	Year	Species	No	Time 1st detected	Duration (secs)	<15m	15-25m	25-50m	50-75m	50-100m	100-125m	125-140m	>140m	Notes
SMIG	3	20	2018	GP	32	14:31	73	73		73						
AMIG	9	25	2018	HH	1	18:59	67	67								Male hen harrier in flight
AMIG	10	6	2018	GP	5	09:10	20	20								
AMIG	10	6	2018	GP	1	11:23	15	15								
AMIG	10	6	2018	GP	1	11:32	15	15								

3.6.6. Breeding Priority Species Surveys 2018

180. There were 115 hours spent searching adjacent habitats for priority species between late February 2018 and August 2018 (**Table 9.1; Table 9.78**) with efforts concentrated on hen harrier, merlin, red grouse and waders during the breeding season. Survey times ranged between 06.25hrs to 23.10hrs and covered a wide range of weather conditions (**Table 9.78**).

Table 9.78 Details of breeding priority species searches (PSS), including survey effort, weather

Survey Type	Search Area	Day	Month	Year	Start time	End time	Duration	Cloud	Height	Wind dir.	Wind strength	Prec.	Vis. (km)
PSS	2 km	23	3	2018	06:40	13:40	07:00	5	350	SW	3	ILR	5
PSS	2 km	18	4	2018	05:50	10:50	05:00	10	800	SE	2	NIL	5
RGS / SNS	500 m	19	4	2018	19:45	23:45	04:00	5	800	W	1	NIL	5
RGS / SNS	500 m	19	4	2018	20:15	23:45	03:30	5	800	W	1	NIL	5
RGS / SNS	500 m	19	4	2018	20:10	23:45	03:35	10	800	SW	3	NIL	5
PSS	2 km	20	4	2018	09:35	14:05	04:30	6	800	SW	2	NIL	5
PSS	2 km	23	4	2018	13:35	19:35	06:00	10	400	W/SW	2	CLR	5
PSS	2 km	25	4	2018	18:55	23:55	05:00	5	900	SW	2	NIL	5
PSS	2 km	3	5	2018	09:40	11:10	01:30	4	300	SW	4	CLR	1.5
PSS	2 km	3	5	2018	15:05	18:50	03:45	4	300	SW	4	ILR	5
PSS	500 m / 2 km / >2 km	24	5	2018	10:05	16:35	06:30	1	900	SE	3	NIL	5

Survey Type	Search Area	Day	Month	Year	Start time	End time	Duration	Cloud	Height	Wind dir.	Wind strength	Prec.	Vis. (km)
SNS	500 m	29	5	2018	22:10	23:40	01:30	2	700	E	4	NIL	5
SNS	2 km	30	5	2018	19:00	23:40	04:40	4	700	NW	2	NIL	5
SNS	500 m / 2 km	30	5	2018	22:00	23:50	01:50	8	600	NE	2	NIL	5
PSS	500 m / 2 km	31	5	2018	10:15	16:15	06:00	10	800	SE	2	ILR	5
PSS	2 km / >2 km	6	6	2018	13:05	17:25	04:20	5	900	SE	1	NIL	5
PSS	500 m / 2 km	13	6	2018	06:25	08:25	02:00	10	500	SW	3	NIL	5
PSS	>2 km	13	6	2018	09:10	11:10	02:00	10	600	SW	3	ILR	5
PSS	>2 km	13	6	2018	11:20	18:45	07:25	10	600	SW	3	ILR	5
PSS	2 km / >2 km	8	7	2018	09:25	16:55	07:30	5	500	SW	2	NIL	5
PSS	2 km / >2 km	14	7	2018	08:00	17:55	09:55	5	700	SW	2	NIL	5
PSS	500 m / 2 km / >2 km	23	7	2018	05:40	07:10	01:30	8	500	SW	2	NIL	5
PSS	500 m / 2 km / >2 km	23	7	2018	10:10	15:40	05:30	10	400	W	2	CLR	2.5
PSS	500 m / 2 km / >2 km	25	7	2018	13:05	16:25	03:20	8	900	SW	3	NIL	5
PSS	2 km	3	8	2018	09:30	12:30	03:00	10	500	W	2	NIL	5
PSS	>2 km	7	8	2018	19:30	20:40	01:10	10	600	SW	1	NIL	5
PSS	2 km	22	8	2018	10:55	13:55	03:00	6	600	NW	2	NIL	5

181. There were 20 target species were recorded; namely buzzard, cormorant, Canada goose, common gull, coot, greylag goose, heron, herring gull, hen harrier, kestrel, lesser black-backed gull, mallard, moorhen, merlin, peregrine, red grouse, raven, sparrowhawk, snipe, wigeon (**Table 9.79**). The sightings from all surveys were aggregated to identify territory locations of target species (**Table 9.1**) and in particular to identify curlew, red grouse, snipe and raptor territories within the survey area and 500 m buffer (**Figure 9.39; Figure 9.39 CONFIDENTIAL**) and to review published avoidance distances (Ruddock & Whitfield, 2007; Pearce-Higgins et al., 2009) (**Figure 9.40; Figure 9.40 CONFIDENTIAL**).

3.6.6.1. Raptor surveys

182. There were no raptors recorded breeding within the 500 m turbine buffers for either existing or proposed turbines. There were two pairs of buzzards breeding within survey area and 500 m buffer including one which was utilizing the previous raven site and the peregrine site within survey area and 500 m buffer was occupied again by a single adult (**Figures 9.39 & 9.39 CONFIDENTIAL**). One pair of ravens was recorded within the survey area and 500 m buffer in the quarry to the north-west. In the wider 2 km area buzzard (n = 6) and sparrowhawk (n = 4) along with one kestrel territory and an additional raven territory (**Figures 9.39 & 9.39 CONFIDENTIAL**).

183. Beyond 2 km, seven additional buzzard territories were identified along with one merlin territory and one hen harrier territory. The hen harrier site has relocated since previous survey years further to the north (**Figure 9.39 CONFIDENTIAL**). Only a single pair were present and these were located further away from the site boundary than recorded in recent surveys in 2014; 2015 and 2016). Additional hen harriers were known to occur beyond 5 km away from the site boundary, but no foraging or movement connectivity to the Site was observed.

3.6.6.2. Red grouse surveys

184. Red grouse surveys within the core survey area and 500 m buffer identified seven red grouse territories (7 in 2014; 5 in 2015; 3 in 2016). All seven of these were within the 500 m buffer of the existing turbines and the proposed turbines (**Figure 9.39**) and one of the existing and proposed turbines were completely outside the 500 m buffer of red grouse territories (**Figures 9.40 & 9.40 CONFIDENTIAL**).

3.6.6.3. Wader surveys

185. There were no curlew within the survey area and 800 m buffer. All curlew territories recorded were greater than 1km beyond both existing and proposed turbines (see Pearce-Higgins et al., 2009; **Figure 9.39**). Only one curlew territory was recorded within the 2 km survey area, beyond Gruig Windfarm (**Table 9.79; Figure 9.39**).

186. There were 10 snipe territories within the survey area and 500 m buffer in 2018 (5 in 2014; 9 in 2015; 10 in 2016), of which four were within the 500 m existing turbine and/or proposed turbine buffer (**Figure 9.39**). The 400 m buffer of snipe territory locations (see Pearce-Higgins et al., 2009) (**Figure 9.40**) shows that six of the ten existing turbines are within 400 m of three snipe territories and four of the five proposed turbines are also within the 400 m buffer of three snipe territories (**Figure 9.40**).

Table 9.79 Details of breeding priority species searches (PSS), including survey dates and species detected.

Survey Type	Search Area	Day	Month	Year	Species detected	Notes
PSS	2 km	23	3	2018	MA, CO, GJ, LB, CG, HG, RN, BZ, CA, H., ML	7MA, 2GJ and CO on Lough Guile. 6 LB flying to the east of Lough Guile. 12 CG and 3 HG on ground North of Corkey. 4 RN flying over Quarry. BZ flying near Carnagall. LB flying near Gruig. 2 RN and ML flying near Skerry hill. 5 CA on reservoir and 1 CA flying over reservoir. 2 RN flying South of reservoir. BZ flying over Slieveanorra forest. H. flying near Altmore burn.
PSS	2 km	18	4	2018	BZ, H., CM, LB, RN, CA	BZ flying near Gallows hill. H. flying over Loughguile. 5 LB on ground and 2 LB flying near by. 2 RN flying to the South of Ballynagabog Bridge. BZ flying near Mallaboy. 12 CM on ground west of Rockend. 6 RN flying near Quarry. RN flying near turbines. RN flying near Corkey. RN flying to the east of Sleivenahanaghan. H. flying near Altmore burn. 5 CA on reservoir. RN flying over Slieveanorra forest.
PSS	500 m	19	4	2018	RG, SN	RG heard at 21:06 and again at 21:09. RG heard at 21:08. RG heard at 21:08. RG heard at 21:11. SN chipping at 21:13. SN chipping at 21:13. SN chipping at 21:35. SN displaying and chipping at 21:42.

Survey Type	Search Area	Day	Month	Year	Species detected	Notes
PSS	500 m	19	4	2018	RG	RG heard at 20:25. RG heard at 20:55
PSS	500 m	19	4	2018	SN	SN heard. SH flying into woods at Carnbuck (male and female chipping and calling)
PSS	2 km	20	4	2018	LB, RN, CA, SH, BZ, CM, H.	H. flying. 3 RN flying over Quarry. 5 CM flying towards Corkey. BZ flying near Lislaban. RN perched. RN flying over forest. LB flying near Lewin bridge. CA on reservoir. RN and SH flying over Slieveanorra forest.
PSS	2 km	23	4	2018	RN, BZ, SH	SH female flying towards Altmore burn. 2 RN flying near Corkey. BZ flying over Slieveanorra forest. 2 RN (1+1) flying to the east of Slieverush. 2 RN flying toward Ballynagabog bridge.
PSS	2 km	25	4	2018	SN, RG, BZ, K., SH, RN, HH	BZ at Knockagallan & quarry; SH hunting and carrying prey at quarry, kestrel in display flight and calling over quarry and chasing RN. SN @ 3 locations during evening watch and 2 RG pairs calling. HH displaying male over Slieveanorra forest; female seen in flight towards male and probable food pass
PSS	2 km	3	5	2018	LB, RN	5 LB and 2 RN flying around Knockagallan.
PSS	2 km	3	5	2018	RG, SN	RG and SN flying to the east of Knockagallan
PSS	500 m/ 2 km/ >2 km	24	5	2018	RN, BZ, CM, CA	5 RN and BZ flying near Quarry. 12 CM on ground. RN flying near reservoir and 3 CA on reservoir. RN flying near turbines. 2 BZ (1+1) flying over Slieveanorra forest.
PSS	500 m	29	5	2018	SN	SN calling at 22:56
PSS	2 km	30	5	2018	RN, BZ	RN flying near windfarm. BZ flying near reservoir.
PSS	500 m / 2 km	30	5	2018	SN	SN calling at 22:34. SN calling at 22:49
PSS	500 m / 2 km	31	5	2018	BZ, CM, SN, LB, H., CA	BZ flying near Quarry.2 BZ and 12 CM flying near Knockagallan. BZ flying near Mullaghmosagh towards Lewin Bridge nest site. 2 SN (1+1) and 5 LB flying near Corkey. H. and CA flying over forest.
PSS	2 km / >2 km	6	6	2018	BZ, SH, K. ML, CU	ML pair seen at site; active; BZ pair active also to the north and entering / exiting forest; BZ and K. at Slieveanorra nest sites; CU heard calling and see chasing crows to south-east in usual valley near Gruig
PSS	500 m / 2 km	13	6	2018	BZ, LB, CM, RN, SN, H., CA	BZ and LB flying near Tullaghmosagh. 3 LB and 8 CM flying near Knockagallan. 4 RN (1+3) flying near Quarry. 2 LB flying near Ballure. SN, RN and H> flying near Corkey. BZ flying over forest. CA flying over reservoir.
PSS	>2 km	13	6	2018	RG, RN, HH	2 RN and RG flying near vp. HH male flying around Orra and female dropping into nest site in heather. RN flying over forest.
PSS	>2 km	13	6	2018	HH, RN, BZ	HH male flying to NW of vp. RN flying near vp. RN flying over forest. BZ flying over forest.
PSS	2 km / >2 km	8	7	2018	BZ	BZ over slieveanorra - no sightings at HH site; failed since June; SH at Altmore Burn delivery of prey; probably magpie; SN heard calling at Skerry Hill
PSS	2 km / >2 km	14	7	2018	BZ	BZ over slieveanorra - no sightings at HH site; failed since June; BZ young flying at Checker Hall and Carngall; Loughguile and Mounthamilton
PSS	500 m / 2 km /	23	7	2018	BZ, CM, LB, RN, H., CA,	2 juv BZ flying. 7 CM flying near Corkey. 5 LB and a BZ flying near Carnagall. LB Flying at Gruig. RN at Ballynagabog bridge. 2 RN flying over Quarry. RN flying. H. flying near Maghalaboy. H. flying north of Ford. 2 CA on reservoir. RN perched in tree. ML flying near Slievenamaddy. RN flying at Skerry hill. BZ flying near slieverush.
PSS	500 m / 2 km / >2 km	23	7	2018	BZ, CM, LB, RN, H., CA, ML	2 juv BZ flying. 7 CM flying near Corkey. 5 LB and a BZ flying near Carnagall. LB Flying at Gruig. RN at Ballynagabog bridge. 2 RN flying over Quarry. RN flying. H. flying near Maghalaboy. H. flying north of Ford. 2 CA on reservoir. RN perched in tree. ML flying near Slievenamaddy. RN flying at Skerry hill. BZ flying near slieverush.
PSS	500 m / 2 km / >2 km	25	7	2018	BZ, RN	BZ flying and circling near Mallaboy. 2 RN (1+1) flying near windfarm. 2 BZ (1+1) flying over slieveanorra forest. RN flying near Slieverush. No evidence of HH
PSS	2 km	3	8	2018	BZ, LB, CM, RN	BZ and 5 CM (4+1) flying near Knockagallan. BZ flying South of Tullaghmosagh. RN flying NE of Corkey. LB flying over Lewin bridge
PSS	>2 km	7	8	2018	K.	K. seen at 20:13 hunting along edge of forestry
PSS	2 km	22	8	2018	WN, MH, MA, CM, K., LB, RN, BZ, CA	2 WN, 7 MA and a MH on Lough Gulie. 15 CM flying near Lavan lower. K. flying south of Corkey. 2 LB and RN near Carnagall. BZ flying near Gruig. BZ flying near Ballure. 2 RN flying over Quarry. RN flying turbines. RN flying over forestry. CA on reservoir. RN flying near reservoir.

3.6.7. Wintering Priority Species Surveys 2018 - 2019

383. During the winter of 2018 to 2019 (September 2018 to February 2019), there were 74 hours and 35 minutes spent searching adjacent habitats within the survey areas (**Figure 9.1**) for priority species (**Table 9.1; Table 9.80**) with efforts concentrated on hen harrier wintering sites, merlin and whooper swan during the wintering season. Survey times ranged between 06.10hrs to 19.00hrs and covered a wide range of weather conditions (**Table 9.80**).

Table 9.80 Details of wintering priority species searches (PSS), including survey dates and species detected.

Survey Type	Search Area	Day	Month	Year	Start time	End time	Duration	Cloud	Height	Wind dir.	Wind strength	Prec.	Vis. (km)
PSS	2 km	28	9	2018	12:40	18:40	06:00	9	700	NE	5	NIL	5
PSS	2 km	14	10	2018	10:40	15:40	05:00	6	800	SW	2	NIL	5
PSS	2 km	21	10	2018	10:35	14:45	04:10	10	400	W	3	CLR	2.5
PSS	500 m / 2 km	25	10	2018	12:30	13:30	01:00	10	400	W	3	NIL	20
PSS	2 km	25	10	2018	13:40	14:30	00:50	9	1000	W	3	ILR	20
PSS	2 km	25	10	2018	14:30	16:00	01:30	10	1000	W	3	ILR	20
PSS	500 m / 2 km / >2 km	25	10	2018	06:05	12:05	06:00	10	350	W	2	CHM	0.5
PSS	2 km / >2 km	31	10	2018	13:05	15:00	01:55	10	400	SW	3	NIL	2
PSS / WRW	2 km / >2 km	22	11	2018	11:45	17:25	05:40	10	600	SE	2	NIL	5
PSS / WRW	2 km	25	11	2018	06:20	10:20	04:00	6	600	E	2	NIL	5
PSS / WRW	2 km / >2 km	10	12	2018	13:05	17:15	04:10	10	600	SW	2	NIL	5
PSS / WRW	2 km / >2 km	16	12	2018	12:55	17:10	04:15	9	400	SW	2	ILR	5
PSS / WRW	2 km / >2 km	2	1	2019	15:30	17:15	01:45	10	600	SE	2	NIL	5
PSS	>2 km	4	1	2019	09:00	13:00	04:00	10	2000	SW	1	NIL	20
PSS / WRW	>2 km	4	1	2019	15:30	17:15	01:45	10	2000	SW	1	NIL	20
PSS	2 km	8	1	2019	12:25	14:30	02:05	4	2000	NW	4	NIL	15
PSS	2 km	8	1	2019	14:30	15:25	00:55	2	2000	NW	4	NIL	15
PSS / WRW	>2 km	17	1	2019	07:30	08:30	01:00	4	1000	NE	3	ILS	20
PSS	>2 km	17	1	2019	12:00	15:00	03:00	8	1000	NE	1	NIL	10
PSS / WRW	>2 km	29	1	2019	06:20	07:30	01:10	9	400	W	2	NIL	5
PSS / WRW	2 km	31	1	2019	12:05	17:55	05:50	5	500	SW	2	NIL	5
PSS	>2 km	1	2	2019	14:00	15:30	01:30	8	2000	N	2	NIL	40
PSS / WRW	>2 km	1	2	2019	16:30	18:00	01:30	9	2000	N	2	NIL	20
PSS	2 km	25	2	2019	14:00	16:00	02:00	7	800	S	3	NIL	5
PSS	2 km	24	3	2019	11:15	12:15	01:00	8	1000	E	4	NIL	10
PSS	2 km	24	3	2019	12:15	13:30	01:15	10	1000	E	5	NIL	10
PSS	2 km	24	3	2019	13:30	14:15	00:45	9	1000	E	5	NIL	10

384. There were 20 target species recorded; namely buzzard, cormorant, common gull, coot, greater black-backed gull, greylag goose, golden plover, heron, lapwing, lesser black-backed gull, little grebe, mallard, moorhen, mute swan, red grouse, raven, sparrowhawk, snipe, wigeon and whooper swan (**Table 9.81**).

385. The sightings from all surveys were aggregated to identify key wintering locations of target species (**Table 9.1**) and in particular to identify hen harrier and whooper swan locations within the core survey areas (**Figure 9.39; Figure 9.39 CONFIDENTIAL**).

386. Wintering priority species were recorded widely within 2 km including buzzard, merlin, sparrowhawk and kestrel in various locations including near known breeding locations (**Figure 9.39**) and ravens including which were again recorded roosting within Slieveanorra forest and various aggregations throughout the winter and were again noted scavenging on carrion at a number of localities. Gulls and cormorants were typically associated with water bodies in the area and any movements to / from such features were evident.

387. The Lissanoure / Lough Guile area continued to host a range of waterbirds including greylag geese, mute swan and whooper swan (**Table 9.81**; **Figures 9.39**) with a number of foraging sites identified well beyond the 5 km survey area. There were no flights towards the Site, similar to previous winters (2014 – 2015) and numbers of whoopers swans were smaller (3) in 2018 – 2019 than previously recorded. As before all observed goose/swan flights from this area departed or arrived to/from the north and/or north-west of the lakes more than 2 km from the survey area and did not travel towards or away from the Site.

388. Hen harrier winter roost areas were utilised just beyond 2 km (**Figure 9.39 & 9.39 CONFIDENTIAL**) and the maximum roost count was one bird (male only) and was recorded to be used only once over the winter survey period in this year again. Several other suitable areas of roosting habitat occurred within 2 km and just beyond 2 km but no hen harriers were observed. The previously roost identified north of Lissanoure (>5 km from survey area) and was recorded to have a maximum of three roosting harriers (two males and one female (**Table 9.81**).

Table 9.81 Details of wintering priority species searches (PSS), including survey dates and species detected.

Survey Type	Search Area	Day	Month	Year	Species detected	Notes
PSS	2 km	28	9	2018	RN, BZ	2 RN flying over quarry, 2 RN flying near Gruig, BZ perched on edge of Slieveanorra forest.
PSS	2 km	14	10	2018	GJ, MA, MH, RN, L., BZ	2 GJ, 7 MA and a MH on Lough Guile. BZ flying near Carnagall. RN flying near Quarry. L. Flying around Tullaghmosagh. 5 RN flying to the west of Skerry hill. 2 RN and a BZ Flying to the west of Slievenamaddy
PSS	2 km	21	10	2018	CA, RN, H., SH, RG, GP, SN	CA Lifted from reservoir and flew east. 2 RN (1+1), H. and SH flying over Slieveanorra forest. RG and SN flying to the west of Skerry Hill. 6 GP seen at 10:55 disappeared into mist then heard calling. 11 GP seen at 10:42 disappeared into mist
PSS	500 m / 2 km	25	10	2018	None	No PSS species seen
PSS	2 km	25	10	2018	None	No PSS species seen
PSS	2 km	25	10	2018	None	No PSS species seen

Survey Type	Search Area	Day	Month	Year	Species detected	Notes
PSS	500 m / 2 km / >2 km	25	10	2018	MA, WN, MH, BZ, CM, RN, SN, H., CA, LB, SH, GB	12 MA (5+7), 3 WN, and a MH on Lough Guile. 2 BZ flying near Kendal hill. 12 CM on ground and 5 MA on lake near Gallows hill. GB flying west of Carnagall. 2 LB, SH and RN flying near Ballynagabog. BZ flying near Quarry. RN flying north of Knockagallan. RN and SN flying SE of Tullaghmosagh. SN and H. flying near Corkey. 2 RN (1+1) and BZ flying forest. CA on reservoir and CA flying over reservoir.
PSS	2 km / > 2 km	31	10	2018	HH, BZ	HH seen foraging north of Lough Guile near roost site. BZ followed HH and dive-bombed it
PSS	2 km / > 2 km	22	11	2018	HH	HH roosting at site just beyond 2 km found previous winter; single adult male on small area of wet grassland / drained bog
PSS	2 km	25	11	2018	WS, MA, BZ, MH, GS, CM, LB, RN, CA, H.	7 GS, 3WS, 11 MA (7+4) and a MH on lough Guile. 2 BZ flying near Kendals hill. 5 CM flying near Loughguile. LB east of Black hill. 3 RN flying around Quarry. 12 CM and a BZ flying near Gruig. 2 RN (1+1), BZ and H. flying over forestry. 2 CA on reservoir.
PSS	2 km / > 2 km	10	12	2018	HH, H., BZ	Two male HH, one female HH seen at roost site north of Lissanoure; H. flew over roost site and spooked HH female who landed again. BZ at Lissanoure
PSS	2 km / > 2 km	16	12	2018	None	No PSS species seen
PSS	2 km / > 2 km	2	1	2019	HH	Male (some brown on tail feathers) seen near roost site but not seen to drop in; may have dropped in out of sight
PSS	>2 km	4	1	2019	BZ, GJ, WS	9:15 BZ flying from hedge over improved grassland. 10:35 BZ flying over rough grassland. 12:50 BZ flying over spring cereal. 12:50 120 GJ Feeding on spring cereal. 12:50 3 WS feeding on spring cereal.
PSS	>2 km	4	1	2019	MA, CO, CA, LG, GJ	15:45 35 MA on lake. 15:45 CO on lake. 16:10 2 CA fishing on lake. 16:30 LG diving on lake. 16:45 approx 100 GJ fly in and land on lake. 16:48 approx 50 GJ fly in and land on lake. 16:52 approx 100 GJ fly in and land on lake. 16:59 approx 50 GJ fly in and land on lake. 17:03 approx 20 GJ fly in and land on lake.
PSS	2 km	8	1	2019	RN	12:32 2 RN Flying at 20m. 12:41 RN flying at 10m.
PSS	2 km	8	1	2019	RN	15:06 3 RN flying at 10m
PSS	>2 km	17	1	2019	GJ	7:41 50 GJ leave from south end of lake flying north. 7:48 50 GJ leave from south end of lake heading NW. 7:52 20 GJ arrive from west to land on lake. 7:54 30 GJ leave from south end of lake flying north. 8:02 20 GJ leave from south end of lake heading south. 8:03 50 GJ leave from north end of lake flying north. 8:09 130 GJ leave from north and south ends of lake flying north.
PSS	>2 km	17	1	2019	BZ, SH	12:01 BZ flying at 5m. 13:10 BZ flying at 10m. 13:33 BZ flying at 5m. 13:36 SH hunting at 1m.
PSS	>2 km	29	1	2019	WS, MA, BZ	3 WS (1J), 7 MA (5+2) on lough Guile and a BZ flying south of lough. BZ perched and flying near Ballyweeny.
PSS	2 km	31	1	2019	BZ, SH, K.	BZ (6) over Slieveanorra; RN (23) into area of Slieveanorra Forest roosting; no HH seen roosting
PSS	>2 km	1	2	2019	BZ, L.	15:23 2 BZ perched in hedge (arable field boundary). 15:26 6 L. flying over arable field.
PSS	>2 km	1	2	2019	BZ, GJ	17:01 BZ hunting over grassland. 17:21 BZ hunting over grassland. 17:25 aprox 30 GJ approach from south. Landed on lake. 17:49 aprox 150 GJ approach from NW land on lake
PSS	2 km	25	2	2019	RN, LB, BZ	2 RN flying near Ballyweeny. BZ flying north of Ballynagabog bridge. LB flying west of windfarm. RN flying east of windfarm. BZ and 2 RN flying over forestry.
PSS	2 km	24	3	2019	None	No PSS species seen
PSS	2 km	24	3	2019	LB	13:05 LB flying at 2-20m
PSS	2 km	24	3	2019	None	No PSS species seen

Corkey Windfarm Repowering

Technical Appendix A9.2: Ornithology Data Review

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SCOTTISHPOWER RENEWABLES

A9.2 Bird Data Review

1. This appendix to the Corkey Windfarm Repowering Environmental Statement (ES) includes the NBN and BTO data used in the ES, Chapter 9: Ornithology.

Table A9.1 Review of NBN data within 10km of the Operational Corkey Windfarm

LSID	Species Name	Taxon Concept	Taxon Rank	Kingdom	Phylum	Class	Order	Family
Acanthis cabaret	(Maller, 1776)	Animalia	Chordata	Aves	Passeriformes	Fringillidae	Acanthis	Acanthis cabaret
Acanthis flammea	(Linnaeus, 1758)	Animalia	Chordata	Aves	Passeriformes	Fringillidae	Acanthis	Acanthis flammea
Accipiter nisus	(Linnaeus, 1758)	Animalia	Chordata	Aves	Falconiformes	Accipitridae	Accipiter	Accipiter nisus
Acrocephalus schoenobaenus	(Linnaeus, 1758)	Animalia	Chordata	Aves	Passeriformes	Acrocephalidae	Acrocephalus	Acrocephalus schoenobaenus
Acrocephalus scirpaceus	(Hermann, 1804)	Animalia	Chordata	Aves	Passeriformes	Acrocephalidae	Acrocephalus	Acrocephalus scirpaceus
Actitis hypoleucos	Linnaeus, 1758	Animalia	Chordata	Aves	Charadriiformes	Scolopacidae	Actitis	Actitis hypoleucos
Aegithalos caudatus	(Linnaeus, 1758)	Animalia	Chordata	Aves	Passeriformes	Aegithalidae	Aegithalos	Aegithalos caudatus
Alauda arvensis	Linnaeus, 1758	Animalia	Chordata	Aves	Passeriformes	Alaudidae	Alauda	Alauda arvensis
Alcedo atthis	(Linnaeus, 1758)	Animalia	Chordata	Aves	Coraciiformes	Alcedinidae	Alcedo	Alcedo atthis
Alectoris rufa	(Linnaeus, 1758)	Animalia	Chordata	Aves	Galliformes	Phasianidae	Alectoris	Alectoris rufa
Anas clypeata	Linnaeus, 1758	Animalia	Chordata	Aves	Anseriformes	Anatidae	Anas	Anas clypeata
Anas crecca	Linnaeus, 1758	Animalia	Chordata	Aves	Anseriformes	Anatidae	Anas	Anas crecca
Anas penelope	Linnaeus, 1758	Animalia	Chordata	Aves	Anseriformes	Anatidae	Anas	Anas penelope
Anas platyrhynchos	Linnaeus, 1758	Animalia	Chordata	Aves	Anseriformes	Anatidae	Anas	Anas platyrhynchos
Anser anser	(Linnaeus, 1758)	Animalia	Chordata	Aves	Anseriformes	Anatidae	Anser	Anser anser
Anthus pratensis	(Linnaeus, 1758)	Animalia	Chordata	Aves	Passeriformes	Motacillidae	Anthus	Anthus pratensis
Apus apus	(Linnaeus, 1758)	Animalia	Chordata	Aves	Apodiformes	Apodidae	Apus	Apus apus
Ardea cinerea	Linnaeus, 1758	Animalia	Chordata	Aves	Ciconiiformes	Ardeidae	Ardea	Ardea cinerea
Asio flammeus	(Pontoppidan, 1763)	Animalia	Chordata	Aves	Strigiformes	Strigidae	Asio	Asio flammeus
Asio otus	(Linnaeus, 1758)	Animalia	Chordata	Aves	Strigiformes	Strigidae	Asio	Asio otus
Aythya ferina	(Linnaeus, 1758)	Animalia	Chordata	Aves	Anseriformes	Anatidae	Aythya	Aythya ferina
Aythya fuligula	(Linnaeus, 1758)	Animalia	Chordata	Aves	Anseriformes	Anatidae	Aythya	Aythya fuligula
Bucephala clangula	(Linnaeus, 1758)	Animalia	Chordata	Aves	Anseriformes	Anatidae	Bucephala	Bucephala clangula
Buteo buteo	(Linnaeus, 1758)	Animalia	Chordata	Aves	Falconiformes	Accipitridae	Buteo	Buteo buteo
Caprimulgus europaeus	Linnaeus, 1758	Animalia	Chordata	Aves	Strigiformes	Caprimulgidae	Caprimulgus	Caprimulgus europaeus
Carduelis carduelis	(Linnaeus, 1758)	Animalia	Chordata	Aves	Passeriformes	Fringillidae	Carduelis	Carduelis carduelis
Certhia familiaris	Linnaeus, 1758	Animalia	Chordata	Aves	Passeriformes	Certhiidae	Certhia	Certhia familiaris
Charadrius hiaticula	Linnaeus, 1758	Animalia	Chordata	Aves	Charadriiformes	Charadriidae	Charadrius	Charadrius hiaticula
Chloris chloris	(Linnaeus, 1758)	Animalia	Chordata	Aves	Passeriformes	Fringillidae	Chloris	Chloris chloris
Chroicocephalus ridibundus	(Linnaeus, 1766)	Animalia	Chordata	Aves	Charadriiformes	Laridae	Chroicocephalus	Chroicocephalus ridibundus
Cinclus cinclus	(Linnaeus, 1758)	Animalia	Chordata	Aves	Passeriformes	Cinclidae	Cinclus	Cinclus cinclus
Circus cyaneus	(Linnaeus, 1766)	Animalia	Chordata	Aves	Falconiformes	Accipitridae	Circus	Circus cyaneus
Columba livia	Gmelin, 1789	Animalia	Chordata	Aves	Columbiformes	Columbidae	Columba	Columba livia
Columba oenas	Linnaeus, 1758	Animalia	Chordata	Aves	Columbiformes	Columbidae	Columba	Columba oenas
Columba palumbus	Linnaeus, 1758	Animalia	Chordata	Aves	Columbiformes	Columbidae	Columba	Columba palumbus
Corvus corax	Linnaeus, 1758	Animalia	Chordata	Aves	Passeriformes	Corvidae	Corvus	Corvus corax
Corvus cornix	Linnaeus, 1758	Animalia	Chordata	Aves	Passeriformes	Corvidae	Corvus	Corvus cornix
Corvus corone x cornix		Animalia	Chordata	Aves	Passeriformes	Corvidae	Corvus	
Corvus corone	Linnaeus, 1758	Animalia	Chordata	Aves	Passeriformes	Corvidae	Corvus	Corvus corone
Corvus frugilegus	Linnaeus, 1758	Animalia	Chordata	Aves	Passeriformes	Corvidae	Corvus	Corvus frugilegus
Corvus monedula	Linnaeus, 1758	Animalia	Chordata	Aves	Passeriformes	Corvidae	Corvus	Corvus monedula
Crex crex	(Linnaeus, 1758)	Animalia	Chordata	Aves	Gruiformes	Rallidae	Crex	Crex crex
Cuculus canorus	Linnaeus, 1758	Animalia	Chordata	Aves	Cuculiformes	Cuculidae	Cuculus	Cuculus canorus
Cyanistes caeruleus	(Linnaeus, 1758)	Animalia	Chordata	Aves	Passeriformes	Paridae	Cyanistes	Cyanistes caeruleus
Cygnus columbianus	(Ord, 1815)	Animalia	Chordata	Aves	Anseriformes	Anatidae	Cygnus	Cygnus columbianus
Cygnus cygnus	(Linnaeus, 1758)	Animalia	Chordata	Aves	Anseriformes	Anatidae	Cygnus	Cygnus cygnus
Cygnus olor	(Gmelin, 1789)	Animalia	Chordata	Aves	Anseriformes	Anatidae	Cygnus	Cygnus olor
Delichon urbicum	(Linnaeus, 1758)	Animalia	Chordata	Aves	Passeriformes	Hirundinidae	Delichon	Delichon urbicum
Emberiza citrinella	Linnaeus, 1758	Animalia	Chordata	Aves	Passeriformes	Emberizidae	Emberiza	Emberiza citrinella
Emberiza schoeniclus	(Linnaeus, 1758)	Animalia	Chordata	Aves	Passeriformes	Emberizidae	Emberiza	Emberiza schoeniclus
Erithacus rubecula	(Linnaeus, 1758)	Animalia	Chordata	Aves	Passeriformes	Muscicapidae	Erithacus	Erithacus rubecula
Falco columbarius	Linnaeus, 1758	Animalia	Chordata	Aves	Falconiformes	Falconidae	Falco	Falco columbarius
Falco peregrinus	Tunstall, 1771	Animalia	Chordata	Aves	Falconiformes	Falconidae	Falco	Falco peregrinus
Falco tinnunculus	Linnaeus, 1758	Animalia	Chordata	Aves	Falconiformes	Falconidae	Falco	Falco tinnunculus
Fringilla coelebs	Linnaeus, 1758	Animalia	Chordata	Aves	Passeriformes	Fringillidae	Fringilla	Fringilla coelebs
Fringilla montifringilla	Linnaeus, 1758	Animalia	Chordata	Aves	Passeriformes	Fringillidae	Fringilla	Fringilla montifringilla
Fulica atra	Linnaeus, 1758	Animalia	Chordata	Aves	Gruiformes	Rallidae	Fulica	Fulica atra
Fulmarus glacialis	(Linnaeus, 1761)	Animalia	Chordata	Aves	Procellariiformes	Procellariidae	Fulmarus	Fulmarus glacialis

LSID	Species Name	Taxon Concept	Taxon Rank	Kingdom	Phylum	Class	Order	Family
Gallinago gallinago	(Linnaeus, 1758)	Animalia	Chordata	Aves	Charadriiformes	Scolopacidae	Gallinago	Gallinago gallinago
Gallinula chloropus	(Linnaeus, 1758)	Animalia	Chordata	Aves	Gruiformes	Rallidae	Gallinula	Gallinula chloropus
Garrulus glandarius	(Linnaeus, 1758)	Animalia	Chordata	Aves	Passeriformes	Corvidae	Garrulus	Garrulus glandarius
Haliaeetus albicilla	(Linnaeus, 1758)	Animalia	Chordata	Aves	Falconiformes	Accipitridae	Haliaeetus	Haliaeetus albicilla
Hirundo rustica	Linnaeus, 1758	Animalia	Chordata	Aves	Passeriformes	Hirundinidae	Hirundo	Hirundo rustica
Lagopus lagopus subsp. scotica	(Latham, 1787)	Animalia	Chordata	Aves	Galliformes	Phasianidae	Lagopus	Lagopus lagopus
Lagopus lagopus	(Linnaeus, 1758)	Animalia	Chordata	Aves	Galliformes	Phasianidae	Lagopus	Lagopus lagopus
Larus argentatus	Pontoppidan, 1763	Animalia	Chordata	Aves	Charadriiformes	Laridae	Larus	Larus argentatus
Larus canus	Linnaeus, 1758	Animalia	Chordata	Aves	Charadriiformes	Laridae	Larus	Larus canus
Larus fuscus	Linnaeus, 1758	Animalia	Chordata	Aves	Charadriiformes	Laridae	Larus	Larus fuscus
Larus marinus	Linnaeus, 1758	Animalia	Chordata	Aves	Charadriiformes	Laridae	Larus	Larus marinus
Linaria cannabina	(Linnaeus, 1758)	Animalia	Chordata	Aves	Passeriformes	Fringillidae	Linaria	Linaria cannabina
Linaria flavirostris	(Linnaeus, 1758)	Animalia	Chordata	Aves	Passeriformes	Fringillidae	Linaria	Linaria flavirostris
Locustella naevia	(Boddaert, 1783)	Animalia	Chordata	Aves	Passeriformes	Locustellidae	Locustella	Locustella naevia
Loxia curvirostra	Linnaeus, 1758	Animalia	Chordata	Aves	Passeriformes	Fringillidae	Loxia	Loxia curvirostra
Lymnocryptes minimus	(Brannich, 1764)	Animalia	Chordata	Aves	Charadriiformes	Scolopacidae	Lymnocryptes	Lymnocryptes minimus
Motacilla alba subsp. yarrellii	Gould, 1837	Animalia	Chordata	Aves	Passeriformes	Motacillidae	Motacilla	Motacilla alba
Motacilla alba	Linnaeus, 1758	Animalia	Chordata	Aves	Passeriformes	Motacillidae	Motacilla	Motacilla alba
Motacilla cinerea	Tunstall, 1771	Animalia	Chordata	Aves	Passeriformes	Motacillidae	Motacilla	Motacilla cinerea
Muscicapa striata	(Pallas, 1764)	Animalia	Chordata	Aves	Passeriformes	Muscicapidae	Muscicapa	Muscicapa striata
Numenius arquata	(Linnaeus, 1758)	Animalia	Chordata	Aves	Charadriiformes	Scolopacidae	Numenius	Numenius arquata
Oenanthe oenanthe	(Linnaeus, 1758)	Animalia	Chordata	Aves	Passeriformes	Muscicapidae	Oenanthe	Oenanthe oenanthe
Parus major	Linnaeus, 1758	Animalia	Chordata	Aves	Passeriformes	Paridae	Parus	Parus major
Passer domesticus	(Linnaeus, 1758)	Animalia	Chordata	Aves	Passeriformes	Passeridae	Passer	Passer domesticus
Passer montanus	(Linnaeus, 1758)	Animalia	Chordata	Aves	Passeriformes	Passeridae	Passer	Passer montanus
Perdix perdix	(Linnaeus, 1758)	Animalia	Chordata	Aves	Galliformes	Phasianidae	Perdix	Perdix perdix
Periparus ater	(Linnaeus, 1758)	Animalia	Chordata	Aves	Passeriformes	Paridae	Periparus	Periparus ater
Phalacrocorax carbo	(Linnaeus, 1758)	Animalia	Chordata	Aves	Pelecaniformes	Phalacrocoracidae	Phalacrocorax	Phalacrocorax carbo
Phasianus colchicus	Linnaeus, 1758	Animalia	Chordata	Aves	Galliformes	Phasianidae	Phasianus	Phasianus colchicus
Phoenicurus phoenicurus	(Linnaeus, 1758)	Animalia	Chordata	Aves	Passeriformes	Muscicapidae	Phoenicurus	Phoenicurus phoenicurus
Phylloscopus collybita	(Vieillot, 1817)	Animalia	Chordata	Aves	Passeriformes	Phylloscopidae	Phylloscopus	Phylloscopus collybita
Phylloscopus trochilus	(Linnaeus, 1758)	Animalia	Chordata	Aves	Passeriformes	Phylloscopidae	Phylloscopus	Phylloscopus trochilus
Pica pica	(Linnaeus, 1758)	Animalia	Chordata	Aves	Passeriformes	Corvidae	Pica	Pica pica
Plectrophenax nivalis	(Linnaeus, 1758)	Animalia	Chordata	Aves	Passeriformes	Emberizidae	Plectrophenax	Plectrophenax nivalis
Pluvialis apricaria	(Linnaeus, 1758)	Animalia	Chordata	Aves	Charadriiformes	Charadriidae	Pluvialis	Pluvialis apricaria
Podiceps cristatus	(Linnaeus, 1758)	Animalia	Chordata	Aves	Podicipediformes	Podicipedidae	Podiceps	Podiceps cristatus
Prunella modularis	(Linnaeus, 1758)	Animalia	Chordata	Aves	Passeriformes	Prunellidae	Prunella	Prunella modularis
Pyrrhula pyrrhula	(Linnaeus, 1758)	Animalia	Chordata	Aves	Passeriformes	Fringillidae	Pyrrhula	Pyrrhula pyrrhula
Rallus aquaticus	(Linnaeus, 1758)	Animalia	Chordata	Aves	Gruiformes	Rallidae	Rallus	Rallus aquaticus
Regulus regulus	(Linnaeus, 1758)	Animalia	Chordata	Aves	Passeriformes	Regulidae	Regulus	Regulus regulus
Riparia riparia	(Linnaeus, 1758)	Animalia	Chordata	Aves	Passeriformes	Hirundinidae	Riparia	Riparia riparia
Saxicola rubetra	(Linnaeus, 1758)	Animalia	Chordata	Aves	Passeriformes	Muscicapidae	Saxicola	Saxicola rubetra
Saxicola rubicola	(Linnaeus, 1758)	Animalia	Chordata	Aves	Passeriformes	Muscicapidae	Saxicola	Saxicola rubicola
Scolopax rusticola	Linnaeus, 1758	Animalia	Chordata	Aves	Charadriiformes	Scolopacidae	Scolopax	Scolopax rusticola
Spinus spinus	(Linnaeus, 1758)	Animalia	Chordata	Aves	Passeriformes	Fringillidae	Spinus	Spinus spinus
Streptopelia decaocto	(Frivaldszky, 1838)	Animalia	Chordata	Aves	Columbiformes	Columbidae	Streptopelia	Streptopelia decaocto
Sturnus vulgaris	Linnaeus, 1758	Animalia	Chordata	Aves	Passeriformes	Sturnidae	Sturnus	Sturnus vulgaris
Sylvia atricapilla	(Linnaeus, 1758)	Animalia	Chordata	Aves	Passeriformes	Sylviidae	Sylvia	Sylvia atricapilla
Sylvia communis	Latham, 1787	Animalia	Chordata	Aves	Passeriformes	Sylviidae	Sylvia	Sylvia communis
Tachybaptus ruficollis	(Pallas, 1764)	Animalia	Chordata	Aves	Podicipediformes	Podicipedidae	Tachybaptus	Tachybaptus ruficollis
Tadorna tadorna	(Linnaeus, 1758)	Animalia	Chordata	Aves	Anseriformes	Anatidae	Tadorna	Tadorna tadorna
Tringa totanus	(Linnaeus, 1758)	Animalia	Chordata	Aves	Charadriiformes	Scolopacidae	Tringa	Tringa totanus
Troglodytes troglodytes	(Linnaeus, 1758)	Animalia	Chordata	Aves	Passeriformes	Troglodytidae	Troglodytes	Troglodytes troglodytes
Turdus iliacus	Linnaeus, 1766	Animalia	Chordata	Aves	Passeriformes	Muscicapidae	Turdus	Turdus iliacus
Turdus merula	Linnaeus, 1758	Animalia	Chordata	Aves	Passeriformes	Muscicapidae	Turdus	Turdus merula
Turdus philomelos	Brehm, 1831	Animalia	Chordata	Aves	Passeriformes	Muscicapidae	Turdus	Turdus philomelos
Turdus pilaris	Linnaeus, 1758	Animalia	Chordata	Aves	Passeriformes	Muscicapidae	Turdus	Turdus pilaris
Turdus viscivorus	Linnaeus, 1758	Animalia	Chordata	Aves	Passeriformes	Muscicapidae	Turdus	Turdus viscivorus
Tyto alba	(Scopoli, 1769)	Animalia	Chordata	Aves	Strigiformes	Tytonidae	Tyto	Tyto alba
Vanellus vanellus	(Linnaeus, 1758)	Animalia	Chordata	Aves	Charadriiformes	Charadriidae	Vanellus	Vanellus vanellus

Table A9.2 Review of breeding and wintering BTO data for ID02 and ID12 10km squares

speccode	CBC_CODE	engname	BOCCI3	BOCC4	season	grid	n_records	maxcat	maxcountall	n_ttvs	maxcountttv
6	LG	Little Grebe	AMBER	GREEN	B	ID02	2	3	4		
6	LG	Little Grebe	AMBER	GREEN	W	ID02	1	3			
26	CA	Cormorant	AMBER	GREEN	W	ID12	1	3			
39	H.	Grey Heron	GREEN	GREEN	B	ID02	1	1	1		
39	H.	Grey Heron	GREEN	GREEN	B	ID12	2	1			
39	H.	Grey Heron	GREEN	GREEN	W	ID12	3	3	2	1	2
46	MS	Mute Swan	AMBER	AMBER	B	ID02	2	3			
46	MS	Mute Swan	AMBER	AMBER	W	ID02	1	3			
48	WS	Whooper Swan	AMBER	AMBER	W	ID02	1	3			
53	GJ	Greylag Goose	AMBER	AMBER	B	ID02	2	3	2		
53	GJ	Greylag Goose	AMBER	AMBER	W	ID02	1	3			
64	WN	Wigeon	RED	AMBER	W	ID02	1	3			
69	MA	Mallard	GREEN	AMBER	B	ID02	3	3	2		
69	MA	Mallard	GREEN	AMBER	B	ID12	1	1			
69	MA	Mallard	GREEN	AMBER	W	ID02	1	3			
79	TU	Tufted Duck	RED	GREEN	B	ID02	1	2	2		
109	SH	Sparrowhawk	AMBER	GREEN	B	ID02	3	3	1		
109	SH	Sparrowhawk	AMBER	GREEN	B	ID12	2	3			
109	SH	Sparrowhawk	AMBER	GREEN	W	ID02	1	3	1		
109	SH	Sparrowhawk	AMBER	GREEN	W	ID12	2	3	1	1	1
110	BZ	Buzzard	GREEN	GREEN	B	ID02	3	2	3		
110	BZ	Buzzard	GREEN	GREEN	B	ID12	7	3	1	1	1
110	BZ	Buzzard	GREEN	GREEN	W	ID02	4	3	1	1	1
110	BZ	Buzzard	GREEN	GREEN	W	ID12	3	3	2	1	2
116	K.	Kestrel	AMBER	AMBER	B	ID02	2	3	2		
116	K.	Kestrel	AMBER	AMBER	B	ID12	1	1			
116	K.	Kestrel	AMBER	AMBER	W	ID12	1	3	1	1	1
119	ML	Merlin	AMBER	RED	B	ID12	4	3			
119	ML	Merlin	AMBER	RED	W	ID12	1	3			
124	PE	Peregrine	GREEN	GREEN	B	ID02	3	3	1		
124	PE	Peregrine	GREEN	GREEN	B	ID12	3	3			
125	RG	Red Grouse	RED	AMBER	B	ID12	4	3			
125	RG	Red Grouse	RED	AMBER	W	ID12	8	3	4	4	4
133	PH	Pheasant	GREEN	GREEN	B	ID02	1	1	1		
133	PH	Pheasant	GREEN	GREEN	B	ID12	2	2			
133	PH	Pheasant	GREEN	GREEN	W	ID02	1	3	2	1	2
133	PH	Pheasant	GREEN	GREEN	W	ID12	1	3	1	1	1
142	MH	Moorhen	GREEN	GREEN	B	ID02	2	1	3		
142	MH	Moorhen	GREEN	GREEN	W	ID02	1	3			
145	CO	Coot	AMBER	GREEN	W	ID02	1	3			
171	L.	Lapwing	RED	RED	B	ID02	1	2	2		
171	L.	Lapwing	RED	RED	W	ID12	1	3			
192	SN	Snipe	AMBER	AMBER	B	ID12	2	1			
192	SN	Snipe	AMBER	AMBER	W	ID02	2	3	3		
192	SN	Snipe	AMBER	AMBER	W	ID12	7	3	2	7	2
196	WK	Woodcock	RED	RED	W	ID12	5	3	1	2	1
203	CU	Curlew	RED	RED	B	ID02	1	1	1		
203	CU	Curlew	RED	RED	B	ID12	5	2			
215	CS	Common Sandpiper	AMBER	AMBER	B	ID12	1	3	2	1	2
268	DV	Rock Dove	GREEN	GREEN	B	ID02	2	2	50		
268	DV	Rock Dove	GREEN	GREEN	W	ID02	1	3			
269	SD	Stock Dove	AMBER	AMBER	B	ID02	1	1	2		
270	WP	Woodpigeon	GREEN	GREEN	B	ID02	3	3	10		
270	WP	Woodpigeon	GREEN	GREEN	B	ID12	5	3	8	2	8
270	WP	Woodpigeon	GREEN	GREEN	W	ID02	2	3	32	2	32
271	CD	Collared Dove	GREEN	GREEN	B	ID02	3	2	6		
271	CD	Collared Dove	GREEN	GREEN	B	ID12	1	1			
271	CD	Collared Dove	GREEN	GREEN	W	ID02	2	3	9	2	9
271	CD	Collared Dove	GREEN	GREEN	W	ID12	1	3			
276	CK	Cuckoo	GREEN	RED	B	ID02	4	2	2		
276	CK	Cuckoo	GREEN	RED	B	ID12	2	1	1		
295	SI	Swift	AMBER	AMBER	B	ID02	1	2			
319	S.	Skylark	AMBER	RED	B	ID02	1	1	3		
319	S.	Skylark	AMBER	RED	B	ID12	5	2	1		
319	S.	Skylark	AMBER	RED	W	ID12	2	3	1	1	1
321	SM	Sand Martin	AMBER	GREEN	B	ID02	5	3	50		
321	SM	Sand Martin	AMBER	GREEN	B	ID12	2	2			
322	SL	Swallow	AMBER	GREEN	B	ID02	2	3	10		
322	SL	Swallow	AMBER	GREEN	B	ID12	4	3	4	3	4
325	HM	House Martin	AMBER	AMBER	B	ID02	2	3	10		
325	HM	House Martin	AMBER	AMBER	B	ID12	3	3	2		
332	MP	Meadow Pipit	RED	AMBER	B	ID02	2	3	5		
332	MP	Meadow Pipit	RED	AMBER	B	ID12	10	3	16	5	16

speccode	CBC_CODE	engname	BOCCI3	BOCC4	season	grid	n_records	maxcat	maxcountall	n_ttvs	maxcountttv
332	MP	Meadow Pipit	RED	AMBER	W	ID02	1	3			
332	MP	Meadow Pipit	RED	AMBER	W	ID12	6	3	3	6	3
336	GL	Grey Wagtail	RED	RED	B	ID12	6	3	3	1	2
336	GL	Grey Wagtail	RED	RED	W	ID12	1	3			
337	PW	Pied/White Wagtail	GREEN	GREEN	B	ID02	4	3	1		
337	PW	Pied/White Wagtail	GREEN	GREEN	B	ID12	4	3	1	1	1
337	PW	Pied/White Wagtail	GREEN	GREEN	W	ID02	3	3	3	2	3
337	PW	Pied/White Wagtail	GREEN	GREEN	W	ID12	1	3			
339	DI	Dipper	GREEN	AMBER	B	ID02	1	1	1		
339	DI	Dipper	GREEN	AMBER	B	ID12	1	1			
339	DI	Dipper	GREEN	AMBER	W	ID02	1	3	1		
339	DI	Dipper	GREEN	AMBER	W	ID12	1	3			
340	WR	Wren	GREEN	GREEN	B	ID02	4	3	9		
340	WR	Wren	GREEN	GREEN	B	ID12	8	2	3	3	3
340	WR	Wren	GREEN	GREEN	W	ID02	2	3	5	2	5
340	WR	Wren	GREEN	GREEN	W	ID12	3	3	3	3	3
342	D.	Dunnock	GREEN	AMBER	B	ID02	1	1	1		
342	D.	Dunnock	GREEN	AMBER	B	ID12	2	1			
342	D.	Dunnock	GREEN	AMBER	W	ID02	1	3			
342	D.	Dunnock	GREEN	AMBER	W	ID12	1	3			
345	R.	Robin	AMBER	GREEN	B	ID02	4	3	3		
345	R.	Robin	AMBER	GREEN	B	ID12	5	1	3	2	3
345	R.	Robin	AMBER	GREEN	W	ID02	3	3	6	2	6
345	R.	Robin	AMBER	GREEN	W	ID12	2	3	3	2	3
354	WC	Whinchat	RED	RED	B	ID12	3	2	2		
355	SC	Stonechat	AMBER	GREEN	B	ID02	1	1	1		
355	SC	Stonechat	AMBER	GREEN	B	ID12	1	3	1	1	1
357	W.	Wheatear	AMBER	GREEN	B	ID02	2	2	4		
357	W.	Wheatear	AMBER	GREEN	B	ID12	6	3	1	1	1
371	B.	Blackbird	GREEN	GREEN	B	ID02	3	3	5		
371	B.	Blackbird	GREEN	GREEN	B	ID12	2	1	1	1	1
371	B.	Blackbird	GREEN	GREEN	W	ID02	2	3	13	2	13
371	B.	Blackbird	GREEN	GREEN	W	ID12	1	3			
375	FF	Fieldfare	GREEN	RED	W	ID02	4	3	34	2	34
376	ST	Song Thrush	GREEN	RED	B	ID02	2	2	1		
376	ST	Song Thrush	GREEN	RED	B	ID12	2	2	2	1	2
376	ST	Song Thrush	GREEN	RED	W	ID02	1	3	3	1	3
376	ST	Song Thrush	GREEN	RED	W	ID12	1	3	1	2	1
377	RE	Redwing	GREEN	RED	W	ID02	2	3	24	2	24
378	M.	Mistle Thrush	AMBER	RED	B	ID02	3	3	2		
378	M.	Mistle Thrush	AMBER	RED	B	ID12	3	3	3	1	3
378	M.	Mistle Thrush	AMBER	RED	W	ID02	1	3	2	1	2
378	M.	Mistle Thrush	AMBER	RED	W	ID12	1	3			
384	GH	Grasshopper Warbler	GREEN	RED	B	ID02	3	2	5		
384	GH	Grasshopper Warbler	GREEN	RED	B	ID12	6	2	1	1	1
389	SW	Sedge Warbler	GREEN	GREEN	B	ID02	1	1	1		
389	SW	Sedge Warbler	GREEN	GREEN	B	ID12	1	1	1	1	1
393	RW	Reed Warbler	AMBER	GREEN	B	ID02	1	1			
412	BC	Blackcap	GREEN	GREEN	B	ID02	2	2	7		
412	BC	Blackcap	GREEN	GREEN	B	ID12	3	2	1	1	1
422	CC	Chiffchaff	GREEN	GREEN	B	ID02	3	2	2		
422	CC	Chiffchaff	GREEN	GREEN	B	ID12	1	1	1	1	1
423	WW	Willow Warbler	GREEN	AMBER	B	ID02	3	3	14		
423	WW	Willow Warbler	GREEN	AMBER	B	ID12	5	3	3	2	3
424	GC	Goldcrest	AMBER	GREEN	B	ID02	1	3			
424	GC	Goldcrest	AMBER	GREEN	B	ID12	4	1	1	2	1
424	GC	Goldcrest	AMBER	GREEN	W	ID02	1	3			
424	GC	Goldcrest	AMBER	GREEN	W	ID12	4	3	4	4	4
426	SF	Spotted Flycatcher	AMBER	RED	B	ID02	1	1	1		
426	SF	Spotted Flycatcher	AMBER	RED	B	ID12	2	2			
431	LT	Long-tailed Tit	GREEN	GREEN	B	ID02	1	1	2		
431	LT	Long-tailed Tit	GREEN	GREEN	W	ID02	1	3			
435	CT	Coal Tit	GREEN	GREEN	B	ID02	4	3	3		
435	CT	Coal Tit	GREEN	GREEN	B	ID12	5	3	4	3	4
435	CT	Coal Tit	GREEN	GREEN	W	ID02	1	3			
435	CT	Coal Tit	GREEN	GREEN	W	ID12	5	3	5	5	5
436	BT	Blue Tit	GREEN	GREEN	B	ID02	5	3	8		
436	BT	Blue Tit	GREEN	GREEN	B	ID12	2	3	1	1	1
436	BT	Blue Tit	GREEN	GREEN	W	ID02	2	3	5	2	5
436	BT	Blue Tit	GREEN	GREEN	W	ID12	1	3	2	1	2
437	GT	Great Tit	GREEN	GREEN	B	ID02	4	3	10		
437	GT	Great Tit	GREEN	GREEN	B	ID12	2	3			
437	GT	Great Tit	GREEN	GREEN	W	ID02	1	3	1	1	1
437	GT	Great Tit	GREEN	GREEN	W	ID12	1	3	1	1	1

speccode	CBC_CODE	engname	BOCCI3	BOCC4	season	grid	n_records	maxcat	maxcountall	n_ttvs	maxcountttv
440	TC	Treecreeper	GREEN	GREEN	B	ID02	1	1	1		
440	TC	Treecreeper	GREEN	GREEN	W	ID02	2	3	1		
440	TC	Treecreeper	GREEN	GREEN	W	ID12	2	3			
449	J.	Jay	GREEN	GREEN	B	ID02	1	2	2		
449	J.	Jay	GREEN	GREEN	B	ID12	2	1	1	1	1
449	J.	Jay	GREEN	GREEN	W	ID02	1	3			
449	J.	Jay	GREEN	GREEN	W	ID12	1	3	2	1	2
450	MG	Magpie	GREEN	GREEN	B	ID02	4	3	33		
450	MG	Magpie	GREEN	GREEN	B	ID12	2	2	2	1	2
450	MG	Magpie	GREEN	GREEN	W	ID02	3	3	9	2	9
450	MG	Magpie	GREEN	GREEN	W	ID12	2	3	2	2	2
453	JD	Jackdaw	GREEN	GREEN	B	ID02	3	3	34		
453	JD	Jackdaw	GREEN	GREEN	B	ID12	2	2			
453	JD	Jackdaw	GREEN	GREEN	W	ID02	3	3	33	2	33
453	JD	Jackdaw	GREEN	GREEN	W	ID12	1	3			
454	RO	Rook	GREEN	GREEN	B	ID02	2	2	300		
454	RO	Rook	GREEN	GREEN	B	ID12	1	1			
454	RO	Rook	GREEN	GREEN	W	ID02	3	3	72	2	72
454	RO	Rook	GREEN	GREEN	W	ID12	1	3			
456	RN	Raven	GREEN	GREEN	B	ID02	3	3	5		
456	RN	Raven	GREEN	GREEN	B	ID12	4	3	7	1	7
456	RN	Raven	GREEN	GREEN	W	ID02	1	3			
456	RN	Raven	GREEN	GREEN	W	ID12	9	3	12	8	12
457	SG	Starling	AMBER	RED	B	ID02	3	3	19		
457	SG	Starling	AMBER	RED	B	ID12	4	3	15	2	15
457	SG	Starling	AMBER	RED	W	ID02	3	3	104	2	104
457	SG	Starling	AMBER	RED	W	ID12	1	3			
459	HS	House Sparrow	AMBER	RED	B	ID02	3	3	10		
459	HS	House Sparrow	AMBER	RED	B	ID12	1	3			
459	HS	House Sparrow	AMBER	RED	W	ID02	3	3	8	2	8
459	HS	House Sparrow	AMBER	RED	W	ID12	1	3			
466	CH	Chaffinch	GREEN	GREEN	B	ID02	3	2	14		
466	CH	Chaffinch	GREEN	GREEN	B	ID12	7	3	4	3	4
466	CH	Chaffinch	GREEN	GREEN	W	ID02	3	3	11	2	11
466	CH	Chaffinch	GREEN	GREEN	W	ID12	4	3	3	4	3
470	GR	Greenfinch	AMBER	GREEN	B	ID02	3	3	3		
470	GR	Greenfinch	AMBER	GREEN	B	ID12	1	1			
470	GR	Greenfinch	AMBER	GREEN	W	ID02	1	3	3	1	3
471	GO	Goldfinch	GREEN	GREEN	B	ID02	3	3	4		
471	GO	Goldfinch	GREEN	GREEN	B	ID12	2	3	2	1	2
471	GO	Goldfinch	GREEN	GREEN	W	ID02	1	3			
471	GO	Goldfinch	GREEN	GREEN	W	ID12	1	3			
472	SK	Siskin	GREEN	GREEN	B	ID02	1	3			
472	SK	Siskin	GREEN	GREEN	B	ID12	4	2	2	1	2
472	SK	Siskin	GREEN	GREEN	W	ID02	1	3	1		
472	SK	Siskin	GREEN	GREEN	W	ID12	2	3	10	1	8
473	LI	Linnet	AMBER	RED	B	ID02	2	3	2		
473	LI	Linnet	AMBER	RED	B	ID12	2	1	1	1	1
474	TW	Twite	RED	RED	W	ID02	1	3	10	1	10
484	BF	Bullfinch	GREEN	AMBER	B	ID02	1	1	1		
484	BF	Bullfinch	GREEN	AMBER	W	ID12	1	3			
512	SB	Snow Bunting	GREEN	AMBER	W	ID12	2	3	1	1	1
524	RB	Reed Bunting	GREEN	AMBER	B	ID02	1	3	3		
524	RB	Reed Bunting	GREEN	AMBER	B	ID12	1	2			
524	RB	Reed Bunting	GREEN	AMBER	W	ID02	1	3			
524	RB	Reed Bunting	GREEN	AMBER	W	ID12	1	3			
910	HC	Hooded Crow	GREEN	GREEN	B	ID02	1	1	16		
910	HC	Hooded Crow	GREEN	GREEN	B	ID12	5	3	2	2	2
910	HC	Hooded Crow	GREEN	GREEN	W	ID02	1	3	1	1	1
910	HC	Hooded Crow	GREEN	GREEN	W	ID12	3	3	11	2	11
1079	LR	Lesser Redpoll	GREEN	RED	B	ID02	1	1	1		
1079	LR	Lesser Redpoll	GREEN	RED	B	ID12	3	3	6	1	6
1079	LR	Lesser Redpoll	GREEN	RED	W	ID02	1	3			
1079	LR	Lesser Redpoll	GREEN	RED	W	ID12	1	3			
1165	ZF	Mallard (domestic)	GREEN	GREEN	B	ID02	1	3			
1247	HB	hybrid Carrion x Hooded Crow	GREEN	GREEN	W	ID12	1	3	2	1	2
1535	XB	unidentified crossbill	GREEN	GREEN	B	ID12	5	3	4	1	4
1535	XB	unidentified crossbill	GREEN	GREEN	W	ID12	5	3	11	2	2

Corkey Windfarm Repowering

Technical Appendix A9.3: Collision Risk Modelling (CRM)

Volume 3 – Technical Appendices
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A9.3 Collision Risk Modelling

1. This appendix to the Corkey Windfarm Repowering Environmental Statement (ES) includes the input and output data used in the bird collision risk modelling calculations reported in the ES, Chapter 9: Ornithology.

Table A9.1 Duration of monthly hours and daylight available for collision risk modelling

	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Days	31	30	31	30	31	31	30	31	30	31	31	28	31
Total hours	744	720	744	720	744	744	720	744	720	744	744	672	744
Average daylight hours	12	14	13	15	16	16.5	16	10	9	8	9	10	12
Total daylight hours	372	420	403	450	496	512	480	310	270	248	279	280	372

Table A9.2 Details of flights of Target 1 species utilised in collision risk modelling (CRM) 2014 – 2015.

VP No	Month	Day	Year	Species	No	Time 1st detected	Duration (secs)	<15m	15-25m	25-50m	50-75m	50-100m	100-125m	125-140m	>140m	Existing Flight (<500m)	Proposed Flight (<500m)
1	5	7	2014	CU	1	07:18	49	34	15							Yes	Yes
1	6	24	2014	CU	1	09:07	73		73							Yes	No
4	7	11	2014	CU	1	11:43	76		76							Yes	Yes
3	9	2	2014	HH	1	08:53	130	100	30							Yes	No
3	9	2	2014	HH	1	09:34	38	23	15							Yes	No
3	9	2	2014	HH	1	10:08	57	57								Yes	No
3	9	30	2014	HH	1	07:48	89	59	30							Yes	No
3	10	10	2014	HH	1	07:43	49	34	15							Yes	Yes
3	10	29	2014	ML	1	12:43	105	80	25							Yes	Yes
2	6	7	2014	PE	1	07:30	12			12						No	No
4	7	11	2014	PE	1	14:17	95		20	25	20	25	5			Yes	Yes
4	7	17	2014	PE	2	11:07	175				10	10	60	65	30	No	No
2	8	30	2014	PE	1	10:28	43			13					30	Yes	Yes
4	9	24	2014	PE	1	18:23	50			50						Yes	Yes
4	1	24	2015	PE	1	12:33	73	13	5	40	5	10				No	No
E Windfarm Potential Collision Zone								No	Yes	Yes	Yes	No	No	No	No	-	-
Proposed Windfarm Potential Collision Zone								No	Yes	Yes	Yes	Yes	Yes	Yes	No	-	-

Table A9.3 Details of flights of Target 1 species utilised in collision risk modelling (CRM) 2018 – 2019.

VP No	Month	Day	Year	Species	No	Time 1st detected	Duration (secs)	<15m	15-25m	25-50m	50-75m	75-100m	100-125m	125-140m	>140m	Existing (<500m)	Proposed (<500m)
3	4	18	2018	HH	1	11:33	96	96								Yes	Yes
2	7	21	2018	HH	1	10:57	15	15								Yes	Yes
2	6	26	2018	ML	1	11:44	45	45								Yes	Yes
2	6	26	2018	ML	1	13:17	75	75								Yes	Yes
1	8	3	2018	ML	1	07:40	85	85								No	No
4	4	25	2018	PE	1	15:04	39				39					No	No
4	6	28	2018	PE	1	14:03	23			23						No	No
2	7	21	2018	PE	1	10:23	17			17						No	No
1	9	26	2018	PE	1	12:18	86	45	30	11						Yes	Yes
Existing Windfarm Potential Collision Zone								No	Yes	Yes	Yes	No	No	No	No	-	-
Proposed Windfarm Potential Collision Zone								No	Yes	Yes	Yes	Yes	Yes	Yes	No	-	-

Table A9.4 Collision Risk Estimate (Band et al., 2007) for the Operational Corkey Windfarm and peregrine falcon

K: [1D or [3D] (0 or 1)	1	Units	Calculation of alpha and p(collision) as a function of radius								
NoBlades	3					Upwind:			Downwind:		
MaxChord	1.63	m	r/R	c/C	a	collide		contribution	collide		contribution
Pitch (degrees)	10		radius	chord	alpha	length	p(collision)	from radius r	length	p(collision)	from radius r
BirdLength	0.42	m	0.025	0.575	9.64	15.31	1.00	0.00125	14.99	1.00	0.00125
Wingspan	1.02	m	0.075	0.575	3.21	5.21	0.56	0.00419	4.89	0.52	0.00393
F: Flapping (0) or gliding (+1)	1		0.125	0.702	1.93	3.62	0.39	0.00485	3.22	0.35	0.00432
			0.175	0.860	1.38	3.04	0.33	0.00570	2.55	0.27	0.00478
Bird speed	14	m/sec	0.225	0.994	1.07	2.69	0.29	0.00647	2.12	0.23	0.00512
RotorDiam	37	m	0.275	0.947	0.88	2.17	0.23	0.00639	1.63	0.17	0.00481
RotationPeriod	2.00	sec	0.325	0.899	0.74	1.81	0.19	0.00629	1.30	0.14	0.00451
			0.375	0.851	0.64	1.54	0.16	0.00617	1.05	0.11	0.00423
			0.425	0.804	0.57	1.33	0.14	0.00604	0.87	0.09	0.00397
			0.475	0.756	0.51	1.16	0.12	0.00590	0.73	0.08	0.00372
Bird aspect ratio: b	0.41		0.525	0.708	0.46	1.02	0.11	0.00574	0.62	0.07	0.00348
			0.575	0.660	0.42	0.90	0.10	0.00556	0.53	0.06	0.00326
			0.625	0.613	0.39	0.97	0.10	0.00651	0.63	0.07	0.00419
			0.675	0.565	0.36	0.90	0.10	0.00654	0.58	0.06	0.00422
			0.725	0.517	0.33	0.84	0.09	0.00654	0.55	0.06	0.00427
			0.775	0.470	0.31	0.79	0.08	0.00654	0.52	0.06	0.00433
			0.825	0.422	0.29	0.74	0.08	0.00652	0.50	0.05	0.00440
			0.875	0.374	0.28	0.69	0.07	0.00648	0.48	0.05	0.00449
			0.925	0.327	0.26	0.65	0.07	0.00643	0.46	0.05	0.00460

K: [1D or [3D] (0 or 1)	1	Units	Calculation of alpha and p(collision) as a function of radius								
			0.975	0.279	0.25	0.61	0.07	0.00637	0.45	0.05	0.00472
				Overall p(collision) =			Upwind	11.6%		Downwind	8.3%
								Average	10.0%		

Table A9.5 Collision Risk Estimate (Band et al., 2007) for the proposed windfarm and peregrine falcon

K: [1D or [3D] (0 or 1)	1		Calculation of alpha and p(collision) as a function of radius								
NoBlades	3					Upwind:			Downwind:		
MaxChord	3.953	m	r/R	c/C	a	collide		contribution	collide		contribution
Pitch (degrees)	44.5		radius	chord	alpha	length	p(collision)	from radius r	length	p(collision)	from radius r
BirdLength	0.42	m	0.025	0.575	6.51	16.37	0.80	0.00100	13.18	0.64	0.00081
Wingspan	1.02	m	0.075	0.575	2.17	6.52	0.32	0.00239	3.33	0.16	0.00122
F: Flapping (0) or gliding (+1)	1		0.125	0.702	1.30	5.36	0.26	0.00328	1.48	0.07	0.00090
			0.175	0.860	0.93	5.24	0.26	0.00449	0.73	0.04	0.00063
Bird speed	14	m/sec	0.225	0.994	0.72	5.25	0.26	0.00578	1.20	0.06	0.00132
RotorDiam	120	m	0.275	0.947	0.59	4.59	0.22	0.00617	1.43	0.07	0.00192
RotationPeriod	4.38	sec	0.325	0.899	0.50	4.08	0.20	0.00649	1.55	0.08	0.00246
			0.375	0.851	0.43	3.68	0.18	0.00675	1.60	0.08	0.00293
			0.425	0.804	0.38	3.51	0.17	0.00731	1.78	0.09	0.00370
			0.475	0.756	0.34	3.24	0.16	0.00754	1.78	0.09	0.00415
Bird aspect ratio: b	0.41		0.525	0.708	0.31	3.00	0.15	0.00771	1.76	0.09	0.00453
			0.575	0.660	0.28	2.78	0.14	0.00781	1.72	0.08	0.00485
			0.625	0.613	0.26	2.57	0.13	0.00785	1.67	0.08	0.00510
			0.675	0.565	0.24	2.37	0.12	0.00782	1.60	0.08	0.00529
			0.725	0.517	0.22	2.18	0.11	0.00773	1.53	0.07	0.00541
			0.775	0.470	0.21	2.00	0.10	0.00758	1.44	0.07	0.00547
			0.825	0.422	0.20	1.82	0.09	0.00736	1.35	0.07	0.00547
			0.875	0.374	0.19	1.65	0.08	0.00708	1.26	0.06	0.00540
			0.925	0.327	0.18	1.49	0.07	0.00673	1.16	0.06	0.00526
			0.975	0.279	0.17	1.32	0.06	0.00631	1.06	0.05	0.00506
				Overall p(collision) =			Upwind	12.5%		Downwind	7.2%
								Average	9.9%		

Table A9.6 Collision Risk Assessment Operational Corkey Windfarm 2014 – 2015: Peregrine falcon

Details	Month	Value	Units
Turbine parameters	Number of turbines	10	n
	Hub height	39	m
	Rotor diameter	37	m
	Rotor radius	18.5	m
	Blade maximum chord	1.63	m
	Blade pitch	10	°
	Rotor rotation period	2	sec
	Blade depth	1.63	m
	Risk window ceiling height	57.5	m
	Risk window floor height	20.5	m
	Windfarm area	2297307	m^2
	Flight risk volume	85000359	m^3
	Rotor swept area (single turbine)	1075.21009	m^2
	Rotor swept volume (single turbine)	2204.18068	m^3
	Rotor swept volume (combined)	22041.8068	m^3
	Proportion of flight risk volume with turbines	0.00025931	
Bird parameters: Peregrine falcon	Months surveyed	Mar 14 - Feb 15	months
	Speed of the bird through the rotor	14	m/s
	Length of the bird	0.42	m
	Wingspan of the bird	1.02	m
	Vantage point hours completed	291	hours
	Vantage point seconds completed	1047600	seconds
	Time available for flight activity per year	4520	hours
	Flight seconds per year	16272000	seconds
	Number of birds observed	3	n
	Total time all birds spent in risk window	128	seconds
	Proportional time individual bird spends in risk window	4.0728E-05	
	Average time individual bird in risk window (Mar - Feb)	662.726231	seconds
	Bird occupancy of flight risk window	1988.17869	seconds
	Bird occupancy of rotor swept area	0.51556312	seconds
	Bird transit time through rotors	0.14642857	seconds
	Number of birds passing through rotors (Mar-Mar)	3.52091889	n
Collision Assessment	Estimated turbine efficiency (Band et al., 2007)	75	%

Details	Month	Value	Units
	Average collision risk (Band et al., 2007)	10	%
	Adjusted collision risk to include turbine efficiency	7.5	%
	No. of collisions with no avoidance (Mar - Feb)	0.26406892	n
	Adjusted for avoidance (95%)	0.01320345	n
	Adjusted for avoidance (98%)	0.00528138	n
	Adjusted for avoidance (99%)	0.00264069	n
	Adjusted for avoidance (99.9%)	0.00026407	n
Frequency of mortality	No avoidance, equivalent to one bird every	3.78689023	years
	98% avoidance, equivalent to one bird every	189.344511	years

Table A9.7 Collision Risk Assessment Proposed Windfarm 2014 – 2015: Peregrine falcon

Details	Month	Value	Units
Turbine parameters	Number of turbines	5	n
	Hub height	75	m
	Rotor diameter	120	m
	Rotor radius	60	m
	Blade maximum chord	3.953	m
	Blade pitch	44.5	°
	Rotor rotation period	4.38	sec
	Blade depth	3.773	m
	Risk window ceiling height	135	m
	Risk window floor height	15	m
	Windfarm area	2,606,092	m^2
	Flight risk volume	312731040	m^3
	Rotor swept area (single turbine)	11309.7336	m^2
	Rotor swept volume (single turbine)	47421.7128	m^3
	Rotor swept volume (combined)	237108.564	m^3
	Proportion of flight risk volume with turbines	0.00075819	
Bird parameters: Peregrine falcon	Months surveyed	Mar 14 - Feb 15	months
	Speed of the bird through the rotor	14	m/s
	Length of the bird	0.42	m
	Wingspan of the bird	1.02	m
	Vantage point hours completed	291	hours
	Vantage point seconds completed	1047600	seconds
	Time available for flight activity per year	4520	hours
	Flight seconds per year	16272000	seconds
	Number of birds observed	3	n
	Total time all birds spent in risk window	158	seconds
	Proportional time individual bird spends in risk window	5.0274E-05	

Details	Month	Value	Units
	Average time individual bird in risk window (Mar - Feb)	818.052692	seconds
	Bird occupancy of flight risk window	2454.15808	seconds
	Bird occupancy of rotor swept area	1.8607104	seconds
	Bird transit time through rotors	0.2995	seconds
	Number of birds passing through rotors (Mar-Feb)	6.21272252	n
Collision Assessment	Estimated turbine efficiency (Band et al., 2007)	75	%
	Average collision risk (Band et al., 2007)	9.9	%
	Adjusted collision risk to include turbine efficiency	7.425	%
	No. of collisions with no avoidance (Mar - Feb)	0.46129465	n
	Adjusted for avoidance (95%)	0.02306473	n
	Adjusted for avoidance (98%)	0.00922589	n
	Adjusted for avoidance (99%)	0.00461295	n
	Adjusted for avoidance (99.9%)	0.00046129	n
Frequency of mortality	No avoidance, equivalent to one bird every	2.16781184	years
	98% avoidance, equivalent to one bird every	108.390592	years

Table A9.8 Collision Risk Assessment Operational Corkey Windfarm 2018 – Peregrine falcon

Details	Month	Value	Units
Turbine parameters	Number of turbines	10	n
	Hub height	39	m
	Rotor diameter	37	m
	Rotor radius	18.5	m
	Blade maximum chord	1.63	m
	Blade pitch	10	°
	Rotor rotation period	2	sec
	Blade depth	1.63	m
	Risk window ceiling height	57.5	m
	Risk window floor height	20.5	m
	Windfarm area	2297307	m^2
	Flight risk volume	85000359	m^3
	Rotor swept area (single turbine)	1075.21009	m^2
	Rotor swept volume (single turbine)	2204.18068	m^3
	Rotor swept volume (combined)	22041.8068	m^3
	Proportion of flight risk volume with turbines	0.00025931	
Bird parameters: Peregrine falcon	Months surveyed	Mar 18 - Mar 19	months
	Speed of the bird through the rotor	14	m/s
	Length of the bird	0.42	m
	Wingspan of the bird	1.02	m

Details	Month	Value	Units
	Vantage point hours completed	309	hours
	Vantage point seconds completed	1112400	seconds
	Time available for flight activity per year	4892	hours
	Flight seconds per year	17611200	seconds
	Number of birds observed	1	n
	Total time all birds spent in risk window	41	seconds
	Proportional time individual bird spends in risk window	3.6857E-05	
	Average time individual bird in risk window (Mar - Feb)	649.100324	seconds
	Bird occupancy of flight risk window	649.100324	seconds
	Bird occupancy of rotor swept area	0.16832098	seconds
	Bird transit time through rotors	0.14642857	seconds
	Number of birds passing through rotors (Mar-Mar)	1.14950915	n
Collision Assessment	Estimated turbine efficiency (Band et al., 2007)	75	%
	Average collision risk (Band et al., 2007)	10	%
	Adjusted collision risk to include turbine efficiency	7.5	%
	No. of collisions with no avoidance (Mar - Mar)	0.08621319	n
	Adjusted for avoidance (95%)	0.00431066	n
	Adjusted for avoidance (98%)	0.00172426	n
	Adjusted for avoidance (99%)	0.00086213	n
	Adjusted for avoidance (99.9%)	8.6213E-05	n
Frequency of mortality	No avoidance, equivalent to one bird every	11.5991538	years
	98% avoidance, equivalent to one bird every	579.957688	years

Table A9.9 Collision Risk Assessment Proposed Windfarm 2018 – Peregrine falcon

Details	Month	Value	Units
Turbine parameters	Number of turbines	5	n
	Hub height	75	m
	Rotor diameter	120	m
	Rotor radius	60	m
	Blade maximum chord	3.953	m
	Blade pitch	44.5	°
	Rotor rotation period	4.38	sec
	Blade depth	3.773	m
	Risk window ceiling height	135	m
	Risk window floor height	15	m
	Windfarm area	2,606,092	m^2
	Flight risk volume	312731040	m^3

Details	Month	Value	Units
	Rotor swept area (single turbine)	11309.7336	m^2
	Rotor swept volume (single turbine)	47421.7128	m^3
	Rotor swept volume (combined)	237108.564	m^3
	Proportion of flight risk volume with turbines	0.00075819	
Bird parameters: Peregrine falcon	Months surveyed	Mar 18 - Mar 19	months
	Speed of the bird through the rotor	14	m/s
	Length of the bird	0.42	m
	Wingspan of the bird	1.02	m
	Vantage point hours completed	309	hours
	Vantage point seconds completed	1112400	seconds
	Time available for flight activity per year	4892	hours
	Flight seconds per year	17611200	seconds
	Number of birds observed	1	n
	Total time all birds spent in risk window	41	seconds
	Proportional time individual bird spends in risk window	3.6857E-05	
	Average time individual bird in risk window (Mar - Mar)	649.100324	seconds
	Bird occupancy of flight risk window	649.100324	seconds
	Bird occupancy of rotor swept area	0.49213933	seconds
	Bird transit time through rotors	0.2995	seconds
	Number of birds passing through rotors (Mar-Mar)	1.64320312	n
Collision Assessment	Estimated turbine efficiency (Band et al., 2007)	75	%
	Average collision risk (Band et al., 2007)	9.9	%
	Adjusted collision risk to include turbine efficiency	7.425	%
	No. of collisions with no avoidance (Mar - Mar)	0.12200783	n
	Adjusted for avoidance (95%)	0.00610039	n
	Adjusted for avoidance (98%)	0.00244016	n
	Adjusted for avoidance (99%)	0.00122008	n
	Adjusted for avoidance (99.9%)	0.00012201	n
Frequency of mortality	No avoidance, equivalent to one bird every	8.19619518	years
	98% avoidance, equivalent to one bird every	409.809759	years

Table A9.10 Collision Risk Estimate (Band et al., 2007) for the Operational Corkey Windfarm and hen harrier.

K: [1D or [3D] (0 or 1)	1		Calculation of alpha and p(collision) as a function of radius								
NoBlades	3					Upwind:			Downwind:		
MaxChord	1.63	m	r/R	c/C	a	collide		contribution	collide		contribution
Pitch (degrees)	10		radius	chord	alpha	length	p(collision)	from radius r	length	p(collision)	from radius r
BirdLength	0.48	m	0.025	0.575	8.26	13.57	1.00	0.00125	13.24	1.00	0.00125
Wingspan	1.1	m	0.075	0.575	2.75	4.63	0.58	0.00434	4.31	0.54	0.00404
F: Flapping (0) or gliding (+1)	1		0.125	0.702	1.65	3.22	0.40	0.00502	2.82	0.35	0.00440
			0.175	0.860	1.18	2.70	0.34	0.00590	2.21	0.28	0.00484
Bird speed	12	m/sec	0.225	0.994	0.92	2.39	0.30	0.00672	1.83	0.23	0.00514
RotorDiam	37	m	0.275	0.947	0.75	1.93	0.24	0.00665	1.40	0.17	0.00481
RotationPeriod	2.00	sec	0.325	0.899	0.64	1.62	0.20	0.00657	1.11	0.14	0.00450
			0.375	0.851	0.55	1.38	0.17	0.00646	0.90	0.11	0.00420
			0.425	0.804	0.49	1.19	0.15	0.00634	0.74	0.09	0.00393
			0.475	0.756	0.43	1.22	0.15	0.00725	0.79	0.10	0.00471
Bird aspect ratio: b	0.44		0.525	0.708	0.39	1.13	0.14	0.00740	0.73	0.09	0.00477
			0.575	0.660	0.36	1.05	0.13	0.00753	0.67	0.08	0.00484
			0.625	0.613	0.33	0.98	0.12	0.00764	0.63	0.08	0.00493
			0.675	0.565	0.31	0.92	0.11	0.00774	0.60	0.07	0.00504
			0.725	0.517	0.28	0.86	0.11	0.00782	0.57	0.07	0.00517
			0.775	0.470	0.27	0.81	0.10	0.00788	0.55	0.07	0.00531
			0.825	0.422	0.25	0.77	0.10	0.00793	0.53	0.07	0.00547
			0.875	0.374	0.24	0.73	0.09	0.00796	0.52	0.06	0.00564
			0.925	0.327	0.22	0.69	0.09	0.00797	0.50	0.06	0.00583
			0.975	0.279	0.21	0.65	0.08	0.00797	0.50	0.06	0.00604
				Overall p(collision) =			**Upwind**	**13.4%**		**Downwind**	**9.5%**
								Average	**11.5%**		

Table A9.11 Collision Risk Estimate (Band et al., 2007) for the proposed windfarm and hen harrier.

K: [1D or [3D] (0 or 1)	1		Calculation of alpha and p(collision) as a function of radius								
NoBlades	3					Upwind:			Downwind:		
MaxChord	3.953	m	r/R	c/C	a	collide		contribution	collide		contribution
Pitch (degrees)	44.5		radius	chord	alpha	length	p(collision)	from radius r	length	p(collision)	from radius r
BirdLength	0.48	m	0.025	0.575	5.58	14.54	0.83	0.00104	11.35	0.65	0.00081
Wingspan	1.1	m	0.075	0.575	1.86	5.91	0.34	0.00253	2.72	0.16	0.00117
F: Flapping (0) or gliding (+1)	1		0.125	0.702	1.12	4.93	0.28	0.00352	1.04	0.06	0.00074

K: [1D or [3D] (0 or 1)	1		Calculation of alpha and p(collision) as a function of radius								
			0.175	0.860	0.80	4.87	0.28	0.00487	1.01	0.06	0.00101
Bird speed	12	m/sec	0.225	0.994	0.62	4.93	0.28	0.00633	1.45	0.08	0.00186
RotorDiam	120	m	0.275	0.947	0.51	4.33	0.25	0.00680	1.62	0.09	0.00255
RotationPeriod	4.38	sec	0.325	0.899	0.43	4.06	0.23	0.00753	1.88	0.11	0.00349
			0.375	0.851	0.37	3.73	0.21	0.00799	1.95	0.11	0.00417
			0.425	0.804	0.33	3.45	0.20	0.00837	1.96	0.11	0.00476
			0.475	0.756	0.29	3.20	0.18	0.00868	1.95	0.11	0.00528
Bird aspect ratio: b	0.44		0.525	0.708	0.27	2.97	0.17	0.00891	1.91	0.11	0.00573
			0.575	0.660	0.24	2.76	0.16	0.00906	1.86	0.11	0.00610
			0.625	0.613	0.22	2.56	0.15	0.00914	1.79	0.10	0.00639
			0.675	0.565	0.21	2.37	0.14	0.00915	1.72	0.10	0.00661
			0.725	0.517	0.19	2.19	0.13	0.00908	1.63	0.09	0.00676
			0.775	0.470	0.18	2.02	0.12	0.00893	1.54	0.09	0.00683
			0.825	0.422	0.17	1.85	0.11	0.00871	1.45	0.08	0.00682
			0.875	0.374	0.16	1.69	0.10	0.00842	1.35	0.08	0.00674
			0.925	0.327	0.15	1.52	0.09	0.00804	1.25	0.07	0.00658
			0.975	0.279	0.14	1.37	0.08	0.00760	1.14	0.07	0.00635
				Overall p(collision) =			Upwind	14.5%		Downwind	9.1%
								Average	11.8%		

Table A9.12 Collision Risk Assessment Operational Corkey Windfarm 2014 – 2015: hen harrier

Details	Month	Value	Units
Turbine parameters	Number of turbines	10	n
	Hub height	39	m
	Rotor diameter	37	m
	Rotor radius	18.5	m
	Blade maximum chord	1.63	m
	Blade pitch	10	°
	Rotor rotation period	2	sec
	Blade depth	1.63	m
	Risk window ceiling height	57.5	m
	Risk window floor height	20.5	m
	Windfarm area	2297307	m^2
	Flight risk volume	85000359	m^3
	Rotor swept area (single turbine)	1075.21009	m^2
	Rotor swept volume (single turbine)	2268.69328	m^3
	Rotor swept volume (combined)	22686.9328	m^3
	Proportion of flight risk volume with turbines	0.0002669	

Details	Month	Value	Units
Bird parameters: Hen Harrier	Months surveyed	Mar 14 - Feb 15	months
	Speed of the bird through the rotor	12	m/s
	Length of the bird	0.48	m
	Wingspan of the bird	1.1	m
	Vantage point hours completed	291	hours
	Vantage point seconds completed	1047600	seconds
	Time available for flight activity per year	4520	hours
	Flight seconds per year	16272000	seconds
	Number of birds observed	5	n
	Total time all birds spent in risk window	90	seconds
	Proportional time individual bird spends in risk window	1.7182E-05	
	Average time individual bird in risk window (Mar - Feb)	279.58763	seconds
	Bird occupancy of flight risk window	1397.93814	seconds
	Bird occupancy of rotor swept area	0.37312	seconds
	Bird transit time through rotors	0.17583	seconds
	Number of birds passing through rotors (Mar-Feb)	2.12198	n
Collision Assessment	Estimated turbine efficiency (Band et al., 2007)	75	%
	Average collision risk (Band et al., 2007)	11.5	%
	Adjusted collision risk to include turbine efficiency	8.625	%
	No. of collisions with no avoidance (Mar - Feb)	0.18302	n
	Adjusted for avoidance (95%)	0.00915	n
	Adjusted for avoidance (98%)	0.00366	n
	Adjusted for avoidance (99%)	0.00183	n
	Adjusted for avoidance (99.9%)	0.00018	n
Frequency of mortality	No avoidance, equivalent to one bird every	5.46385	years
	99% avoidance, equivalent to one bird every	546.38545	years

Table A9.13 Collision Risk Assessment Proposed Windfarm 2014 – 2015: hen harrier

Details	Month	Value	Units
Turbine parameters	Number of turbines	5	n
	Hub height	75	m
	Rotor diameter	120	m
	Rotor radius	60	m
	Blade maximum chord	3.953	m
	Blade pitch	44.5	°
	Rotor rotation period	4.38	sec
	Blade depth	3.773	m

Details	Month	Value	Units
	Risk window ceiling height	135	m
	Risk window floor height	15	m
	Windfarm area	2606092	m^2
	Flight risk volume	312731040	m^3
	Rotor swept area (single turbine)	11309.7336	m^2
	Rotor swept volume (single turbine)	48100.2968	m^3
	Rotor swept volume (combined)	240501.484	m^3
	Proportion of flight risk volume with turbines	0.00076904	
Bird parameters: Hen Harrier	Months surveyed	Mar 14 - Feb 15	months
	Speed of the bird through the rotor	12	m/s
	Length of the bird	0.48	m
	Wingspan of the bird	1.1	m
	Vantage point hours completed	291	hours
	Vantage point seconds completed	1047600	seconds
	Time available for flight activity per year	4520	hours
	Flight seconds per year	16272000	seconds
	Number of birds observed	1	n
	Total time all birds spent in risk window	15	seconds
	Proportional time individual bird spends in risk window	1.4318E-05	
	Average time individual bird in risk window (Mar - Feb)	232.98969	seconds
	Bird occupancy of flight risk window	232.98969	seconds
	Bird occupancy of rotor swept area	0.17918	seconds
	Bird transit time through rotors	0.35442	seconds
	Number of birds passing through rotors (Mar-Feb)	0.50556	n
Collision Assessment	Estimated turbine efficiency (Band et al., 2007)	75	%
	Average collision risk (Band et al., 2007)	11.8	%
	Adjusted collision risk to include turbine efficiency	8.85	%
	No. of collisions with no avoidance (Mar - Feb)	0.04474	n
	Adjusted for avoidance (95%)	0.00224	n
	Adjusted for avoidance (98%)	0.00089	n
	Adjusted for avoidance (99%)	0.00045	n
	Adjusted for avoidance (99.9%)	0.00004	n
Frequency of mortality	No avoidance, equivalent to one bird every	22.35051	years
	99% avoidance, equivalent to one bird every	2235.05075	years

Table A9.14 Collision Risk Estimate (Band et al., 2007) for the Operational Corkey Windfarm and merlin.

K: [1D or [3D] (0 or 1)	1		Calculation of alpha and p(collision) as a function of radius								
NoBlades	3					Upwind:			Downwind:		
MaxChord	1.63	m	r/R	c/C	a	collide		contribution	collide		contribution
Pitch (degrees)	10		radius	chord	alpha	length	p(collision)	from radius r	length	p(collision)	from radius r
BirdLength	0.28	m	0.025	0.575	8.95	11.61	1.00	0.00125	11.29	1.00	0.00125
Wingspan	0.56	m	0.075	0.575	2.98	3.98	0.46	0.00344	3.65	0.42	0.00316
F: Flapping (0) or gliding (+1)	1		0.125	0.702	1.79	2.85	0.33	0.00411	2.45	0.28	0.00354
			0.175	0.860	1.28	2.46	0.28	0.00498	1.98	0.23	0.00399
Bird speed	13	m/sec	0.225	0.994	0.99	2.22	0.26	0.00577	1.66	0.19	0.00431
RotorDiam	37	m	0.275	0.947	0.81	1.79	0.21	0.00569	1.26	0.15	0.00399
RotationPeriod	2.00	sec	0.325	0.899	0.69	1.49	0.17	0.00560	0.98	0.11	0.00369
			0.375	0.851	0.60	1.27	0.15	0.00549	0.79	0.09	0.00340
			0.425	0.804	0.53	1.09	0.13	0.00536	0.64	0.07	0.00313
			0.475	0.756	0.47	1.07	0.12	0.00584	0.64	0.07	0.00349
Bird aspect ratio: b	0.50		0.525	0.708	0.43	0.96	0.11	0.00584	0.56	0.07	0.00342
			0.575	0.660	0.39	0.88	0.10	0.00583	0.51	0.06	0.00335
			0.625	0.613	0.36	0.81	0.09	0.00581	0.46	0.05	0.00331
			0.675	0.565	0.33	0.74	0.09	0.00577	0.42	0.05	0.00328
			0.725	0.517	0.31	0.68	0.08	0.00571	0.39	0.04	0.00326
			0.775	0.470	0.29	0.63	0.07	0.00564	0.36	0.04	0.00326
			0.825	0.422	0.27	0.58	0.07	0.00555	0.34	0.04	0.00328
			0.875	0.374	0.26	0.54	0.06	0.00545	0.33	0.04	0.00331
			0.925	0.327	0.24	0.50	0.06	0.00533	0.31	0.04	0.00335
			0.975	0.279	0.23	0.46	0.05	0.00519	0.30	0.04	0.00342
				Overall p(collision) =			**Upwind**	**10.4%**		**Downwind**	**6.7%**
								Average	**8.5%**		

Table A9.15 Collision Risk Estimate (Band et al., 2007) for the proposed windfarm and merlin.

K: [1D or [3D] (0 or 1)	1		Calculation of alpha and p(collision) as a function of radius								
NoBlades	3					Upwind:			Downwind:		
MaxChord	3.953	m	r/R	c/C	a	collide		contribution	collide		contribution
Pitch (degrees)	44.5		radius	chord	alpha	length	p(collision)	from radius r	length	p(collision)	from radius r
BirdLength	0.28	m	0.025	0.575	6.04	13.54	0.71	0.00089	10.36	0.55	0.00068
Wingspan	0.56	m	0.075	0.575	2.01	5.58	0.29	0.00220	2.39	0.13	0.00094
F: Flapping (0) or gliding (+1)	1		0.125	0.702	1.21	4.76	0.25	0.00314	0.88	0.05	0.00058
			0.175	0.860	0.86	4.78	0.25	0.00441	0.60	0.03	0.00055

K: [1D or [3D] (0 or 1)	1		Calculation of alpha and p(collision) as a function of radius								
Bird speed	13	m/sec	0.225	0.994	0.67	4.88	0.26	0.00578	1.11	0.06	0.00132
RotorDiam	120	m	0.275	0.947	0.55	4.28	0.23	0.00621	1.35	0.07	0.00196
RotationPeriod	4.38	sec	0.325	0.899	0.46	3.95	0.21	0.00676	1.59	0.08	0.00273
			0.375	0.851	0.40	3.61	0.19	0.00712	1.67	0.09	0.00330
			0.425	0.804	0.36	3.31	0.17	0.00742	1.70	0.09	0.00381
			0.475	0.756	0.32	3.05	0.16	0.00764	1.70	0.09	0.00425
Bird aspect ratio: b	0.50		0.525	0.708	0.29	2.82	0.15	0.00779	1.67	0.09	0.00461
			0.575	0.660	0.26	2.60	0.14	0.00787	1.62	0.09	0.00491
			0.625	0.613	0.24	2.40	0.13	0.00789	1.56	0.08	0.00514
			0.675	0.565	0.22	2.20	0.12	0.00783	1.49	0.08	0.00530
			0.725	0.517	0.21	2.02	0.11	0.00771	1.41	0.07	0.00538
			0.775	0.470	0.19	1.84	0.10	0.00751	1.32	0.07	0.00540
			0.825	0.422	0.18	1.67	0.09	0.00725	1.23	0.06	0.00535
			0.875	0.374	0.17	1.50	0.08	0.00691	1.13	0.06	0.00523
			0.925	0.327	0.16	1.34	0.07	0.00651	1.03	0.05	0.00504
			0.975	0.279	0.15	1.17	0.06	0.00603	0.93	0.05	0.00478
				Overall p(collision) =			**Upwind**	**12.5%**		**Downwind**	**7.1%**
								Average	**9.8%**		

Table A9.16 Collision Risk Assessment Operational Corkey Windfarm 2014 – 2015: merlin

Details	Month	Value	Units
Turbine parameters	Number of turbines	10	n
	Hub height	39	m
	Rotor diameter	37	m
	Rotor radius	18.5	m
	Blade maximum chord	1.63	m
	Blade pitch	10	°
	Rotor rotation period	2	sec
	Blade depth	1.63	m
	Risk window ceiling height	57.5	m
	Risk window floor height	20.5	m
	Windfarm area	2297307	m^2
	Flight risk volume	85000359	m^3
	Rotor swept area (single turbine)	1075.210086	m^2
	Rotor swept volume (single turbine)	2053.651264	m^3
	Rotor swept volume (combined)	20536.51264	m^3
	Proportion of flight risk volume with turbines	0.000241605	

Details	Month	Value	Units
Bird parameters: Merlin	Months surveyed	Mar 14 - Feb 15	months
	Speed of the bird through the rotor	13	m/s
	Length of the bird	0.28	m
	Wingspan of the bird	0.56	m
	Vantage point hours completed	291	hours
	Vantage point seconds completed	1047600	seconds
	Time available for flight activity per year	4520	hours
	Flight seconds per year	16272000	seconds
	Number of birds observed	1	n
	Total time all birds spent in risk window	25	seconds
	Proportional time individual bird spends in risk window	2.3864E-05	
	Average time individual bird in risk window (Mar - Feb)	388.31615	seconds
	Bird occupancy of flight risk window	388.31615	seconds
	Bird occupancy of rotor swept area	0.09382	seconds
	Bird transit time through rotors	0.14692	seconds
	Number of birds passing through rotors (Mar-Feb)	0.63856	n
Collision Assessment	Estimated turbine efficiency (Band et al., 2007)	75	%
	Average collision risk (Band et al., 2007)	8.5	%
	Adjusted collision risk to include turbine efficiency	6.375	%
	No. of collisions with no avoidance (Mar - Feb)	0.040708	n
	Adjusted for avoidance (95%)	0.002035	n
	Adjusted for avoidance (98%)	0.000814	n
	Adjusted for avoidance (99%)	0.000407	n
	Adjusted for avoidance (99.9%)	0.000041	n
Frequency of mortality	No avoidance, equivalent to one bird every	24.565094	years
	98% avoidance, equivalent to one bird every	1228.254712	years

Table A9.17 Collision Risk Assessment Proposed Windfarm 2014 – 2015: merlin

Details	Month	Value	Units
Turbine parameters	Number of turbines	5	n
	Hub height	75	m
	Rotor diameter	120	m
	Rotor radius	60	m
	Blade maximum chord	3.953	m
	Blade pitch	44.5	°
	Rotor rotation period	4.38	sec
	Blade depth	3.773	m
	Risk window ceiling height	135	m
	Risk window floor height	15	m
	Windfarm area	2606092	m^2
	Flight risk volume	312731040	m^3
	Rotor swept area (single turbine)	11309.73355	m^2
	Rotor swept volume (single turbine)	45838.35009	m^3
	Rotor swept volume (combined)	229191.7504	m^3
	Proportion of flight risk volume with turbines	0.000732872	
Bird parameters: Merlin	Months surveyed	Mar 14 - Feb 15	months
	Speed of the bird through the rotor	13	m/s
	Length of the bird	0.28	m
	Wingspan of the bird	0.56	m
	Vantage point hours completed	291	hours
	Vantage point seconds completed	1047600	seconds
	Time available for flight activity per year	4520	hours
	Flight seconds per year	16272000	seconds
	Number of birds observed	1	n
	Total time all birds spent in risk window	25	seconds
	Proportional time individual bird spends in risk window	2.3864E-05	
	Average time individual bird in risk window (Mar - Feb)	388.31615	seconds
	Bird occupancy of flight risk window	388.31615	seconds
	Bird occupancy of rotor swept area	0.28459	seconds
	Bird transit time through rotors	0.31177	seconds
	Number of birds passing through rotors (Mar-Feb)	0.91281	n
Collision Assessment	Estimated turbine efficiency (Band et al., 2007)	75	%
	Average collision risk (Band et al., 2007)	9.8	%
	Adjusted collision risk to include turbine efficiency	7.35	%
	No. of collisions with no avoidance (Mar - Feb)	0.067092	n
	Adjusted for avoidance (95%)	0.003355	n
	Adjusted for avoidance (98%)	0.001342	n
	Adjusted for avoidance (99%)	0.000671	n
	Adjusted for avoidance (99.9%)	0.000067	n
Frequency of mortality	No avoidance, equivalent to one bird every	14.905017	years
	98% avoidance, equivalent to one bird every	745.250832	years

Table A9.18 Collision Risk Estimate (Band et al., 2007) for the Operational Corkey Windfarm and curlew.

K: [1D or [3D] (0 or 1)	1		Calculation of alpha and p(collision) as a function of radius								
NoBlades	3					Upwind:			Downwind:		
MaxChord	1.63	m	r/R	c/C	a	collide		contribution	collide		contribution
Pitch (degrees)	10		radius	chord	alpha	length	p(collision)	from radius r	length	p(collision)	from radius r
BirdLength	0.55	m	0.025	0.575	11.01	16.64	1.00	0.00125	16.31	1.00	0.00125
Wingspan	0.9	m	0.075	0.575	3.67	5.65	0.53	0.00398	5.33	0.50	0.00375
F: Flapping (0) or gliding (+1)	1		0.125	0.702	2.20	3.94	0.37	0.00462	3.54	0.33	0.00415
			0.175	0.860	1.57	3.32	0.31	0.00544	2.83	0.27	0.00464
Bird speed	16	m/sec	0.225	0.994	1.22	2.94	0.28	0.00619	2.37	0.22	0.00500
RotorDiam	37	m	0.275	0.947	1.00	2.36	0.22	0.00609	1.83	0.17	0.00471
RotationPeriod	2.00	sec	0.325	0.899	0.85	1.96	0.18	0.00598	1.45	0.14	0.00443
			0.375	0.851	0.73	1.66	0.16	0.00585	1.18	0.11	0.00416
			0.425	0.804	0.65	1.43	0.13	0.00571	0.98	0.09	0.00390
			0.475	0.756	0.58	1.47	0.14	0.00653	1.04	0.10	0.00463
Bird aspect ratio: b	0.61		0.525	0.708	0.52	1.35	0.13	0.00663	0.95	0.09	0.00465
			0.575	0.660	0.48	1.24	0.12	0.00671	0.87	0.08	0.00469
			0.625	0.613	0.44	1.16	0.11	0.00678	0.81	0.08	0.00475
			0.675	0.565	0.41	1.08	0.10	0.00683	0.76	0.07	0.00481
			0.725	0.517	0.38	1.01	0.09	0.00688	0.72	0.07	0.00489
			0.775	0.470	0.36	0.95	0.09	0.00691	0.68	0.06	0.00498
			0.825	0.422	0.33	0.90	0.08	0.00693	0.66	0.06	0.00508
			0.875	0.374	0.31	0.84	0.08	0.00693	0.63	0.06	0.00519
			0.925	0.327	0.30	0.80	0.07	0.00692	0.61	0.06	0.00532
			0.975	0.279	0.28	0.76	0.07	0.00690	0.60	0.06	0.00546
				Overall p(collision) =			Upwind	12.0%		Downwind	9.0%
								Average	10.5%		

Table A9.19 Collision Risk Estimate (Band et al., 2007) for the proposed windfarm and curlew.

K: [1D or [3D] (0 or 1)	1		Calculation of alpha and p(collision) as a function of radius								
NoBlades	3					Upwind:			Downwind:		
MaxChord	3.953	m	r/R	c/C	a	collide		contribution	collide		contribution
Pitch (degrees)	44.5		radius	chord	alpha	length	p(collision)	from radius r	length	p(collision)	from radius r
BirdLength	0.55	m	0.025	0.575	7.44	17.91	0.77	0.00096	14.72	0.63	0.00079
Wingspan	0.9	m	0.075	0.575	2.48	7.03	0.30	0.00226	3.85	0.16	0.00123
F: Flapping (0) or gliding (+1)	1		0.125	0.702	1.49	5.74	0.25	0.00307	1.85	0.08	0.00099
			0.175	0.860	1.06	5.57	0.24	0.00417	0.80	0.03	0.00060

K: [1D or [3D] (0 or 1)	1		Calculation of alpha and p(collision) as a function of radius								
Bird speed	16	m/sec	0.225	0.994	0.83	5.54	0.24	0.00534	0.91	0.04	0.00088
RotorDiam	120	m	0.275	0.947	0.68	4.81	0.21	0.00567	1.21	0.05	0.00142
RotationPeriod	4.38	sec	0.325	0.899	0.57	4.49	0.19	0.00625	1.59	0.07	0.00221
			0.375	0.851	0.50	4.10	0.18	0.00658	1.72	0.07	0.00276
			0.425	0.804	0.44	3.77	0.16	0.00685	1.79	0.08	0.00325
			0.475	0.756	0.39	3.48	0.15	0.00707	1.81	0.08	0.00368
Bird aspect ratio: b	0.61		0.525	0.708	0.35	3.22	0.14	0.00723	1.81	0.08	0.00406
			0.575	0.660	0.32	2.98	0.13	0.00734	1.78	0.08	0.00438
			0.625	0.613	0.30	2.76	0.12	0.00739	1.73	0.07	0.00464
			0.675	0.565	0.28	2.55	0.11	0.00738	1.68	0.07	0.00485
			0.725	0.517	0.26	2.36	0.10	0.00732	1.61	0.07	0.00499
			0.775	0.470	0.24	2.17	0.09	0.00720	1.53	0.07	0.00509
			0.825	0.422	0.23	1.99	0.09	0.00702	1.45	0.06	0.00512
			0.875	0.374	0.21	1.81	0.08	0.00678	1.36	0.06	0.00510
			0.925	0.327	0.20	1.64	0.07	0.00649	1.27	0.05	0.00503
			0.975	0.279	0.19	1.47	0.06	0.00615	1.17	0.05	0.00489
				Overall p(collision) =			**Upwind**	**11.9%**		**Downwind**	**6.6%**
								Average	**9.2%**		

Table A9.20 Collision Risk Assessment Operational Corkey Windfarm 2014 – 2015: curlew

Details	Month	Value	Units
Turbine parameters	Number of turbines	10	n
	Hub height	39	m
	Rotor diameter	37	m
	Rotor radius	18.5	m
	Blade maximum chord	1.63	m
	Blade pitch	10	°
	Rotor rotation period	2	sec
	Blade depth	1.63	m
	Risk window ceiling height	57.5	m
	Risk window floor height	20.5	m
	Windfarm area	2297307	m^2
	Flight risk volume	85000359	m^3
	Rotor swept area (single turbine)	1075.21009	m^2
	Rotor swept volume (single turbine)	2343.95799	m^3
	Rotor swept volume (combined)	23439.5799	m^3

Details	Month	Value	Units
	Proportion of flight risk volume with turbines	0.00027576	
Bird parameters: Curlew	Months surveyed	Mar 14 - Feb 15	months
	Speed of the bird through the rotor	16	m/s
	Length of the bird	0.55	m
	Wingspan of the bird	0.9	m
	Vantage point hours completed	291	hours
	Vantage point seconds completed	1047600	seconds
	Time available for flight activity per year	4520	hours
	Flight seconds per year	16272000	seconds
	Number of birds observed	3	n
	Total time all birds spent in risk window	164	seconds
	Proportional time individual bird spends in risk window	5.2183E-05	
	Average time individual bird in risk window (Mar - Feb)	849.117984	seconds
	Bird occupancy of flight risk window	2547.35395	seconds
	Bird occupancy of rotor swept area	0.70245476	seconds
	Bird transit time through rotors	0.13625	seconds
	Number of birds passing through rotors (Mar-Feb)	5.15563123	n
Collision Assessment	Estimated turbine efficiency (Band et al., 2007)	75	%
	Average collision risk (Band et al., 2007)	10.5	%
	Adjusted collision risk to include turbine efficiency	7.875	%
	No. of collisions with no avoidance (Mar - Feb)	0.40601	n
	Adjusted for avoidance (95%)	0.02030	n
	Adjusted for avoidance (98%)	0.00812	n
	Adjusted for avoidance (99%)	0.00406	n
	Adjusted for avoidance (99.9%)	0.00041	n
Frequency of mortality	No avoidance, equivalent to one bird every	2.46302	years
	98% avoidance, equivalent to one bird every	123.15090	years

Table A9.21 Collision Risk Assessment Proposed Windfarm 2014 – 2015: curlew

Details	Month	Value	Units
Turbine parameters	Number of turbines	5	n
	Hub height	75	m
	Rotor diameter	120	m
	Rotor radius	60	m
	Blade maximum chord	3.953	m
	Blade pitch	44.5	°
	Rotor rotation period	4.38	sec
	Blade depth	3.773	m

Details	Month	Value	Units
	Risk window ceiling height	135	m
	Risk window floor height	15	m
	Windfarm area	2606092	m^2
	Flight risk volume	312731040	m^3
	Rotor swept area (single turbine)	11309.7336	m^2
	Rotor swept volume (single turbine)	48891.9781	m^3
	Rotor swept volume (combined)	244459.891	m^3
	Proportion of flight risk volume with turbines	0.00078169	
Bird parameters: Curlew	Months surveyed	Mar 14 - Feb 15	months
	Speed of the bird through the rotor	16	m/s
	Length of the bird	0.55	m
	Wingspan of the bird	0.9	m
	Vantage point hours completed	291	hours
	Vantage point seconds completed	1047600	seconds
	Time available for flight activity per year	4520	hours
	Flight seconds per year	16272000	seconds
	Number of birds observed	2	n
	Total time all birds spent in risk window	91	seconds
	Proportional time individual bird spends in risk window	4.3433E-05	
	Average time individual bird in risk window (Mar - Feb)	706.735395	seconds
	Bird occupancy of flight risk window	1413.47079	seconds
	Bird occupancy of rotor swept area	1.10490124	seconds
	Bird transit time through rotors	0.2701875	seconds
	Number of birds passing through rotors (Mar-Feb)	4.08938698	n
Collision Assessment	Estimated turbine efficiency (Band et al., 2007)	75	%
	Average collision risk (Band et al., 2007)	9.2	%
	Adjusted collision risk to include turbine efficiency	6.9	%
	No. of collisions with no avoidance (Mar - Feb)	0.28217	n
	Adjusted for avoidance (95%)	0.01411	n
	Adjusted for avoidance (98%)	0.00564	n
	Adjusted for avoidance (99%)	0.00282	n
	Adjusted for avoidance (99.9%)	0.00028	n
Frequency of mortality	No avoidance, equivalent to one bird every	3.54399	years
	98% avoidance, equivalent to one bird every	177.19959	years

Table A9.22 Details of flights of buzzard, kestrel and raven utilised in collision risk modelling (CRM) 2014 – 2015.

Species	No of sightings (2014-2015)	No of 5 minute intervals (2014-2015)	% of flights at PCH (existing) (2014-2015)	% of flights at PCH (proposed) (2014-2015)	Total no of minutes flight	Total no of seconds	Total no of seconds at PCH (existing)	Total no of seconds at PCH (proposed)
BZ	19	19	31.6	78.9	19	1140	360.24	899.46
K.	11	12	63.6	72.7	12	720	457.92	523.44
RN	164	185	59.8	79.3	185	11100	6637.8	8802.3

Table A9.23 Details of flights of buzzard, kestrel and raven utilised in collision risk modelling (CRM) 2018 – 2019.

Species	No of sightings (2018-2019)	No of 5 minute intervals (2018-2019)	% of flights at PCH (existing) (2018-2019)	% of flights at PCH (proposed) (2018-2019)	Total no of minutes flight	Total no of seconds	Total no of seconds at PCH (existing)	Total no of seconds at PCH (proposed)
BZ	53	61	45.3	66	61	3660	1657.98	2415.6
K.	9	10	55.6	55.6	10	600	333.6	333.6
RN	135	147	32.6	41.5	147	8820	2875.32	3660.3

Table A9.24 Collision Risk Estimate (Band et al., 2007) for the Operational Corkey Windfarm and buzzard.

K: [1D or [3D] (0 or 1)	1		Calculation of alpha and p(collision) as a function of radius								
NoBlades	3					Upwind:			Downwind:		
MaxChord	1.63	m	r/R	c/C	a	collide		contribution	collide		contribution
Pitch (degrees)	10		radius	chord	alpha	length	p(collision)	from radius r	length	p(collision)	from radius r
BirdLength	0.54	m	0.025	0.575	8.95	15.26	1.00	0.00125	14.93	1.00	0.00125
Wingspan	1.2	m	0.075	0.575	2.98	5.19	0.60	0.00449	4.87	0.56	0.00421
F: Flapping (0) or gliding (+1)	1		0.125	0.702	1.79	3.58	0.41	0.00516	3.18	0.37	0.00459
			0.175	0.860	1.28	2.98	0.34	0.00603	2.50	0.29	0.00504
Bird speed	13	m/sec	0.225	0.994	0.99	2.63	0.30	0.00682	2.06	0.24	0.00536
RotorDiam	37	m	0.275	0.947	0.81	2.13	0.25	0.00674	1.59	0.18	0.00504
RotationPeriod	2.00	sec	0.325	0.899	0.69	1.77	0.20	0.00665	1.26	0.15	0.00474
			0.375	0.851	0.60	1.51	0.17	0.00654	1.03	0.12	0.00446
			0.425	0.804	0.53	1.31	0.15	0.00642	0.85	0.10	0.00419
			0.475	0.756	0.47	1.15	0.13	0.00628	0.72	0.08	0.00393
Bird aspect ratio: b	0.45		0.525	0.708	0.43	1.22	0.14	0.00742	0.82	0.10	0.00499
			0.575	0.660	0.39	1.14	0.13	0.00756	0.77	0.09	0.00508
			0.625	0.613	0.36	1.07	0.12	0.00768	0.72	0.08	0.00518
			0.675	0.565	0.33	1.00	0.12	0.00779	0.68	0.08	0.00530
			0.725	0.517	0.31	0.94	0.11	0.00789	0.65	0.07	0.00544
			0.775	0.470	0.29	0.89	0.10	0.00796	0.62	0.07	0.00559
			0.825	0.422	0.27	0.84	0.10	0.00803	0.60	0.07	0.00575
			0.875	0.374	0.26	0.80	0.09	0.00807	0.59	0.07	0.00593
			0.925	0.327	0.24	0.76	0.09	0.00810	0.57	0.07	0.00613

K: [1D or [3D] (0 or 1)	1		Calculation of alpha and p(collision) as a function of radius								
			0.975	0.279	0.23	0.72	0.08	0.00812	0.56	0.07	0.00634
				Overall p(collision) =			**Upwind**	**13.5%**		**Downwind**	**9.9%**
								Average	**11.7%**		

Table A9.25 Collision Risk Estimate (Band et al., 2007) for the proposed windfarm and buzzard.

K: [1D or [3D] (0 or 1)	1		Calculation of alpha and p(collision) as a function of radius								
NoBlades	3					Upwind:			Downwind:		
MaxChord	3.953	m	r/R	c/C	a	collide		contribution	collide		contribution
Pitch (degrees)	44.5		radius	chord	alpha	length	p(collision)	from radius r	length	p(collision)	from radius r
BirdLength	0.54	m	0.025	0.575	6.04	16.00	0.84	0.00105	12.82	0.68	0.00084
Wingspan	1.2	m	0.075	0.575	2.01	6.40	0.34	0.00253	3.21	0.17	0.00127
F: Flapping (0) or gliding (+1)	1		0.125	0.702	1.21	5.26	0.28	0.00346	1.37	0.07	0.00090
			0.175	0.860	0.86	5.14	0.27	0.00473	0.95	0.05	0.00088
Bird speed	13	m/sec	0.225	0.994	0.67	5.15	0.27	0.00610	1.39	0.07	0.00164
RotorDiam	120	m	0.275	0.947	0.55	4.51	0.24	0.00653	1.58	0.08	0.00228
RotationPeriod	4.38	sec	0.325	0.899	0.46	4.02	0.21	0.00689	1.67	0.09	0.00286
			0.375	0.851	0.40	3.87	0.20	0.00764	1.93	0.10	0.00382
			0.425	0.804	0.36	3.57	0.19	0.00800	1.96	0.10	0.00439
			0.475	0.756	0.32	3.31	0.17	0.00829	1.96	0.10	0.00490
Bird aspect ratio: b	0.45		0.525	0.708	0.29	3.08	0.16	0.00851	1.93	0.10	0.00533
			0.575	0.660	0.26	2.86	0.15	0.00866	1.88	0.10	0.00570
			0.625	0.613	0.24	2.66	0.14	0.00874	1.82	0.10	0.00599
			0.675	0.565	0.22	2.46	0.13	0.00876	1.75	0.09	0.00622
			0.725	0.517	0.21	2.28	0.12	0.00870	1.67	0.09	0.00638
			0.775	0.470	0.19	2.10	0.11	0.00857	1.58	0.08	0.00646
			0.825	0.422	0.18	1.93	0.10	0.00838	1.49	0.08	0.00648
			0.875	0.374	0.17	1.76	0.09	0.00811	1.39	0.07	0.00643
			0.925	0.327	0.16	1.60	0.08	0.00777	1.29	0.07	0.00631
			0.975	0.279	0.15	1.43	0.08	0.00737	1.19	0.06	0.00612
				Overall p(collision) =			**Upwind**	**13.9%**		**Downwind**	**8.5%**
								Average	**11.2%**		

Table A9.26 Collision Risk Assessment Operational Corkey Windfarm 2014 – 2015: buzzard

Details	Month	Value	Units
Turbine parameters	Number of turbines	10	n
	Hub height	39	m
	Rotor diameter	37	m
	Rotor radius	18.5	m
	Blade maximum chord	1.63	m
	Blade pitch	10	°
	Rotor rotation period	2	sec
	Blade depth	1.63	m
	Risk window ceiling height	57.5	m
	Risk window floor height	20.5	m
	Windfarm area	2297307	m^2
	Flight risk volume	85000359	m^3
	Rotor swept area (single turbine)	1075.21009	m^2
	Rotor swept volume (single turbine)	2333.20589	m^3
	Rotor swept volume (combined)	23332.0589	m^3
	Proportion of flight risk volume with turbines	0.00027449	
Bird parameters: Buzzard	Months surveyed	Mar 14 - Feb 15	months
	Speed of the bird through the rotor	13	m/s
	Length of the bird	0.54	m
	Wingspan of the bird	1.2	m
	Vantage point hours completed	291	hours
	Vantage point seconds completed	1047600	seconds
	Time available for flight activity per year	4520	hours
	Flight seconds per year	16272000	seconds
	Number of birds observed	19	n
	Total time all birds spent in risk window	360	seconds
	Proportional time individual bird spends in risk window	1.8086E-05	
	Average time individual bird in risk window (Mar - Feb)	294.302767	seconds
	Bird occupancy of flight risk window	5591.75258	seconds
	Bird occupancy of rotor swept area	1.53490058	seconds
	Bird transit time through rotors	0.16692308	seconds
	Number of birds passing through rotors (Mar-Mar)	9.19525693	n
Collision Assessment	Estimated turbine efficiency (Band et al., 2007)	75	%
	Average collision risk (Band et al., 2007)	11.7	%
	Adjusted collision risk to include turbine efficiency	8.775	%
	No. of collisions with no avoidance (Mar - Mar)	0.8068838	n
	Adjusted for avoidance (95%)	0.04034419	n
	Adjusted for avoidance (98%)	0.01613768	n
	Adjusted for avoidance (99%)	0.00806884	n
	Adjusted for avoidance (99.9%)	0.00080688	n
Frequency of mortality	No avoidance, equivalent to one bird every	1.23933583	years
	98% avoidance, equivalent to one bird every	61.9667916	years

Table A9.27 Collision Risk Assessment Proposed Windfarm 2014 – 2015: buzzard

Details	Month	Value	Units
Turbine parameters	Number of turbines	5	n
	Hub height	75	m
	Rotor diameter	120	m
	Rotor radius	60	m
	Blade maximum chord	3.953	m
	Blade pitch	44.5	°
	Rotor rotation period	4.38	sec
	Blade depth	3.773	m
	Risk window ceiling height	135	m
	Risk window floor height	15	m
	Windfarm area	2606092	m^2
	Flight risk volume	312731040	m^3
	Rotor swept area (single turbine)	11309.7336	m^2
	Rotor swept volume (single turbine)	48778.8808	m^3
	Rotor swept volume (combined)	243894.404	m^3
	Proportion of flight risk volume with turbines	0.00077989	
Bird parameters: Buzzard	Months surveyed	Mar 14 - Feb 15	months
	Speed of the bird through the rotor	13	m/s
	Length of the bird	0.54	m
	Wingspan of the bird	1.2	m
	Vantage point hours completed	291	hours
	Vantage point seconds completed	1047600	seconds
	Time available for flight activity per year	4520	hours
	Flight seconds per year	16272000	seconds
	Number of birds observed	19	n
	Total time all birds spent in risk window	899	seconds
	Proportional time individual bird spends in risk window	4.5166E-05	
	Average time individual bird in risk window (Mar - Feb)	734.93941	seconds
	Bird occupancy of flight risk window	13963.8488	seconds

Details	Month	Value	Units
	Bird occupancy of rotor swept area	10.8902032	seconds
	Bird transit time through rotors	0.33176923	seconds
	Number of birds passing through rotors (Mar-Feb)	32.824633	n
Collision Assessment	Estimated turbine efficiency (Band et al., 2007)	75	%
	Average collision risk (Band et al., 2007)	11.2	%
	Adjusted collision risk to include turbine efficiency	8.4	%
	No. of collisions with no avoidance (Mar - Feb)	2.75726917	n
	Adjusted for avoidance (95%)	0.13786346	n
	Adjusted for avoidance (98%)	0.05514538	n
	Adjusted for avoidance (99%)	0.02757269	n
	Adjusted for avoidance (99.9%)	0.00275727	n
Frequency of mortality	No avoidance, equivalent to one bird every	0.36267769	years
	98% avoidance, equivalent to one bird every	18.1338843	years

Table A9.28 Collision Risk Assessment Operational Corkey Windfarm 2018 – 2019: buzzard

Details	Month	Value	Units
Turbine parameters	Number of turbines	10	n
	Hub height	39	m
	Rotor diameter	37	m
	Rotor radius	18.5	m
	Blade maximum chord	1.63	m
	Blade pitch	10	°
	Rotor rotation period	2	sec
	Blade depth	1.63	m
	Risk window ceiling height	57.5	m
	Risk window floor height	20.5	m
	Windfarm area	2297307	m^2
	Flight risk volume	85000359	m^3
	Rotor swept area (single turbine)	1075.21009	m^2
	Rotor swept volume (single turbine)	2333.20589	m^3
	Rotor swept volume (combined)	23332.0589	m^3
	Proportion of flight risk volume with turbines	0.00027449	
Bird parameters: Buzzard	Months surveyed	Mar 18 - Mar 19	months
	Speed of the bird through the rotor	13	m/s
	Length of the bird	0.54	m
	Wingspan of the bird	1.2	m
	Vantage point hours completed	309	hours
	Vantage point seconds completed	1112400	seconds
	Time available for flight activity per year	4892	hours

Details	Month	Value	Units
	Flight seconds per year	17611200	seconds
	Number of birds observed	53	n
	Total time all birds spent in risk window	1657	seconds
	Proportional time individual bird spends in risk window	2.8105E-05	
	Average time individual bird in risk window (Mar - Mar)	494.965134	seconds
	Bird occupancy of flight risk window	26233.1521	seconds
	Bird occupancy of rotor swept area	7.20083369	seconds
	Bird transit time through rotors	0.16692308	seconds
	Number of birds passing through rotors (Mar-Mar)	43.138635	n
Collision Assessment	Estimated turbine efficiency (Band et al., 2007)	75	%
	Average collision risk (Band et al., 2007)	11.7	%
	Adjusted collision risk to include turbine efficiency	8.775	%
	No. of collisions with no avoidance (Mar - Mar)	3.78541522	n
	Adjusted for avoidance (95%)	0.18927076	n
	Adjusted for avoidance (98%)	0.0757083	n
	Adjusted for avoidance (99%)	0.03785415	n
	Adjusted for avoidance (99.9%)	0.00378542	n
Frequency of mortality	No avoidance, equivalent to one bird every	0.26417181	years
	98% avoidance, equivalent to one bird every	13.2085906	years

Table A9.29 Collision Risk Assessment Proposed Windfarm 2018 – 2019: buzzard

Details	Month	Value	Units
Turbine parameters	Number of turbines	5	n
	Hub height	75	m
	Rotor diameter	120	m
	Rotor radius	60	m
	Blade maximum chord	3.953	m
	Blade pitch	44.5	°
	Rotor rotation period	4.38	sec
	Blade depth	3.773	m
	Risk window ceiling height	135	m
	Risk window floor height	15	m
	Windfarm area	2606092	m^2
	Flight risk volume	312731040	m^3
	Rotor swept area (single turbine)	11309.7336	m^2
	Rotor swept volume (single turbine)	48778.8808	m^3
	Rotor swept volume (combined)	243894.404	m^3

Details	Month	Value	Units
	Proportion of flight risk volume with turbines	0.00077989	
Bird parameters: Peregrine falcon	Months surveyed	Mar 18 - Mar 19	months
	Speed of the bird through the rotor	13	m/s
	Length of the bird	0.54	m
	Wingspan of the bird	1.2	m
	Vantage point hours completed	309	hours
	Vantage point seconds completed	1112400	seconds
	Time available for flight activity per year	4892	hours
	Flight seconds per year	17611200	seconds
	Number of birds observed	53	n
	Total time all birds spent in risk window	2415	seconds
	Proportional time individual bird spends in risk window	4.0962E-05	
	Average time individual bird in risk window (Mar - Mar)	721.388533	seconds
	Bird occupancy of flight risk window	38233.5922	seconds
	Bird occupancy of rotor swept area	29.8178243	seconds
	Bird transit time through rotors	0.33176923	seconds
	Number of birds passing through rotors (Mar-Mar)	89.8751949	n
Collision Assessment	Estimated turbine efficiency (Band et al., 2007)	75	%
	Average collision risk (Band et al., 2007)	11.2	%
	Adjusted collision risk to include turbine efficiency	8.4	%
	No. of collisions with no avoidance (Mar - Mar)	7.54951637	n
	Adjusted for avoidance (95%)	0.37747582	n
	Adjusted for avoidance (98%)	0.15099033	n
	Adjusted for avoidance (99%)	0.07549516	n
	Adjusted for avoidance (99.9%)	0.00754952	n
Frequency of mortality	No avoidance, equivalent to one bird every	0.13245882	years
	98% avoidance, equivalent to one bird every	6.6229408	years

Table A9.30 Collision Risk Estimate (Band et al., 2007) for the Operational Corkey Windfarm and kestrel.

K: [1D or [3D] (0 or 1)	1		Calculation of alpha and p(collision) as a function of radius								
NoBlades	3					Upwind:			Downwind:		
MaxChord	1.63	m	r/R	c/C	a	collide		contribution	collide		contribution
Pitch (degrees)	10		radius	chord	alpha	length	p(collision)	from radius r	length	p(collision)	from radius r
BirdLength	0.34	m	0.025	0.575	8.26	11.78	1.00	0.00125	11.46	1.00	0.00125
Wingspan	0.76	m	0.075	0.575	2.75	4.04	0.50	0.00378	3.71	0.46	0.00348
F: Flapping (0) or gliding (+1)	1		0.125	0.702	1.65	2.86	0.36	0.00447	2.46	0.31	0.00384
			0.175	0.860	1.18	2.44	0.31	0.00534	1.96	0.24	0.00428

K: [1D or [3D] (0 or 1)	1		Calculation of alpha and p(collision) as a function of radius								
Bird speed	12	m/sec	0.225	0.994	0.92	2.19	0.27	0.00616	1.63	0.20	0.00458
RotorDiam	37	m	0.275	0.947	0.75	1.77	0.22	0.00609	1.24	0.15	0.00425
RotationPeriod	2.00	sec	0.325	0.899	0.64	1.48	0.18	0.00601	0.97	0.12	0.00394
			0.375	0.851	0.55	1.26	0.16	0.00590	0.78	0.10	0.00365
			0.425	0.804	0.49	1.09	0.14	0.00579	0.63	0.08	0.00337
			0.475	0.756	0.43	1.08	0.14	0.00642	0.65	0.08	0.00388
Bird aspect ratio: b	0.45		0.525	0.708	0.39	0.99	0.12	0.00648	0.59	0.07	0.00385
			0.575	0.660	0.36	0.91	0.11	0.00652	0.53	0.07	0.00384
			0.625	0.613	0.33	0.84	0.10	0.00655	0.49	0.06	0.00384
			0.675	0.565	0.31	0.78	0.10	0.00656	0.46	0.06	0.00386
			0.725	0.517	0.28	0.72	0.09	0.00655	0.43	0.05	0.00390
			0.775	0.470	0.27	0.67	0.08	0.00653	0.41	0.05	0.00395
			0.825	0.422	0.25	0.63	0.08	0.00649	0.39	0.05	0.00402
			0.875	0.374	0.24	0.59	0.07	0.00643	0.38	0.05	0.00411
			0.925	0.327	0.22	0.55	0.07	0.00635	0.36	0.05	0.00422
			0.975	0.279	0.21	0.51	0.06	0.00626	0.36	0.04	0.00434
				Overall p(collision) =			Upwind	11.6%		Downwind	7.6%
								Average	9.6%		

Table A9.31 Collision Risk Estimate (Band et al., 2007) for the proposed windfarm and kestrel.

K: [1D or [3D] (0 or 1)	1		Calculation of alpha and p(collision) as a function of radius								
NoBlades	3					Upwind:			Downwind:		
MaxChord	3.953	m	r/R	c/C	a	collide		contribution	collide		contribution
Pitch (degrees)	44.5		radius	chord	alpha	length	p(collision)	from radius r	length	p(collision)	from radius r
BirdLength	0.34	m	0.025	0.575	5.58	13.33	0.76	0.00095	10.15	0.58	0.00072
Wingspan	0.76	m	0.075	0.575	1.86	5.51	0.31	0.00236	2.32	0.13	0.00099
F: Flapping (0) or gliding (+1)	1		0.125	0.702	1.12	4.69	0.27	0.00335	0.80	0.05	0.00057
			0.175	0.860	0.80	4.70	0.27	0.00470	0.84	0.05	0.00084
Bird speed	12	m/sec	0.225	0.994	0.62	4.79	0.27	0.00615	1.32	0.08	0.00169
RotorDiam	120	m	0.275	0.947	0.51	4.22	0.24	0.00663	1.52	0.09	0.00238
RotationPeriod	4.38	sec	0.325	0.899	0.43	3.92	0.22	0.00727	1.74	0.10	0.00323
			0.375	0.851	0.37	3.59	0.20	0.00769	1.81	0.10	0.00387
			0.425	0.804	0.33	3.31	0.19	0.00803	1.82	0.10	0.00442
			0.475	0.756	0.29	3.06	0.17	0.00830	1.81	0.10	0.00490
Bird aspect ratio: b	0.45		0.525	0.708	0.27	2.83	0.16	0.00849	1.77	0.10	0.00531
			0.575	0.660	0.24	2.62	0.15	0.00860	1.72	0.10	0.00564

K: [1D or [3D] (0 or 1)	1		Calculation of alpha and p(collision) as a function of radius								
			0.625	0.613	0.22	2.42	0.14	0.00864	1.65	0.09	0.00589
			0.675	0.565	0.21	2.23	0.13	0.00861	1.58	0.09	0.00607
			0.725	0.517	0.19	2.05	0.12	0.00850	1.49	0.09	0.00618
			0.775	0.470	0.18	1.88	0.11	0.00831	1.40	0.08	0.00621
			0.825	0.422	0.17	1.71	0.10	0.00805	1.31	0.07	0.00616
			0.875	0.374	0.16	1.55	0.09	0.00772	1.21	0.07	0.00604
			0.925	0.327	0.15	1.38	0.08	0.00730	1.11	0.06	0.00584
			0.975	0.279	0.14	1.23	0.07	0.00682	1.00	0.06	0.00557
				Overall p(collision) =			**Upwind**	**13.6%**		**Downwind**	**8.3%**
								Average	**10.9%**		

Table A9.32 Collision Risk Assessment Operational Corkey Windfarm 2014 – 2015: kestrel

Details	Month	Value	Units
Turbine parameters	Number of turbines	10	n
	Hub height	39	m
	Rotor diameter	37	m
	Rotor radius	18.5	m
	Blade maximum chord	1.63	m
	Blade pitch	10	°
	Rotor rotation period	2	sec
	Blade depth	1.63	m
	Risk window ceiling height	57.5	m
	Risk window floor height	20.5	m
	Windfarm area	2297307	m^2
	Flight risk volume	85000359	m^3
	Rotor swept area (single turbine)	1075.21009	m^2
	Rotor swept volume (single turbine)	2118.16387	m^3
	Rotor swept volume (combined)	21181.6387	m^3
	Proportion of flight risk volume with turbines	0.00024919	
Bird parameters: Kestrel	Months surveyed	Mar 14 - Feb 15	months
	Speed of the bird through the rotor	12	m/s
	Length of the bird	0.34	m
	Wingspan of the bird	0.76	m
	Vantage point hours completed	291	hours
	Vantage point seconds completed	1047600	seconds
	Time available for flight activity per year	4520	hours
	Flight seconds per year	16272000	seconds
	Number of birds observed	11	n
	Total time all birds spent in risk window	457	seconds
	Proportional time individual bird spends in risk window	3.9658E-05	
	Average time individual bird in risk window (Mar - Feb)	645.31084	seconds
	Bird occupancy of flight risk window	7098.41924	seconds
	Bird occupancy of rotor swept area	1.76888843	seconds
	Bird transit time through rotors	0.16416667	seconds
	Number of birds passing through rotors (Mar-Feb)	10.7749549	n
Collision Assessment	Estimated turbine efficiency (Band et al., 2007)	75	%
	Average collision risk (Band et al., 2007)	9.6	%
	Adjusted collision risk to include turbine efficiency	7.2	%
	No. of collisions with no avoidance (Mar - Feb)	0.77579675	n
	Adjusted for avoidance (95%)	0.03878984	n
	Adjusted for avoidance (98%)	0.01551594	n
	Adjusted for avoidance (99%)	0.00775797	n
	Adjusted for avoidance (99.9%)	0.0007758	n
Frequency of mortality	No avoidance, equivalent to one bird every	1.2889974	years
	95% avoidance, equivalent to one bird every	25.779948	years

Table A9.33 Collision Risk Assessment Proposed Windfarm 2014 – 2015: kestrel

Details	Month	Value	Units
Turbine parameters	Number of turbines	5	n
	Hub height	75	m
	Rotor diameter	120	m
	Rotor radius	60	m
	Blade maximum chord	3.953	m
	Blade pitch	44.5	°
	Rotor rotation period	4.38	sec
	Blade depth	3.773	m
	Risk window ceiling height	135	m
	Risk window floor height	15	m
	Windfarm area	2606092	m^2
	Flight risk volume	312731040	m^3
	Rotor swept area (single turbine)	11309.7336	m^2
	Rotor swept volume (single turbine)	46516.9341	m^3
	Rotor swept volume (combined)	232584.671	m^3
	Proportion of flight risk volume with turbines	0.00074372	

Details	Month	Value	Units
Bird parameters: Kestrel	Months surveyed	Mar 14 - Feb 15	months
	Speed of the bird through the rotor	12	m/s
	Length of the bird	0.34	m
	Wingspan of the bird	0.76	m
	Vantage point hours completed	291	hours
	Vantage point seconds completed	1047600	seconds
	Time available for flight activity per year	4520	hours
	Flight seconds per year	16272000	seconds
	Number of birds observed	11	n
	Total time all birds spent in risk window	523	seconds
	Proportional time individual bird spends in risk window	4.5385E-05	
	Average time individual bird in risk window (Mar - Feb)	738.506717	seconds
	Bird occupancy of flight risk window	8123.57388	seconds
	Bird occupancy of rotor swept area	6.04167324	seconds
	Bird transit time through rotors	0.34275	seconds
	Number of birds passing through rotors (Mar-Feb)	17.6270554	n
Collision Assessment	Estimated turbine efficiency (Band et al., 2007)	75	%
	Average collision risk (Band et al., 2007)	10.9	%
	Adjusted collision risk to include turbine efficiency	8.175	%
	No. of collisions with no avoidance (Mar - Feb)	1.44101178	n
	Adjusted for avoidance (95%)	0.07205059	n
	Adjusted for avoidance (98%)	0.02882024	n
	Adjusted for avoidance (99%)	0.01441012	n
	Adjusted for avoidance (99.9%)	0.00144101	n
Frequency of mortality	No avoidance, equivalent to one bird every	0.69395685	years
	95% avoidance, equivalent to one bird every	13.8791371	years

Table A9.34 Collision Risk Assessment Operational Corkey Windfarm 2018 – 2019: kestrel

Details	Month	Value	Units
Turbine parameters	Number of turbines	10	n
	Hub height	39	m
	Rotor diameter	37	m
	Rotor radius	18.5	m
	Blade maximum chord	1.63	m
	Blade pitch	10	°
	Rotor rotation period	2	sec
	Blade depth	1.63	m
	Risk window ceiling height	57.5	m
	Risk window floor height	20.5	m
	Windfarm area	2297307	m^2
	Flight risk volume	85000359	m^3
	Rotor swept area (single turbine)	1075.21009	m^2
	Rotor swept volume (single turbine)	2118.16387	m^3
	Rotor swept volume (combined)	21181.6387	m^3
	Proportion of flight risk volume with turbines	0.00024919	
Bird parameters: Kestrel	Months surveyed	Mar 18 - Mar 19	months
	Speed of the bird through the rotor	12	m/s
	Length of the bird	0.34	m
	Wingspan of the bird	0.76	m
	Vantage point hours completed	309	hours
	Vantage point seconds completed	1112400	seconds
	Time available for flight activity per year	4892	hours
	Flight seconds per year	17611200	seconds
	Number of birds observed	9	n
	Total time all birds spent in risk window	333	seconds
	Proportional time individual bird spends in risk window	3.3261E-05	
	Average time individual bird in risk window (Mar - Mar)	585.773463	seconds
	Bird occupancy of flight risk window	5271.96117	seconds
	Bird occupancy of rotor swept area	1.31374476	seconds
	Bird transit time through rotors	0.16416667	seconds
	Number of birds passing through rotors (Mar-Mar)	8.00250618	n
Collision Assessment	Estimated turbine efficiency (Band et al., 2007)	75	%
	Average collision risk (Band et al., 2007)	9.6	%
	Adjusted collision risk to include turbine efficiency	7.2	%
	No. of collisions with no avoidance (Mar - Feb)	0.57618044	n
	Adjusted for avoidance (95%)	0.02880902	n
	Adjusted for avoidance (98%)	0.01152361	n
	Adjusted for avoidance (99%)	0.00576180	n
	Adjusted for avoidance (99.9%)	0.00057618	n
Frequency of mortality	No avoidance, equivalent to one bird every	1.73556741	years
	95% avoidance, equivalent to one bird every	34.7113481	years

Table A9.35 Collision Risk Assessment Proposed Windfarm 2018 – 2019: kestrel

Details	Month	Value	Units
Turbine parameters	Number of turbines	5	n
	Hub height	75	m
	Rotor diameter	120	m
	Rotor radius	60	m
	Blade maximum chord	3.953	m
	Blade pitch	44.5	°
	Rotor rotation period	4.38	sec
	Blade depth	3.773	m
	Risk window ceiling height	135	m
	Risk window floor height	15	m
	Windfarm area	2606092	m^2
	Flight risk volume	312731040	m^3
	Rotor swept area (single turbine)	11309.7336	m^2
	Rotor swept volume (single turbine)	46516.9341	m^3
	Rotor swept volume (combined)	232584.671	m^3
	Proportion of flight risk volume with turbines	0.00074372	
Bird parameters: Kestrel	Months surveyed	Mar 18 - Mar 19	months
	Speed of the bird through the rotor	12	m/s
	Length of the bird	0.34	m
	Wingspan of the bird	0.76	m
	Vantage point hours completed	309	hours
	Vantage point seconds completed	1112400	seconds
	Time available for flight activity per year	4892	hours
	Flight seconds per year	17611200	seconds
	Number of birds observed	9	n
	Total time all birds spent in risk window	333	seconds
	Proportional time individual bird spends in risk window	3.3261E-05	
	Average time individual bird in risk window (Mar - Mar)	585.773463	seconds
	Bird occupancy of flight risk window	5271.96117	seconds
	Bird occupancy of rotor swept area	3.92086871	seconds
	Bird transit time through rotors	0.34275	seconds
	Number of birds passing through rotors (Mar-Mar)	11.4394419	n
Collision Assessment	Estimated turbine efficiency (Band et al., 2007)	75	%
	Average collision risk (Band et al., 2007)	10.9	%
	Adjusted collision risk to include turbine efficiency	8.175	%
	No. of collisions with no avoidance (Mar - Mar)	0.93517438	n
	Adjusted for avoidance (95%)	0.04675872	n
	Adjusted for avoidance (98%)	0.01870349	n
	Adjusted for avoidance (99%)	0.00935174	n
	Adjusted for avoidance (99.9%)	0.00093517	n
Frequency of mortality	No avoidance, equivalent to one bird every	1.06931929	years
	95% avoidance, equivalent to one bird every	21.3863858	years

Table A9.36 Collision Risk Estimate (Band et al., 2007) for the Operational Corkey Windfarm and raven.

K: [1D or [3D] (0 or 1)	1		Calculation of alpha and p(collision) as a function of radius								
NoBlades	3					Upwind:			Downwind:		
MaxChord	1.63	m	r/R	c/C	a	collide		contribution	collide		contribution
Pitch (degrees)	10		radius	chord	alpha	length	p(collision)	from radius r	length	p(collision)	from radius r
BirdLength	0.64	m	0.025	0.575	9.64	17.34	1.00	0.00125	17.01	1.00	0.00125
Wingspan	1.35	m	0.075	0.575	3.21	5.89	0.63	0.00473	5.56	0.60	0.00447
F: Flapping (0) or gliding (+1)	1		0.125	0.702	1.93	4.02	0.43	0.00539	3.63	0.39	0.00486
			0.175	0.860	1.38	3.33	0.36	0.00624	2.84	0.30	0.00532
Bird speed	14	m/sec	0.225	0.994	1.07	2.91	0.31	0.00702	2.35	0.25	0.00566
RotorDiam	37	m	0.275	0.947	0.88	2.35	0.25	0.00693	1.82	0.19	0.00535
RotationPeriod	2.00	sec	0.325	0.899	0.74	1.96	0.21	0.00683	1.45	0.16	0.00506
			0.375	0.851	0.64	1.67	0.18	0.00671	1.19	0.13	0.00478
			0.425	0.804	0.57	1.45	0.15	0.00658	0.99	0.11	0.00451
			0.475	0.756	0.51	1.27	0.14	0.00644	0.84	0.09	0.00426
Bird aspect ratio: b	0.47		0.525	0.708	0.46	1.36	0.15	0.00766	0.96	0.10	0.00541
			0.575	0.660	0.42	1.27	0.14	0.00783	0.90	0.10	0.00553
			0.625	0.613	0.39	1.19	0.13	0.00799	0.85	0.09	0.00566
			0.675	0.565	0.36	1.12	0.12	0.00813	0.80	0.09	0.00581
			0.725	0.517	0.33	1.06	0.11	0.00825	0.77	0.08	0.00598
			0.775	0.470	0.31	1.01	0.11	0.00836	0.74	0.08	0.00616
			0.825	0.422	0.29	0.96	0.10	0.00846	0.72	0.08	0.00635
			0.875	0.374	0.28	0.91	0.10	0.00854	0.70	0.07	0.00656
			0.925	0.327	0.26	0.87	0.09	0.00861	0.68	0.07	0.00678
			0.975	0.279	0.25	0.83	0.09	0.00867	0.67	0.07	0.00702
				Overall p(collision) =			Upwind	14.1%		Downwind	10.7%
								Average	12.4%		

Table A9.37 Collision Risk Estimate (Band et al., 2007) for the proposed windfarm and raven.

K: [1D or [3D] (0 or 1)	1		Calculation of alpha and p(collision) as a function of radius								
NoBlades	3					Upwind:			Downwind:		
MaxChord	3.953	m	r/R	c/C	a	collide		contribution	collide		contribution
Pitch (degrees)	44.5		radius	chord	alpha	length	p(collision)	from radius r	length	p(collision)	from radius r
BirdLength	0.64	m	0.025	0.575	6.51	17.73	0.87	0.00108	14.55	0.71	0.00089
Wingspan	1.35	m	0.075	0.575	2.17	6.97	0.34	0.00256	3.79	0.19	0.00139
F: Flapping (0) or gliding (+1)	1		0.125	0.702	1.30	5.64	0.28	0.00345	1.75	0.09	0.00107
			0.175	0.860	0.93	5.44	0.27	0.00465	0.93	0.05	0.00079
Bird speed	14	m/sec	0.225	0.994	0.72	5.40	0.26	0.00595	1.35	0.07	0.00149
RotorDiam	120	m	0.275	0.947	0.59	4.71	0.23	0.00634	1.55	0.08	0.00209
RotationPeriod	4.38	sec	0.325	0.899	0.50	4.19	0.20	0.00666	1.65	0.08	0.00263
			0.375	0.851	0.43	4.04	0.20	0.00741	1.96	0.10	0.00359
			0.425	0.804	0.38	3.73	0.18	0.00776	2.00	0.10	0.00416
			0.475	0.756	0.34	3.46	0.17	0.00805	2.00	0.10	0.00466
Bird aspect ratio: b	0.47		0.525	0.708	0.31	3.22	0.16	0.00827	1.98	0.10	0.00509
			0.575	0.660	0.28	3.00	0.15	0.00843	1.94	0.10	0.00547
			0.625	0.613	0.26	2.79	0.14	0.00852	1.89	0.09	0.00577
			0.675	0.565	0.24	2.59	0.13	0.00855	1.82	0.09	0.00602
			0.725	0.517	0.22	2.40	0.12	0.00852	1.75	0.09	0.00619
			0.775	0.470	0.21	2.22	0.11	0.00841	1.66	0.08	0.00631
			0.825	0.422	0.20	2.04	0.10	0.00825	1.57	0.08	0.00636
			0.875	0.374	0.19	1.87	0.09	0.00802	1.48	0.07	0.00634
			0.925	0.327	0.18	1.71	0.08	0.00772	1.38	0.07	0.00626
			0.975	0.279	0.17	1.54	0.08	0.00736	1.28	0.06	0.00611
				Overall p(collision) =			Upwind	13.6%		Downwind	8.3%
								Average	10.9%		

Table A9.38 Collision Risk Assessment Operational Corkey Windfarm 2014 – 2015: raven

Details	Month	Value	Units
Turbine parameters	Number of turbines	10	n
	Hub height	39	m
	Rotor diameter	37	m
	Rotor radius	18.5	m
	Blade maximum chord	1.63	m
	Blade pitch	10	°
	Rotor rotation period	2	sec
	Blade depth	1.63	m

Details	Month	Value	Units
	Risk window ceiling height	57.5	m
	Risk window floor height	20.5	m
	Windfarm area	2297307	m^2
	Flight risk volume	85000359	m^3
	Rotor swept area (single turbine)	1075.21009	m^2
	Rotor swept volume (single turbine)	2440.72689	m^3
	Rotor swept volume (combined)	24407.2689	m^3
	Proportion of flight risk volume with turbines	0.00028714	
Bird parameters: Raven	Months surveyed	Mar 14 – Feb 15	months
	Speed of the bird through the rotor	14	m/s
	Length of the bird	0.64	m
	Wingspan of the bird	1.35	m
	Vantage point hours completed	291	hours
	Vantage point seconds completed	1047600	seconds
	Time available for flight activity per year	4520	hours
	Flight seconds per year	16272000	seconds
	Number of birds observed	164	n
	Total time all birds spent in risk window	6637	seconds
	Proportional time individual bird spends in risk window	3.8631E-05	
	Average time individual bird in risk window (Mar - Feb)	628.598609	seconds
	Bird occupancy of flight risk window	103090.172	seconds
	Bird occupancy of rotor swept area	29.6016344	seconds
	Bird transit time through rotors	0.16214286	seconds
	Number of birds passing through rotors (Mar-Feb)	182.565146	n
Collision Assessment	Estimated turbine efficiency (Band et al., 2007)	75	%
	Average collision risk (Band et al., 2007)	12.4	%
	Adjusted collision risk to include turbine efficiency	9.3	%
	No. of collisions with no avoidance (Mar - Feb)	16.9785586	n
	Adjusted for avoidance (95%)	0.84892793	n
	Adjusted for avoidance (98%)	0.33957117	n
	Adjusted for avoidance (99%)	0.16978559	n
	Adjusted for avoidance (99.9%)	0.01697856	n
Frequency of mortality	No avoidance, equivalent to one bird every	0.05889781	years
	98% avoidance, equivalent to one bird every	2.94489074	years

Table A9.39 Collision Risk Assessment Proposed Windfarm 2014 – 2015: raven

Details	Month	Value	Units
Turbine parameters	Number of turbines	5	n
	Hub height	75	m
	Rotor diameter	120	m
	Rotor radius	60	m
	Blade maximum chord	3.953	m
	Blade pitch	44.5	°
	Rotor rotation period	4.38	sec
	Blade depth	3.773	m
	Risk window ceiling height	135	m
	Risk window floor height	15	m
	Windfarm area	2606092	m^2
	Flight risk volume	312731040	m^3
	Rotor swept area (single turbine)	11309.7336	m^2
	Rotor swept volume (single turbine)	49909.8542	m^3
	Rotor swept volume (combined)	249549.271	m^3
	Proportion of flight risk volume with turbines	0.00079797	
Bird parameters: Raven	Months surveyed	Mar 14 - Feb 15	months
	Speed of the bird through the rotor	14	m/s
	Length of the bird	0.64	m
	Wingspan of the bird	1.35	m
	Vantage point hours completed	291	hours
	Vantage point seconds completed	1047600	seconds
	Time available for flight activity per year	4520	hours
	Flight seconds per year	16272000	seconds
	Number of birds observed	164	n
	Total time all birds spent in risk window	8802	seconds
	Proportional time individual bird spends in risk window	5.1232E-05	
	Average time individual bird in risk window (Mar - Feb)	833.648479	seconds
	Bird occupancy of flight risk window	136718.351	seconds
	Bird occupancy of rotor swept area	109.096829	seconds
	Bird transit time through rotors	0.31521429	seconds
	Number of birds passing through rotors (Mar-Feb)	346.103694	n
Collision Assessment	Estimated turbine efficiency (Band et al., 2007)	75	%
	Average collision risk (Band et al., 2007)	10.9	%
	Adjusted collision risk to include turbine efficiency	8.175	%
	No. of collisions with no avoidance (Mar - Feb)	28.293977	n
	Adjusted for avoidance (95%)	1.41469885	n
	Adjusted for avoidance (98%)	0.56587954	n
	Adjusted for avoidance (99%)	0.28293977	n
	Adjusted for avoidance (99.9%)	0.02829398	n
Frequency of mortality	No avoidance, equivalent to one bird every	0.03534321	years
	98% avoidance, equivalent to one bird every	1.76716055	years

Table A9.40 Collision Risk Assessment Operational Corkey Windfarm 2018 – 2019: raven

Details	Month	Value	Units
Turbine parameters	Number of turbines	10	n
	Hub height	39	m
	Rotor diameter	37	m
	Rotor radius	18.5	m
	Blade maximum chord	1.63	m
	Blade pitch	10	°
	Rotor rotation period	2	sec
	Blade depth	1.63	m
	Risk window ceiling height	57.5	m
	Risk window floor height	20.5	m
	Windfarm area	2297307	m^2
	Flight risk volume	85000359	m^3
	Rotor swept area (single turbine)	1075.21009	m^2
	Rotor swept volume (single turbine)	2440.72689	m^3
	Rotor swept volume (combined)	24407.2689	m^3
	Proportion of flight risk volume with turbines	0.00028714	
Bird parameters: Raven	Months surveyed	Mar 18 - Mar 19	months
	Speed of the bird through the rotor	14	m/s
	Length of the bird	0.64	m
	Wingspan of the bird	1.35	m
	Vantage point hours completed	309	hours
	Vantage point seconds completed	1112400	seconds
	Time available for flight activity per year	4892	hours
	Flight seconds per year	17611200	seconds
	Number of birds observed	135	n
	Total time all birds spent in risk window	2875	seconds
	Proportional time individual bird spends in risk window	1.9144E-05	
	Average time individual bird in risk window (Mar - Mar)	337.156898	seconds
	Bird occupancy of flight risk window	45516.1812	seconds

Details	Month	Value	Units
	Bird occupancy of rotor swept area	13.0696586	seconds
	Bird transit time through rotors	0.16214286	seconds
	Number of birds passing through rotors (Mar-Mar)	80.6058242	n
Collision Assessment	Estimated turbine efficiency (Band et al., 2007)	75	%
	Average collision risk (Band et al., 2007)	12.4	%
	Adjusted collision risk to include turbine efficiency	9.3	%
	No. of collisions with no avoidance (Mar - Mar)	7.49634165	n
	Adjusted for avoidance (95%)	0.37481708	n
	Adjusted for avoidance (98%)	0.14992683	n
	Adjusted for avoidance (99%)	0.07496342	n
	Adjusted for avoidance (99.9%)	0.00749634	n
Frequency of mortality	No avoidance, equivalent to one bird every	0.1333984	years
	98% avoidance, equivalent to one bird every	6.66992012	years

Table A9.41 Collision Risk Assessment Proposed Windfarm 2018 – 2019: raven

Details	Month	Value	Units
Turbine parameters	Number of turbines	5	n
	Hub height	75	m
	Rotor diameter	120	m
	Rotor radius	60	m
	Blade maximum chord	3.953	m
	Blade pitch	44.5	°
	Rotor rotation period	4.38	sec
	Blade depth	3.773	m
	Risk window ceiling height	135	m
	Risk window floor height	15	m
	Windfarm area	2606092	m^2
	Flight risk volume	312731040	m^3
	Rotor swept area (single turbine)	11309.7336	m^2
	Rotor swept volume (single turbine)	49909.8542	m^3
	Rotor swept volume (combined)	249549.271	m^3
	Proportion of flight risk volume with turbines	0.00079797	
Bird parameters: Raven	Months surveyed	Mar 18 - Mar 19	months
	Speed of the bird through the rotor	14	m/s
	Length of the bird	0.64	m
	Wingspan of the bird	1.35	m
	Vantage point hours completed	309	hours
	Vantage point seconds completed	1112400	seconds

Details	Month	Value	Units
	Time available for flight activity per year	4892	hours
	Flight seconds per year	17611200	seconds
	Number of birds observed	135	n
	Total time all birds spent in risk window	3660	seconds
	Proportional time individual bird spends in risk window	2.4372E-05	
	Average time individual bird in risk window (Mar - Mar)	429.21539	seconds
	Bird occupancy of flight risk window	57944.0777	seconds
	Bird occupancy of rotor swept area	46.2375028	seconds
	Bird transit time through rotors	0.31521429	seconds
	Number of birds passing through rotors (Mar-Mar)	146.685937	n
Collision Assessment	Estimated turbine efficiency (Band et al., 2007)	75	%
	Average collision risk (Band et al., 2007)	10.9	%
	Adjusted collision risk to include turbine efficiency	8.175	%
	No. of collisions with no avoidance (Mar - Mar)	11.9915753	n
	Adjusted for avoidance (95%)	0.59957877	n
	Adjusted for avoidance (98%)	0.23983151	n
	Adjusted for avoidance (99%)	0.11991575	n
	Adjusted for avoidance (99.9%)	0.01199158	n
Frequency of mortality	No avoidance, equivalent to one bird every	0.08339188	years
	98% avoidance, equivalent to one bird every	4.16959395	years

Corkey Windfarm Repowering

Technical Appendix A9.4 Operational Phase Bird Monitoring Plan

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SCOTTISHPOWER RENEWABLES

1 Operational Phase Bird Monitoring Plan

Given the low abundance of breeding activity on the site, and the difficulties with estimating abundance and inferring causal links described above, it is considered searching for bird fatalities using the method described below would provide the most useful surveillance of bird impacts on the site during the operational phase.

SPR have an established system for detecting and recording carcasses found under turbines across every windfarm in their portfolio. The system integrates the programme of weekly external turbine inspections to include a visual check of the hardstanding and adjacent access track for dead or injured animals. While not covering the entire area where carcasses could potentially fall, this method provides a systematic sample which can be used to generate estimates of collisions.

The system was reviewed under Scottish Windfarm Bird Steering Group (SWBSG) research contract 1605[1], and can be effective at providing useful estimates provided the following conditions are met:

1. The threshold number of fatalities to detect is relatively high or the duration of the study is long (e.g. 20 years +)
2. Observer efficiency is high
3. Scavenger removal rates are likely to be high
4. There is no requirement for high precision of estimates

The collision rate for bird species at the site is currently unknown. However, if fatalities occur either frequently over a short period of time, or less frequently over a long period of time, it is probable that at least some carcasses will fall on the hardstanding areas and be detected.

1.1 Methodology

SPR will undertake external checks for carcasses at weekly intervals for the entire duration of the operational period.

External turbine checks are part of the routine maintenance programme undertaken by SPR operations, and involve a survey by the site attendant who will run through a checklist at each turbine location. Part of this checklist prompts the site attendant to visually scan the hardstanding areas around the turbine for any dead or injured animal. If any animal is found, it will trigger a detailed recording protocol which will gather the following information which is logged in the ISO140001 Environmental System and in parallel reported to the internal ecology team (4 members of staff) who will review and advise any further actions:

1. Turbine number, distance and direction from the tower
2. Photo of carcass with turbine, close-up photo(s) of the carcass with common object for scale
3. Date and notes of any injuries

Training by way of a "toolbox talk" is provided by a member of the ecology team to the site attendant to ensure familiarity with the detection, recording and reporting procedures.

1.1.1 Observer efficiency and carcass removal

Previous testing of the methodology at Whitelee windfarm 2014 – 2016 involving placing decoy carcasses randomly below turbines on hardstandings in order to test observer efficiency generated an estimate of 93% of carcasses in n=105 trials were detected and reported by operational personnel. This figure compares well to other studies in the reported literature, and is likely to be due to the easy visibility of the hardstanding areas.

Scavenger removal rates at the site are currently unknown. Studies of carcass removal rates have reported significant differences depending on species, location and time of year meaning it is difficult to rely on estimates from other studies for a specific project. However, the availability of sufficient numbers of fresh golden plover carcasses to undertake such a site-specific study is practically unachievable. For the purposes of methodological scenario testing, an exponential daily carcass persistence probability value of 0.93 has been assumed (i.e. there is a 93% probability a carcass will persist between days). This value was calculated experimentally at Clachan Flats windfarm using quail, and also at Braes of Doune windfarm using pheasant carcasses, and was also determined to be the best available estimate from a literature review carried out for the SWBSG[1]. For raptors, the persistence rate is predicted to be higher from studies which have attempted to compare removal rates between raptors and game species.

1.1.2 Example Scenario

A realistic minimum objective of this type of study would be to conclude that there is a >80% probability that the total number of bird fatalities of a particular species was <6 over an illustrative 25 years. This calculation is explained below using a worked example based on the following parameters:

Carcass persistence: 0.93 (Clachan and Braes estimated this value, was also used in SWBSG)

Observer efficiency: 0.933 (Whitelee trials)

Proportion of area searched: 0.3

Probability of detection PR(det)[2]: 0.229

Scenarios after an illustrative 25 years[3]:

No. carcasses found	Mean estimate of fatalities	80% Credible Interval
0	2	0 – 6
1	6	2 – 15
2	11	5 – 21
3	15	8 – 27

From the scenarios in Table 1, if 0 carcasses are detected using the SPR methodology during the windfarm operation it there is a >80% probability that the true fatality rate is <6.

1.1.3 Reporting

Annual reports of all habitat monitoring and carcass search results will be provided to NIEA and RSPB.

[1] Caryl, F., Vallejo, G., Tidhar, D. and Robinson, C. (2016) Precision and bias of bird fatality estimates from two contrasting carcass detection strategies. SWBSG Commissioned report number 1605.

[2] Using the perickson function in R package "carcass", reported by SWBSG project 1605 to provide the least biased results

[3] Using the posteriorN function in R package "carcass"