Chapter 9
Ornithology

SCOTTISHPOWER RENEWABLES

Table of contents

List of Figures

List of Technical Appendices

Chapter 9
Ornithology

9.1 Introduction

1. This Chapter of the Environmental Impact Assessment Report (EIA Report) considers the potential impacts of the proposed Development on ornithological features. It summarises the methods used to establish the bird populations within the Site and its surroundings, the results of the baseline surveys, and the process used to determine the sensitivity of the bird populations present. The ways in which birds might be affected (directly or indirectly) by the construction and operation of the proposed Development are assessed, prior to and after any mitigation measures are considered.

2. This Chapter is supported by **Technical Appendix 9.1 Ornithology**, which contains the following Annexes:

- Annex A – Legal Protection;
- Annex B – Ornithological Survey Methodologies;
- Annex C – Ornithological Survey Effort and General Information;
- Annex D – Ornithological Survey Results;
- Annex E – Collision Risk Assessments; and
- Annex F – Review of the effects of artificial light on birds in relation to deployment of obstruction lighting on turbines.

3. Confidential information relating to the breeding locations of protected species is presented in figures contained in **Technical Appendix 9.2: Confidential Ornithology**. Technical Appendix 9.2 has restricted distribution due to the sensitivity of nest location information contained within. Latin names for all species recorded within the proposed Development are presented in **Table D-9** in **Technical Appendix 9.1 Ornithology Annex D**.

4. This ornithology assessment has been undertaken by MacArthur Green.

9.2 Legislation, Policy and Guidelines

5. The following legislation, policy and guidance have been considered in carrying out this assessment.

9.2.1 Legislation

- European Commission (2019a). Directive 2009/147/EC on the Conservation of Wild Birds ('Birds Directive');
- European Commission (2019b). Directive 92/43/EEC on Conservation of Natural Habitats and of Wild Fauna and Flora (as amended) ('Habitats Directive');
- European Commission (2019c). Environmental Impact Assessment Directive 2014/52/EU;
- Scottish Government (2019a). The Wildlife and Countryside Act 1981 (as amended);
- Scottish Government (2019b). The Conservation (Natural Habitats &c.) Regulations 1994 (as amended) (The Habitats Regulations);
- Scottish Government (2019c). The Nature Conservation (Scotland) Act 2004 (as amended); and
- Scottish Government (2017). The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017.

9.2.2 Planning Policy

- UK Post-2010 Biodiversity Framework (2012);
- Scottish Biodiversity Strategy: It's in Your Hands (2004)/2020 Challenge for Scotland's Biodiversity (2013); and
- Scottish Government (2017). Planning Advice Note 1/2013-Environmental Impact Assessment, Revision 1.0.

9.2.3 Guidelines

- CIEEM (2019) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine version 1.1. Chartered Institute of Ecology and Environmental Management, Winchester;
- Eaton M.A., Aebischer N.J., I A.F., Hearn R.D., Lock L., Musgrove A.J., Noble D.G., Stroud D.A. and Gregory R.D. (2015). Birds of Conservation Concern 4: the population status of birds in the United Kingdom, Channel Islands and Isle of Man. British Birds 108, 708–746;
- European Commission (2011). Natura 2000 Guidance Document 'Wind Energy Developments and Natura 2000'. European Commission, Brussels;
- Scottish Executive Rural Affairs Department (SERAD) (2000). Habitats and Birds Directives, Nature Conservation; Implementation in Scotland of EC Directives on the Conservation of Natural Habitats and of Wild Flora and Fauna and the Conservation of Wild Birds ("the Habitats and Birds Directives"). Revised Guidance Updating Scottish Office Circular No 6/1995;
- Scottish Natural Heritage (SNH) (2000). Windfarms and birds: calculating a theoretical collision risk assuming no avoidance action. SNH Guidance Note;
- SNH (2010). Survey methods for use in assessing the impacts of onshore windfarms on bird communities;
- SNH (2013). Recommended bird survey methods to inform impact assessment of onshore windfarms;
- SNH (2014). Recommended bird survey methods to inform impact assessment of onshore wind farms;
- SNH (2016a). Assessing connectivity with Special Protection Areas (SPAs). Version 3;
- SNH (2016b). Environmental Statements and Annexes of Environmentally Sensitive Bird Information; Guidance for Developers, Consultants and Consultees Version 2;
- SNH (2017). Recommended bird survey methods to inform impact assessment of onshore windfarms;
- SNH (2018a). Assessing the cumulative impacts of onshore wind farms on birds. SNH Guidance Note;
- SNH (2018b). Assessing significance of impacts from onshore wind farms on birds out with designated areas. Version 2; and
- SNH (2018c). Environmental Impact Assessment Handbook – Version 5: Guidance for competent authorities, consultation bodies, and others involved in the Environmental Impact Assessment process in Scotland.

9.3 Consultation

6. Consultation for ornithology was undertaken with the organisations shown in **Table 9.3.1**.

Table 9.3.1 Consultation Responses

Consultee	Type and Date	Summary of Consultation Response	How Addressed
Scottish Natural Heritage (SNH)	3 March 2017 Pre-application advice	SNH provided advice for future survey requirements. Apart from osprey, SNH considered that the Site appears to be of low bird interest. It was advised that in 2017 survey work could concentrate on scarce species, and in particular where the closest osprey pair feeds, and whether the proposed Development may pose a risk to movements.	Survey work in 2017 concentrated on scarce species and specific osprey surveys were undertaken. See **Technical Appendix 9.1** for survey details, and a summary in Section 9.5 Baseline Conditions.
	11 April 2019 Scoping Opinion	SNH agrees with the conclusions in the scoping report that Glen App and Galloway Moors Special Protection Area (SPA) and Site of Special Scientific Interest (SSSI) can be scoped out of the EIA as it is unlikely	Noted. Details of designated sites are provided in Section 9.5 Baseline Conditions.

Consultee	Type and Date	Summary of Consultation Response	How Addressed
		that the proposal would have a significant effect on the qualifying interests either directly or indirectly.	
		SNH agrees with the conclusions in the scoping report that there is no connectivity between the proposed Development Site and the breeding bird assemblage of the Merrick Kells SSSI and this designated site can be scoped out of the EIA.	Noted. Details of designated sites are provided in Section 9.5 Baseline Conditions.
		SNH agrees that the range of surveys undertaken to date and ongoing surveys should be sufficient and appropriate to inform the assessment.	Noted. Full details of baseline surveys are provided in **Technical Appendix 9.1.**
South Ayrshire Council	2 May 2019 Scoping Opinion	The proposed assessment methodology / survey framework plans to cover all the relevant significant environmental effects relating to ornithology which would be considered in the final EIA Report.	Noted.
Royal Society for the Protection of Birds (RSPB) Scotland	30 April 2019 Scoping Opinion	RSPB is content that there is no connectivity between the Glen App and Galloway Moors SPA (and underpinning SSSI) or Merrick Kells SSSI and that these designated sites can therefore be scoped out of the EIA Report.	Noted. Details of designated sites are provided in Section 9.5 Baseline Conditions.
		RSPB considers that the ornithology surveys are sufficient and appropriate for the proposed Development.	Noted. Full details of baseline surveys are provided in **Technical Appendix 9.1**.
		RSPB agreed that the proposed mitigation is sufficient and appropriate, although noted that a Habitat Management Plan should be produced.	Noted. Mitigation measures are outlined in Section 9.7.

9.4 Assessment Methodology and Significance Criteria

9.4.1 Scope of Assessment

7. The key impacts for the assessment of potential ornithological effects relating to the proposed Development are:

- direct habitat loss for birds through construction of the proposed Development;
- displacement of birds through direct and indirect loss of habitat as a result of construction activity disturbance, turbine operation and maintenance, or visitor disturbance. This also includes barrier effects to commuting or migrating birds due to the presence of wind turbines or other infrastructure;
- habitat modification due to change in land cover (e.g. forestry removal) or changes in hydrological regime, and consequent effects on bird populations;
- death or injury through collision with wind turbine blades or other types of infrastructure associated with the proposed Development; and
- cumulative effects of the proposed Development during construction and operation when considering windfarm projects within the same Natural Heritage Zone (NHZ).

9.4.2 Study Area

8. This ornithological assessment focuses on the Site and appropriate buffer areas (collectively the 'study areas') which have been applied, as recommended by SNH (2017) guidance. The specific study areas are as follows:

- ornithological designated sites: within 20 km of the Site (**Figure 9.1**);
- flight activity (Vantage Point, VP) surveys: areas within a 500 m buffer of the outermost wind turbine locations, referred to for collision risk modelling (CRM) purposes as the Collision Risk Analysis Area (CRAA) (see **Technical Appendix 9.1, Annex E and Figure 9.2 and Figure 9.3**);
- breeding birds (waders): within suitable upland habitat (non-forested), a 500 m buffer around the Site boundary (**Figure 9.4**);
- scarce breeding birds: 2 km buffer around the Site (**Figure 9.4**);
- black grouse: 1.5 km buffer around the Site (**Figure 9.4**); and
- non-breeding birds: 500 m buffer around the Site (**Figure 9.4**).

9.4.3 Baseline Survey Methodology

9.4.3.1 Desk Study

9. The following sources were consulted as part of the assessment:

- SNH SiteLink (www.snh.gov.uk/sitelink) for designated site information;
- The Dumfries & Galloway Raptor Study Group (D&GRSG) for historical nesting raptor records; and
- The South of Scotland Golden Eagle Project.

9.4.3.2 Field Surveys

10. All surveys followed best practice methods and guidance available at the time, namely SNH (2010, 2013, 2014 and 2017), Brown and Shepherd 1993, Gilbert *et al*. (1998) and Hardey *et al*. (2009 and 2013) (see **Annex B of Technical Appendix 9.1**). The application boundary and planned infrastructure layout was subject to change during the baseline survey period (2012-2019), and so survey areas sometimes differed between years. These changes are not considered detrimental to the assessment, with all final infrastructure locations being sufficiently covered by all surveys during the baseline period.

11. Ornithological fieldwork commenced in September 2012 and was completed in August 2019, and comprised the following surveys (see **Technical Appendix 9.1, Annexes B and C** for further details):

- **flight activity surveys:** two breeding seasons (2013 and 2018) and two non-breeding seasons (2012-13 and 2013-14). The target minimum survey effort of 36 hours per VP, per season as per SNH (SNH, 2017 P.17, SNH, 2013 P.17 and SNH, 2010 P.14) guidance was achieved on all occasions. Each survey period used a total of six VPs to cover the Site, although most of those VP locations in 2012 to 2014 differed to those in 2018 due to refinements in wind turbine layout (**Table 9.4.1**, **Figure 9.2** and **Figure 9.3**).

Table 9.4.1 Flight Activity Survey Effort (hours) per Non-Breeding Season (NBS) and Breeding Season (BS) (excludes time lost to poor visibility conditions <1km)

VP	2012-13 NBS	2013 BS	2013-14 NBS	2018 BS
1	36	36	36	-
2	36.25	36	36	-
3	36	36	36	-
4	35.5	36	37	-
5	36	36	36	-
6	36	42	36.5	36
7	-	-	-	36
8	-	-	-	36
9	-	-	-	36
10	-	-	-	36
11	-	-	-	36

- **scarce breeding bird surveys:** surveys for breeding raptors, divers and any other species listed in Schedule 1 of the Wildlife and Countryside Act 1981 took place within the application boundary and a survey area buffer of up to 2 km during the breeding seasons in 2013, 2014, 2015, 2017, 2018 and 2019.
- **upland breeding bird surveys:** two breeding seasons (2013 and 2018) were surveyed across all open (non-forested) parts of the Site and 500 m survey area buffer. These focussed on recording breeding waders and any other species of conservation concern;
- **black grouse surveys:** three years of surveys (2013, 2014, 2015 and 2017) to record lek distribution were conducted within the Site and a 1.5 km buffer around the application boundary;
- **winter walkovers**: surveys to record the non-breeding season assemblage usage within the Site and 500 m survey area in 2012-13, 2013-14 and 2018-19; and
- **woodland point counts**: surveys to record species assemblage within forested areas in 2012-13 non-breeding season and 2013 breeding season.

9.4.4 Methodology for the Assessment of Effects

12. The significance of the potential effects of the proposed Development has been classified by professional consideration of the sensitivity of the feature (a combination of nature conservation importance and conservation status) and the magnitude of impact on the feature.

13. The evaluation of interests involves the following process:

- identifying the potential impacts associated with the proposed Development;
- considering the likelihood of occurrence of potential impacts where appropriate;
- defining the nature conservation importance and conservation status of the bird populations present to establish level of sensitivity;
- establishing the magnitude associated with the likely impact (both spatial and temporal);
- based on the above information, making a judgement as to whether or not the resultant effect is significant in terms of the EIA Regulations;
- if a potential effect is determined to be significant, suggesting measures to mitigate or compensate the effect where required;
- considering opportunities for enhancement where appropriate; and
- confirming residual effects after mitigation, compensation or enhancement are considered.

9.4.4.1 Sensitivity of Receptors

14. The sensitivity of the potentially affected ornithological features, is assessed in line with best practice guidance, legislation and professional judgement.

15. Determination of the level of sensitivity of an ornithological feature is based on a combination of the feature's nature conservation importance and conservation status. **Table 9.4.2**Error! Reference source not found. details the framework for determining the sensitivity of features.

Table 9.4.2 Determining Factors of an Ornithological Feature's Nature Conservation Importance

Importance	Description
High	Populations receiving protection by an SPA, proposed SPA, Ramsar Site, SSSI or which would otherwise qualify under selection guidelines. Species present in nationally important numbers (>1% national breeding or wintering population).
Medium	The presence of species listed in Annex 1 of the Birds Directive (but population does not meet the designation criteria under selection guidelines). The presence of breeding species listed on Schedule 1 of the Wildlife and Countryside Act 1981 (as amended). The presence of species noted on the latest Birds of Conservation Concern (BoCC) Red list (Eaton *et al*. 2015).
	Regularly occurring migratory species, which are either rare or vulnerable, or warrant special consideration on account of the proximity of migration routes, or breeding, moulting, wintering or staging areas in relation to the proposed Development. Species present in regionally important numbers (>1% regional breeding population).
Low	All other species' populations not covered by the above categories.

16. Important Ornithological Features (IOFs) to be assessed (as per CIEEM, 2019 guidelines) were taken to be those species of High and Medium Nature Conservation Importance.

17. As defined by SNH (2018b), the conservation status of a species is "*the sum of the influences acting on it which may affect its long-term distribution and abundance, within the geographical area of interest (which for the purposes of the Birds Directive is the EU)*". Conservation status is considered by SNH (2018b) to be "*favourable*" under the following circumstances:

- "*population dynamics indicate that the species is maintaining itself on a long-term basis as a viable component of its habitats;*
- *the natural range of the species is not being reduced, nor is likely to be reduced for the foreseeable future; and*
- *there is (and probably will continue to be) a sufficiently large habitat to maintain its population on a long-term basis*".

18. SNH (2018b) recommends that "*the concept of favourable conservation status of a species should be applied at the level of its Scottish population, to determine whether an impact is sufficiently significant to be of concern. An adverse impact on a species at a regional scale (within Scotland) may adversely affect its national conservation status*". Thus, "*An impact should therefore be judged as of concern where it would adversely affect the existing favourable conservation status of a species or prevent a species from recovering to favourable conservation status, in Scotland*."

19. In the case of non-designated sites in Scotland, the relevant regional scale for breeding species is considered to be the appropriate NHZ which the Site falls within, in this case the Western Southern Uplands and Inner Solway NHZ 19. For wintering or migratory species, the national UK population is often considered to be the relevant scale for determining effects on the conservation status and this approach is applied here.

9.4.4.2 Magnitude of Impact

20. An impact can be defined as a change of a particular magnitude to the abundance and/or distribution of an IOF's population as a result of the proposed Development. Impacts can be positive, negative or neutral.

21. In determining the magnitude of impact, the resilience of a population to recover from temporary adverse conditions is considered in respect of each potentially affected population.

22. The sensitivity of individual IOFs to disturbance during relevant behaviours is considered when determining spatial and temporal magnitude of change and is assessed using guidance described by Bright *et al*. (2006), Hill *et al*. (1997) and Ruddock and Whitfield (2007).

23. Magnitude of impact can be judged in terms of space and time, within the context of the relevant reference population (para. 19). There are five levels of spatial effects and temporal effects as detailed in **Table 9.4.3** and **Table 9.4.4** respectively. The examples given in these two tables provide a guideline to the assessment, but professional judgement will be relied upon in each individual case.

Table 9.4.3 Spatial Magnitude of Impact

Magnitude of Impact	Definition
Very High	Total/near total loss of a bird population due to mortality or displacement. Total/near total loss of productivity in a bird population due to disturbance. Guide: >80% of population lost, or increase in additive mortality.

Magnitude of Impact	Definition
High	Major reduction in the status or productivity of a bird population due to mortality or displacement or disturbance. Guide: 21-80% of population lost, or increase in additive mortality.
Medium	Partial reduction in the status or productivity of a bird population due to mortality or displacement or disturbance. Guide: 6-20% of population lost, or increase in additive mortality.
Low	Small but discernible reduction in the status or productivity of a bird population due to mortality or displacement or disturbance. Guide: 1-5% of population lost, or increase in additive mortality.
Negligible	Very slight reduction in the status or productivity of a bird population due to mortality or displacement or disturbance. Reduction barely discernible, approximating to the "no change" situation. Guide: < 1% of population lost, or increase in additive mortality.

Table 9.4.4 Temporal Magnitude of Impact

Magnitude of Impact	Definition
Permanent	Effects continuing indefinitely beyond the span of one human generation (taken as approximately 30+ years), except where there is likely to be substantial improvement after this period. Where this is the case, Long-Term may be more appropriate.
Long-term	Approximately 15 - 30 years or longer (see above).
Medium-term	Approximately 5 – 15 years.
Short-term	Up to approximately 5 years.
Negligible	<12 months.

9.4.4.3 Significance of Effect

24. The potential significance of the effect was determined through a standard method of assessment based on professional judgement, considering both sensitivity of IOF and magnitude of impact as detailed in **Table 9.4.5**. Major and moderate effects are considered significant in the context of the EIA Regulations.

Table 9.4.5 Significance Criteria

Overall Magnitude	Description
Major	Significant effect, as the effect is likely to result in a permanent/ long term and very high/ high extent significant adverse effect on the integrity of the feature.
Moderate	Significant effect, as the effect is likely to result in a medium term and high / medium extent partially significant adverse effect on the integrity of the feature.
Minor	The effect is likely to adversely affect the feature at an insignificant level by virtue of its limited duration and/or extent, but there will probably be no effect on its integrity. This is not a significant effect.
Negligible	No material effect. This is not a significant effect.

9.4.4.4 Assessment Limitations

25. There can often be varying degrees of uncertainty over the sensitivity or magnitude of impacts as a result of limited information. A precautionary approach is therefore adopted for the assessment where the response of a population to an effect is uncertain.

26. All proposed turbine locations have been covered by surveyor viewsheds for at least one whole year (breeding season and non-breeding season), with the exception of turbine 2 and turbine 13 which are just outside 2km viewshed coverage (**Figures 9.2** and **9.3**). In both cases however, flight activity in these areas is likely to be similar to that recorded within the remainder of the Site, which generally comprises similarly-aged dense conifer plantation. Flight activity rates recorded across the Site are therefore considered representative of the whole wind turbine area.

27. Although some baseline data are over five years old, a full suite of ornithology surveys has been conducted since 2017, and survey results were similar to those recorded in 2012-2014. This is likely to be due to the consistency of habitats and land use since 2012. As such, it is considered that all baseline data are relevant for consideration in the impact assessment.

28. In summary, the VP coverage and survey effort is considered sufficient to allow a robust assessment of ornithological activity associated with the site.

9.4.4.5 Embedded Mitigation

29. The following considerations relating to ornithological interests were incorporated into the proposed Development design:

- wind turbines are located within low conservation value conifer plantation forestry (with the exception of turbine 10 and 13), where the importance of habitat for IOFs, and therefore activity rates are likely to be low.
- the design layout process has taken into consideration breeding osprey, locating turbines away from nest sites and waterbodies; and
- the black grouse lek site recorded during baseline surveys were buffered by at least 500 m from proposed wind turbine locations.

9.5 Baseline Conditions

9.5.1 Designated Sites

30. There are no statutory designations with ornithological features within the Site. The proposed Development is within 20 km of three statutory designations that include ornithological features (**Table 9.5.1**, **Figure 9.1**):

- Glen App and Galloway Moors SPA, underpinned by Glen App and Galloway Moors Site of Special Scientific Interest (SSSI);
- Merrick Kells SSSI.

Table 9.5.1 Summary of Designated Sites within 20 km of application boundary

Designated Site	Distance from Site	Qualifying Features	Status	Connectivity Distance (SNH 2016a)
Glen App and Galloway Moors SPA and SSSI	14 km	Hen harrier, breeding	July 2008: Favourable maintained	2 km
Merrick Kells SSSI	4.7 km	Breeding bird assemblage	June 2010: Favourable maintained	N/A

31. It is also noted that the proposed Development is within the buffer zone of the Galloway and Southern Ayrshire Biosphere [http://www.gsabiosphere.org.uk/], which although is a non-statutory site, forms part of the background context for the assessment.

9.5.2 Birds Recorded During Desk and Field Surveys

32. The following paragraphs summarise the baseline ornithological field survey results (between September 2012 and August 2019), and historic data obtained during the desk study. Full details can be found within **Technical Appendix 9.1, Annex D, Figures 9.1.1** to **9.1.4, Confidential Technical Appendix 9.2 and Confidential Figures 9.2.2** to **9.2.4**.

9.5.2.1 Flight Activity Surveys

33. A summary of all target species recorded during flight activity surveys at the Site is presented in **Table 9.5.2**. This tallies all flights observed during the baseline period (2012 to 2018) and includes flights recorded outwith the CRAA and which are therefore not included in collision modelling since they would not be at risk of collision with a turbine. Bird seconds are calculated for each observation as the product of flight duration and number of individuals. For further details of seasonal breakdown and flights included in the collision model, see **Technical Appendix 9.1, Annex E**.

Table 9.5.2 Species recorded during flight activity surveys 2012 to 2018

Species	No. Flightlines Recorded	No. Birds Recorded	Total Bird Seconds Recorded
Black grouse	1	1	30
Golden plover	1	2	42
Goldeneye	1	1	45
Goshawk	16	16	1,005
Greylag goose	15	58	2,978
Hen harrier	7	8	711
Herring gull	1	5	150
Merlin	1	1	50
Osprey	1	1	75
Pink-footed goose	2	235	35,640
Red kite	1	1	147

9.5.2.2 Geese

34. Greylag geese were recorded relatively regularly during the baseline period, mainly during the breeding season. Birds were observed using Loch Scalloch within the Site, and Loch Moan and a disused quarry to the south of the Site. Breeding evidence was recorded on Loch Moan. Flock size was generally small, usually six or fewer individuals, with a maximum flock size of 25 individuals.

35. Pink-footed goose was recorded occasionally in flight during the non-breeding season, with a peak flock size of 200 individuals.

9.5.2.3 Black grouse

36. Very low numbers of black grouse were recorded during the 2013, 2014 and 2017 breeding seasons (in addition, birds were heard outwith the survey area on two occasions during the 2018 breeding season) with only a single male recorded lekking on the eastern edge of the Site boundary in 2014 and 2017 (**Figure 9.1.4**). A female was also recorded on one occasion during the 2014 breeding season.

9.5.2.4 Raptors

37. Scarce breeding bird surveys were undertaken during the 2013, 2014, 2015, 2017 and 2018 breeding seasons in order to determine the distribution of occupied nests/territories for target raptor and owl species within 2 km of the Site, and record breeding success. Targeted monitoring of breeding activity at known barn owl and osprey nests was also undertaken during the 2019 breeding season.

38. One raptor species was recorded breeding within the 2 km study area during baseline surveys: **osprey** (see **Confidential Technical Appendix 9.2** and **Confidential Figure 9.2.3** for details). In addition to establishing breeding success between 2013 and 2019, surveys for osprey aimed to identify regular flight paths to and from the nest in order to ascertain whether osprey would be commuting across the Site. Across all the survey years, osprey were only recorded overflying the Site on two occasions (in 2014 and 2018) with the majority of the flights heading south west and north east from the nest (i.e. away from the proposed Development). In the context of the wider area, this flight direction is not unexpected as the distribution of suitable fishing waterbodies is focussed to the east and south of the Site (from Loch Doon and Loch Brandon in the north east to Loch Trool and Loch Maeberry in the south). No evidence of osprey fishing on Loch Scalloch (located within the Site boundary) was recorded.

39. D&GRSG hold historic osprey breeding records within the 2 km study area at the same location identified during the baseline surveys (these include active breeding records recorded between 2015 to 2019). D&GRSG also hold breeding data on another osprey nest located in the wider area at a distance of >11 km north-east from the application boundary (see **Confidential Figure 9.2.1**).

40. **Goshawk** was recorded infrequently during scarce breeding bird surveys, with breeding behaviour (displaying and copulating) observed during the 2017 breeding season and an adult observed carrying prey in June 2018 (see **Confidential Technical Appendix 9.2** and **Confidential Figure 9.2.2** for details). Goshawk were also recorded on 16 occasions during flight activity surveys during the 2018 breeding season. Whilst no active nests were located in any years, the forest within and surrounding the Site provides suitable habitat for breeding and it is likely that at least one goshawk territory is present within 2 km of the Site in any year.

41. D&GRSG hold one historic goshawk breeding territory within the southern part of the application boundary (see **Confidential Figure 9.2.1**); the nest site was established in 2016 with unknown breeding success in that year, but each year between 2017 to 2019 breeding success failed at the nest site due to unknown reasons. D&GRSG hold records of three other historic goshawk breeding territories outside of the 2 km study area, located >3 km, >9 km and >17 km from the Site.

42. One location (BO_1) within the application boundary, but outside the 1 km study area, was identified to have some **barn owl** suitability (low to moderate) during baseline surveys; potential breeding activity was recorded in 2013, 2014 and 2017, but breeding was not confirmed (see **Confidential Technical Appendix 9.2** and **Confidential Figure 9.2.4** for details). No barn owls were recorded in 2018 or 2019. Barn owls were infrequently recorded at this location using the site for roosting. One other potential barn owl site (BO_3, no breeding or roosting birds were recorded at this site during the baseline surveys) was identified just inside the application boundary, but outside the 1 km study area and over 900 m to the closest new track layout. Three further potential barn owl sites were identified at least 1 km from the application boundary, but no breeding evidence was observed at any of these sites. D&GRSG do not hold any historic barn owl records within the Site, with closest historic records likely to be over 1 km from any proposed turbine locations.

43. **Hen harrier, merlin, red kite, short-eared owl** and **honey buzzard** were all infrequently recorded within the survey area, however no signs of breeding were recorded in any survey year. A single juvenile **golden eagle** was recorded over Loch Moan in June 2013 and there have been no further sightings or signs of a territory being established within 2 km of the Site. The D&GRSG do not hold any historic golden eagle breeding data within 6 km of the Site over the last five years. Although it is possible that there are un-marked golden eagles passing through the wider area > 2 km from the Site, the South of Scotland Golden Eagle Project has confirmed that to date, there has been no tagged golden eagle activity around the Site (latest pers comm. 30th July 2019).

44. Apart from two historic **peregrine falcon** breeding records located over 9 km north from the application boundary, D&GRSG held no historic breeding records within the 2 km study area for other raptor species.

45. **Raven, buzzard, kestrel** and **sparrowhawk** were all regularly observed as secondary (non-target) species.

9.5.2.5 Waders

46. Wader breeding activity was not recorded within the study area as the majority of the proposed Development is situated within Sitka spruce forestry. Three records of **common sandpiper** were recorded within the study area during the 2017 breeding season but breeding was not confirmed.

47. Non-breeding **golden plovers** were recorded on two occasions – a single individual in July 2017 and a flock of 34 individuals in November 2018.

9.6 Potential Effects

9.6.1 Scoped-in Important Ornithological Features

48. The assessment is applied to those 'scoped-in' IOFs of Medium or High Nature Conservation Importance (see **Table 9.4.2**) that are known to be present within the Site or surrounding area (as confirmed through survey results and consultations outlined above). These comprise: **black grouse**, **osprey** and **goshawk** (**Table 9.6.1**).

Table 9.6.1 Scoped in IOFs

IOF	Nature Conservation Importance	Reason for Inclusion
Black grouse	Medium	BoCC Red-listed; sensitive to windfarm impacts (SNH, 2018a)
Osprey	Medium	Annex I; Schedule 1
Goshawk	Medium	Schedule 1

49. In addition, it is necessary to consider the species' conservation status when assessing the likely effects. Relevant conservation status information for the 'scoped in' IOFs is detailed within **Table 9.6.2**.

Table 9.6.2 Conservation Status of Scoped in IOFs

IOF	Conservation Status	Information
Black grouse	Red List (HD, BDp1, BDp2, BDMr2)	Black grouse is Red-listed due to a historical decline in the UK, without substantial recent recovery. It also qualifies due to a severe decline in the UK breeding population size of >50% over 25 years. Breeding numbers in the UK declined by 80% between 1991 and 2004. Sim *et al*. (2008) estimated there to be 5,078 male black grouse in the UK in 2005, with approximately two-thirds of these occurring in Scotland. However, Forrester *et al*. (2007) estimate that in Scotland there are around 3,550 to 5,750 lekking males, representing about 71% of the British population. In Scotland the breeding range is contracting and numbers are declining, though the rate of decline varies regionally, being high in south western Scotland (-49%). Evidence however suggests that the national and regional populations are in unfavourable conservation status. The NHZ 19 population was estimated by Wilson *et al*. (2015) to be 121 (range 71-168) displaying males in 2005.
Osprey	Amber list (HD Rec, BR)	The NHZ 19 population was estimated to be 6 pairs in 2013 (Wilson *et al*. 2015). The Scottish Raptor Study Group however monitored 14 pairs in Dumfries & Galloway in 2018 (Challis *et al*. 2019), suggesting that numbers may be higher. The Scottish population has increased in the long-term to an estimated 224 pairs (Challis *et al*. 2019), and this is likely to be reflected in the NHZ 19 population.
Goshawk	BoCC Green List	There are an estimated 400 pairs in Britain (Musgrove *et al*. 2013). The NHZ 19 population was estimated to be 31 (range 17-41) pairs in 2013 (Wilson *et al*. 2015). The goshawk population appears to be expanding in range in Scotland (Forrester *et al*. 2007) and as the species is BoCC Green-listed, the national and regional/NHZ 19 populations are likely to be in favourable conservation status.

BoCC criteria (Eaton *et al*. 2015):
HD: Historical Decline. A severe decline in the UK between 1800 and 1995, without substantial recent recovery.
HDrec: Historical decline – recovery. Previously Red-listed for historical decline, followed by an increase of at least 100% over 25 years or the longer-term period.
BDp: Breeding Population Decline. Severe decline in the UK breeding population size, of >50%, over 25 years (BDp1) or the entire period used for assessments since the first BoCC review, starting in 1969 ("longer-term") (BDp2).
BDMr: Breeding Range Decline. Moderate decline (by more than 25% but less than 50%) in the last 25 years (BDMr1) or over longer term BDMr2).
BR: Breeding rarity. Species qualified as rare breeders if the UK breeding population was <300 pairs.

9.6.2 Scoped Out Designated Sites and Species

50. Based on distance from the Site, likely foraging ranges of qualifying interest species during the breeding season (Pendlebury *et al*. 2011; SNH, 2016a) and consultation with SNH and RSPB (**Table 9.3.1**), all designated sites have been scoped out of the assessment due to a lack of connectivity.

51. The following target species have also been scoped out due to either very low activity, few or no 'at-risk' flights, or a lack of breeding activity recorded during baseline surveys, and the general lack of suitable habitats within the Site:

- all goose species: restricted utilisation of the Site, and low estimated collision rates when considered in context with the national or flyway populations (see **Table 9.6.3**);
- all target raptor species (except osprey and goshawk): no breeding records within likely zone of influence of the proposed Development and low activity rates recorded during baseline surveys. Very low, or zero collision risk (**Table 9.6.3**);
- all wader species, no breeding records within likely zone of influence of the proposed Development and low activity rates recorded during baseline surveys with consequently no collision rates predicted (**Table 9.6.3**); and
- all passerine species, as per SNH (2017; 2018a) guidance.

52. Collision risk modelling was undertaken using the flight activity survey data across the baseline period (see **Technical Appendix 9.1, Annex E)**. The mean annual collision rate for each species has been calculated by summing the mean breeding season (2013 and 2018) and mean non-breeding season (2012-2013, 2013-2014, 2017-2018) collision rates.

Table 9.6.3 Collision Risk Modelling Results (collision rate per season)

Species	2012-2013 NBS	2013 BS	2013-2014 NBS	2017-2018 NBS[1]	2018 BS	Mean Annual	One every *X* years
Goshawk	0	0	0	N/A	0.1259	0.0629	15.89
Greylag goose	0.0052	0	0	0.0026	0	0.0026	382
Hen harrier	0	0.003	0.0063	N/A	0	0.0046	216
Osprey	0	0	0	N/A	0.018	0.0090	111

[1] Whilst flight activity surveys were only undertaken between March and August 2018, the seasons used for collision modelling are adjusted for different species groups (as per SNH 2017, refer to **Technical Appendix 9.1 Annex E** for further information). For geese, the non-breeding season is considered to be from 1st September to 14th May and therefore the geese recorded during the 2018 flight activity surveys have been considered in the 2017/2018 non-breeding season for the purposes of collision modelling.

Species	2012-2013 NBS	2013 BS	2013-2014 NBS	2017-2018 NBS[1]	2018 BS	Mean Annual	One every *X* years
Pink-footed goose	0	0	0	1.1934	0	0.3978	2.51

NBS = non-breeding season collision rate; BS = breeding season collision rate.

9.6.3 Construction Effects

9.6.3.1 Assumptions of the Assessment

53. The specifics of the proposed Development's construction period considered relevant for assessing potential effects on IOFs are:

- a construction period of approximately 18 months, with a worst-case scenario of commencement during a breeding season, and overlapping with two consecutive breeding seasons;
- phased forestry felling to facilitate construction; and
- construction activities would be limited to the working hours of 07:00 to 19:00 Monday to Friday and 07:00 to 16:00 on weekends.

54. Further details of the planned construction phase are presented in **Chapter 4: Development Description**.

9.6.3.2 Potential Impacts

55. The main potential impacts of construction activities across the Site are the displacement and disruption of breeding, foraging and roosting birds as a result of noise and visual disturbance over a short-term period (either the duration of a particular construction activity within working hours, or the duration of the whole construction period).

56. Impacts on birds would be confined to areas in the locality of forestry operations, temporary construction compounds, wind turbines, tracks and other infrastructure. Few attempts have been made to quantify the impacts of disturbance of birds due to activities of this type, and much of the available information is inconsistent. However, as a broad generalisation, larger bird species such as raptors, or those that feed in flocks in the open tend to be more susceptible to disturbance than small birds living in structurally complex habitats (such as woodland, scrub and hedgerow) (Hill *et al*. 1997).

57. Direct habitat loss would also occur due to the proposed Development's construction, which would be both temporary (e.g. construction compounds) and longer term (access tracks and turbines, forestry removal). This has the potential to impact on breeding, foraging or roosting individuals.

9.6.3.2.1 Black Grouse

58. **Impact:** black grouse may be displaced from lekking, breeding or foraging habitat due to the impacts of construction activities and habitat loss.

59. **Sensitivity:** Due to its Red-list conservation status and sensitivity to windfarms, the species is classified as Medium nature conservation importance (**Table 9.6.1**). The NHZ 19 and national populations are likely to be in unfavourable conservation status, and so the overall sensitivity of black grouse in the context of this site is considered to be Medium-High.

60. **Magnitude of Impact:** A single male was recorded lekking within the Site, approximately 800 m from the nearest proposed turbine location, and borrow pit (**Figure 9.1.4**).

61. Although no lek habitat would be directly affected, it is possible that some woodland edge habitat that is used for black grouse foraging or resting may be lost. However, based on distance from closest recorded activity, and low activity rates recorded within the Site, this is unlikely to significantly affect any lekking individuals or pair productivity, and so a Negligible spatial, and Long-term temporal magnitude of effect is predicted due to habitat loss.

62. According to an expert survey by Ruddock and Whitfield (2007) leks may be actively disturbed at 300–500m from disturbance source, and SNH has more recently advocated that a buffer of up to 750m should be applied to avoid all disturbance during the construction phase of windfarms (from information in Zwart *et al*. 2015). This advice has been considered during the proposed Development design process, and all proposed infrastructure is located over 750 m from the lek site.

63. Unmitigated, the magnitude of effect of construction disturbance on the regional (NHZ 19) black grouse population is considered to be Negligible spatial and Short-Term temporal.

64. **Significance of Effect:** The overall unmitigated effect from construction is classified as **Negligible** and is therefore **Not Significant** in the context of the EIA Regulations.

9.6.3.2.2 Osprey

65. **Impact:** foraging ospreys may be displaced from the site by disturbance associated with construction activities.

66. **Sensitivity:** as an Annex I and Schedule 1 listed species, osprey is classified as of Medium nature conservation importance. The national and NHZ 19 populations are considered to be in favourable conservation status and the species' sensitivity in the context of this site is Medium.

67. **Magnitude of Impact:** the closest osprey nest site and foraging area to any proposed turbine location is over 3 km distant, and approximately 1 km from the nearest access track, which is through forestry (see **Confidential Figure 9.2.3**). Within the Site there is very limited foraging habitat, with no signs of usage at the only waterbody, Loch Scalloch.

68. Ruddock & Whitfield (2007) present a wide range of previously advised potential disturbance distances for ospreys, but suggest from expert literature evidence that 750 m represents the likely uppermost distance. Nesting and foraging ospreys are therefore unlikely to be affected by habitat loss and construction disturbance. The magnitude of impact of construction on osprey is considered to be Negligible spatial and Short-term temporal.

69. **Significance of Effect:** The likelihood of any individuals being significantly affected by construction is very low. The unmitigated effect on the NHZ 19 osprey population is classified as **Negligible** and therefore **Not Significant** in the context of the EIA Regulations.

9.6.3.2.3 Goshawk

70. **Impact:** breeding or foraging goshawks may be displaced from the site during construction, either by disturbance or direct habitat loss.

71. **Sensitivity:** as a Schedule 1 listed species, goshawk is classified as Medium nature conservation importance. The national and NHZ 19 populations are considered to be in favourable conservation status and the species' sensitivity in the context of this site is Medium.

72. **Magnitude of Impact:** evidence recorded during baseline surveys suggests that the Site may host up to two goshawk territories, one of which is inside the Site boundary, within 500 m of an existing forestry track to be used as the access track. Activity was recorded widely across the Site and in general the conifer plantation habitat appears to be suitable for the species. The Site is subject to ongoing commercial forestry activities and vehicle movements, this is a dynamic and constantly changing environment and so breeding birds are likely to be accustomed to a reasonably regular amount of localised disturbance that would be similar to those associated with windfarm construction. This may result in the movement of a breeding territory between years, as a response to coupe felling or replanting activities.

73. Forestry Commission Scotland (2006) has recommended a safe working distance of up to 450m for forestry activities around a goshawk nest, with Ruddock & Whitfield (2007) concluding that birds may be affected up to 500m from disturbance source. As such, depending on the location of future territories, and the extent of planned felling activities, up to two territories may be affected by construction activities, including upgrading of, or increased usage of access tracks, and this may result in lowered productivity or even breeding failure over the short-term. However, it is considered unlikely that these territories would be lost, but rather the pairs would be more likely to relocate at sufficient distance from disturbance sources. As such a Low spatial and Short-term temporal magnitude of impact is predicted on the NHZ 19 population.

74. **Significance of Effect:** The unmitigated effect on breeding goshawk from construction is classified as **Minor Adverse** and is therefore **Not Significant** in the context of the EIA Regulations.

9.6.4 Operational Effects

9.6.4.1 Assumptions of the Assessment

75. The following operational impacts are assessed in this section:

- displacement of birds around operational turbines, including barrier effects; and
- collisions with turbines.

76. The specifics of the proposed Development's operational period considered relevant for assessing potential impacts on IOFs are:

- The proposed Development would consist of 18 turbines, with a rotor diameter of 150 m, a hub height of 125 m and an upper rotor tip height of 200 m;
- The proposed Development would include ancillary infrastructure including a permanent control compound, incorporating the control building, substation and energy storage. Crane hardstandings, underground cabling, temporary construction compounds, up to eight borrow pits, a permanent wind monitoring mast and laydown area as well as new and upgraded access tracks; and
- The operational phase of the proposed Development will be in-perpetuity.

9.6.4.2 Potential Effects: Displacement and Barrier Effects

77. The displacement of nesting and foraging birds from the Site has the potential to extend beyond the construction phase, and to occur during the operational phase.

78. Displacement away from operational wind turbines has been found to occur in a number of individual windfarm studies, although the effects vary considerably between sites and species. Considering a range of breeding bird species but predominantly waders and passerines at upland windfarms, Pearce-Higgins *et al*. (2012) showed that there were no displacement effects on any bird species from windfarms during the operational phase other than those that had already occurred during construction, and for some species, the effects during construction were reversed during operation with numbers returning to pre-construction numbers. More recently Sansom *et al*. (2016) have shown information to suggest that breeding golden plovers may be affected by operational turbines up to 400 m away, although displacement was less than complete, with an estimated 79 % reduction.

79. It is recognised that disturbance may occur due to maintenance or recreational activities throughout the operational phase, although since these individual occurrences are likely to be of shorter duration and smaller extent than construction activities, effects would be lower than those predicted for construction effects (see previous section).

80. An additional consideration is the displacement of birds from larger areas where the wind turbines act as a barrier to bird movement. The likelihood of this effect occurring tends to increase with windfarm size, with larger turbine arrays giving rise to a greater risk that birds are forced to alter their regular flight paths, resulting in an increase in distance flown and so energy expended. Modelling of energy costs to migrating bird species most likely to be sensitive to barrier effects (large and long-lived breeding birds such as seabirds) by Masden *et al*. (2010) found that there are unlikely to be any significant effects on populations. However, the increased cost of repeated diversions around a windfarm made by breeding birds moving between their nests and foraging areas may be more substantial (see Masden *et al*. 2010). This may also be the case for roosting birds such as geese regularly moving to feeding areas. Humphreys *et al*. (2015) concluded that the extent to which barrier and displacement effects have been differentiated between in the field is however highly debatable as both are manifested as a reduction of birds within the windfarm (Cook *et al*. 2014). It may be the case therefore that barrier effects during the breeding season have already been accounted for as displacement effects.

81. Pearce-Higgins *et al*. (2009) observed certain species experiencing localised population increases with proximity to windfarm infrastructure, so while some birds may be displaced locally, others may benefit from the introduction of new structures into the habitat, or some other consequence of construction. This finding was further supported by Pearce-Higgins *et al*. (2012) who reported significant increases in breeding numbers of skylarks and stonechats at windfarms.

9.6.4.2.1 Black Grouse

82. **Impact:** Black grouse is recognised as a species which is potentially sensitive to the presence of windfarms (e.g. SNH, 2018b), and windfarm operation may cause some displacement of breeding and foraging black grouse from areas close to turbines and other infrastructure.

83. **Sensitivity:** Medium-High.

84. **Magnitude of Impact:** Evidence presented from Austria has suggested that leks may be adversely affected by windfarms, although it is not clear what the exact causes may be: potentially a combination of turbine noise, maintenance activities or collisions (Zieler and Grünschachner-Berger, 2009). At the operational Griffin Windfarm near Dunkeld in Perthshire, early indications are that there were no obvious effects of the turbines on the closest lek which was approximately 500-600m from a turbine (Ross, 2012). At Berry Burn Windfarm south of Forres in the Scottish Highlands, the closest active leks to turbines recorded during the operational period were 240m away in 2014, and 175m away in 2016 (with a second 280m away) (MacArthur Green, 2018).

85. For the proposed Development, the closest lek site was located around 800 m from the closest proposed turbine location. Birds are therefore predicted to be unimpeded by new infrastructure, and able to continue to use the lek site, should forest conditions remain suitable. There is little evidence to suggest that black grouse use the Site for foraging or breeding, although it is possible that some movements may occur through the Site between leks in the wider area, but this is unlikely to be of a frequency that would cause sufficient displacement to affect the viability of any lek or the NHZ 19 population.

86. Although some vehicular movement along access routes may be required for maintenance activities through the lifespan of the proposed Development, this is likely to be of negligible frequency and duration compared to the construction phase and current forestry activities, and sufficiently distant to avoid any disturbance risks. Any increased recreational access associated with the proposed Development is unlikely to be at distances close enough to leks, or occurring early enough in the morning, to cause displacement.

87. The magnitude of impact of collision with turbine infrastructure on black grouse is considered to be negligible spatial and long-term temporal on the NHZ 19 black grouse population.

88. **Significance of Effect:** The effect on black grouse is classified as **Negligible** and is **Not Significant** in the context of the EIA Regulations.

9.6.4.2.2 Osprey

89. **Impact:** nesting or foraging osprey may be at risk of displacement from habitat around turbines or other infrastructure, thereby impacting on breeding success, productivity or survival rates.

90. **Sensitivity:** Medium.

91. **Magnitude of Impact:** with the closest osprey nest site located over 3 km from a proposed turbine location, nesting birds would not be displaced by operational turbines. Most of the flight activity recorded was in proximity to the nest and closest foraging site, with only two flights recorded over the Site during baseline surveys, reflective of the lack of suitable habitat within and adjacent to the Site. No displacement or barrier effects are considered likely as a result of wind farm operation and birds are likely to be able to forage without any reductions in productivity or fitness because of turbines. As such an impact of Negligible spatial and Long-term temporal magnitude is predicted.

92. **Significance of Effect:** the unmitigated effect on osprey from operational displacement is classified as **Negligible** and is therefore **Not Significant** in the context of the EIA Regulations.

9.6.4.2.3 Goshawk

93. **Impact:** nesting or foraging goshawks may be at risk of displacement from habitat around turbines or other infrastructure, thereby impacting on breeding success, productivity or survival rates.

94. **Sensitivity:** Medium.

95. **Magnitude of Impact:** baseline survey data indicates that the site may hold at least two territories, with inter-annual variation in distribution likely to occur each year as a result of ongoing commercial forestry activities within the Site.

96. As a predominantly woodland species, it is unlikely that goshawks would be subject to displacement around operational turbines compared to some open moorland species for example. Some localised loss of foraging or nesting habitat in close proximity to operational turbines may occur (which may be at least in part offset by areas of new woodland planting as part of the Clauchrie Forest Design Plan), but this is unlikely to result in a significant effect on the viability of any territory, with sufficient woodland habitat still likely to exist in the wider area. Creation of infrastructure may result in increased forest edge habitat, which may increase foraging opportunities. The impact of displacement on the goshawk NHZ 19 population is considered to result in an impact of Negligible spatial and Long-term temporal magnitude.

97. **Significance of Effect:** With the NHZ19 and national populations of goshawk likely to be in favourable conservation status, the unmitigated effect from operational displacement is classified as **Negligible** and is **Not Significant** in the context of the EIA Regulations.

9.6.4.3 Potential Effects: Collision Risk

98. Birds that utilise the airspace within the windfarm area at potential collision heights would be at risk of collision with wind turbines. The risk of collision with moving wind turbine blades is presumed to be related (although not necessarily linearly) to the amount of flight activity over the site, the topography of the site, species' behaviour and the ability of birds to detect and manoeuvre around rotating turbine blades. Collision rates are likely to increase with a windfarm's proximity to large concentrations of birds, whether these are breeding and foraging birds, wintering birds, or those utilising specific areas for local or large-scale migration (Gill *et al*. 1996).

99. Band *et al*. (2007) describe a method of quantifying potential bird collisions with onshore wind turbines, in which the following estimates are combined:

- the flight activity rate per unit area per season, extrapolated from a representative sample of observations; and
- the likelihood that a flight through the rotor swept area would result in a collision.

100. Finally, an 'avoidance rate' is applied to account for behavioural adaptation of birds to the presence of wind turbines. This results in a figure for the likely mortality rate at the proposed Development which is then assessed within the context of the species' relevant populations to determine the significance of any losses.

101. CRM summary results are presented in **Table 9.6.3** and detailed in **Technical Appendix 9.1**.

9.6.4.3.1 Black Grouse

102. **Impact:** black grouse flying within the Site may be subject to a collision risk with wind turbines or other infrastructure, thereby increasing the mortality rate of the population above background levels.

103. **Sensitivity:** Medium-High.

104. **Magnitude of Impact:** Black grouse are known to be at risk of colliding with structures close to ground level, such as fences and wires, and deer fencing has proved to be a particular hazard for this species. Zeiler and Grünschachner-Berger (2009) reported cases of black grouse mortality resulting from collisions with various structures close to ground level, and reports strong declines in black grouse numbers in local populations in areas where three wind farms were constructed in the Alpine zone in Austria.

105. One black grouse was recorded during flight activity surveys (**Table 9.5.2**) but the flight was not recorded at Potential Collision Height (PCH), and no CRM was undertaken.

106. There is a theoretical collision risk to black grouse from structures such as fences and railings of the steps associated with wind turbines. However, based on the distribution of lekking black grouse around the Site, the likelihood of this occurring is considered to be low.

107. The magnitude of impact of collision with turbine infrastructure on black grouse is considered to be negligible spatial and long-term temporal on the NHZ 19 black grouse population.

108. **Significance of Effect:** The effect on black grouse is classified as **Negligible** and is **Not Significant** in the context of the EIA Regulations.

9.6.4.3.2 Osprey

109. **Impact:** Osprey flying within the Site may be subject to a collision risk with wind turbines, thereby potentially increasing the mortality rate of the population above background levels.

110. **Sensitivity:** Medium.

111. **Magnitude of Impact:** One flight was recorded during flight activity surveys (**Table 9.5.2**) at PCH and a resultant mean annual collision risk of 0.009, or one collision every 111 years, was predicted (**Table 9.6.3**). Most of the flight activity recorded was in proximity to the nest located over 3 km from a proposed turbine location, and the Site does not appear to form part of a regular commuting route, with most flights recorded directed in the opposite direction. As such an impact of Negligible spatial and Long-term temporal magnitude is predicted.

112. **Significance of Effect:** the effect on osprey from operational collision risk is classified as **Negligible** and is therefore **Not Significant** in the context of the EIA Regulations.

9.6.4.3.3 Goshawk

113. **Impact:** Goshawk flying within the Site may be subject to a collision risk with wind turbines, thereby potentially increasing the mortality rate of the population above background levels.

114. **Sensitivity:** Medium.

115. **Magnitude of Impact:** Goshawk were recorded in flight within the Site during flight activity surveys in the breeding and non-breeding seasons. All 16 flight events were recorded at potential collision height (**Table 9.5.2**), five of these flight events were recorded within the CRAA at PCH and a resultant mean annual collision risk of 0.0629, or one collision every 15.89 years, was predicted (**Table 9.6.3**).

116. Although some areas of forestry around turbines may be opened up and therefore provide enhanced foraging opportunities, goshawks are in general likely to fly below turbine rotor heights when hunting within and adjacent to forestry, and only regularly fly at risk heights when displaying around nest sites. With no nesting confirmed within proximity to proposed turbine locations, collision risk is likely to be low.

117. The NHZ 19 population of goshawk was estimated to be 31 pairs in 2013 (Wilson *et al*. 2015). Based on an adult survival rate of 0.830 (BTO BirdFacts), additional mortality associated with collisions would result in an increase in annual mortality rate over the baseline level by 0.6 %. The goshawk population appears to be expanding in range in Scotland (Forrester *et al*. 2007) and as the species is BoCC Green-listed, the national and regional/NHZ 19 populations are likely to be in favourable conservation status. As such, low spatial and long-term temporal magnitude of impact is predicted.

118. **Significance of Effect:** the unmitigated effect on goshawk from operational displacement is classified as **Minor Adverse** and is therefore **Not Significant** in the context of the EIA Regulations.

9.6.4.4 Potential Effects: Lighting

119. There are potential lighting impacts on birds where turbines have a rotor tip height over 150 m as these turbines would need to be lit in accordance with Article 222 of the UK Air Navigation Order (ANO) (in line with current guidance from the Civil Aviation Authority (CAA, 2019).

9.6.4.4.1 All IOFs

120. **Impact:** impacts on IOFs might arise as a consequence of deployment of obstruction lighting on turbines over 150 m to blade tip. For the proposed Development, the applicant is considering radar activated lighting, which would illuminate only when aircraft pass overhead. It is estimated, that with radar activation, turbines may be lit for only

5% of the time. Due to the low temporal occurrence of artificial lighting at the proposed Development, effects on IOFs are likely to be small. However, two effects of the artificial lighting on IOFs are possible: birds may be attracted and thereby placed at higher risk of collisions, or they may avoid the lights (due to the paucity of illumination, birds may not become habituated to the lights) with a consequent displacement impact.

121. **Sensitivity:** medium for osprey and goshawk, and medium-high for black grouse

122. **Magnitude of Impact: Technical Appendix 9.1 Annex F** provides a literature review on the potential impacts of artificial lighting on birds. For breeding birds, there are no studies or observations reporting clear examples of any seasonal activities of birds being affected by exposure to artificial light. The review concluded that there is very little, if any, impact of artificial light on photoperiod responses (e.g. daily period of time birds are active, or breeding or migratory cues) of wild birds.

123. It is widely recognised that nocturnal migrant birds are attracted to artificial light while migrating, and historical reports of collisions associated with structures such as lighthouses or oil rigs suggest that risks are highest during periods of poor visibility and high winds. Watson *et al*. (2016) conclude that artificial lighting changes behaviour of nocturnal migrant birds, either by changing their flight paths to pass over lit areas, by flying at lower altitudes over lit areas, by increasing their call rates over lit areas, or by remaining longer over lit areas.

124. The evidence provided in the literature review indicates that lights on turbines may increase numbers of nocturnal migrant birds that collide, particularly if lights are steady rather than flashing. Obstruction lighting on turbines however appears to be several orders of magnitude less effective than the light from lighthouses and lightships in attracting nocturnal migrant birds.

125. Regarding potential displacement around turbines, Day *et al*. (2017) reported that migrating eiders showed higher avoidance at night of an oil-production facility in Alaska when it was illuminated with a hazing light system. However, this seems to be a rare example of birds being displaced by artificial lights, and there seem to be more examples of birds using artificial lights to their benefit, such as the use by shorebirds of artificial lights to allow them to feed visually at night.

126. Based on the literature review, it is considered that there is little evidence in the scientific literature to indicate that any of the IOFs would be significantly impacted either negatively or positively by lighting requirements, particularly at a relatively small project such as the proposed Development, located in low conservation value conifer plantation habitat.

127. **Significance of Effect:** in conclusion, the magnitude of impact on IOFs associated with lighting is predicted to be negligible spatial and long-term temporal, and at worst, **Minor adverse** and **Not Significant** in the context of the EIA Regulations.

9.7 Mitigation

128. No significant effects were predicted for any IOF, and therefore no specific mitigation is required. General mitigation to be undertaken during the construction and operational phases are specified below.

9.7.1 Construction Phase

129. A Breeding Bird Protection Plan (BBPP) would be set up as standard to avoid the destruction or disturbance of any nest site (or lek in the case of black grouse), with species-specific temporal and spatial restrictions around construction works should any active nest be located.

130. Pre-construction breeding bird surveys would be undertaken by a suitably qualified ornithologist as part of the BBPP to determine whether any breeding activity is taking place within potential species-specific disturbance zones of any proposed infrastructure (assumed to be 500 m for Schedule 1 raptors and 750 m for black grouse). If breeding (or lekking in the case of black grouse) does occur within a potential disturbance zone, all construction works would be halted immediately and a disturbance risk assessment would be prepared. The risk assessment would consider the likelihood and possible implications of the associated construction activities on the breeding attempt and set out necessary measures to ensure that no disturbance occurs. The proposed mitigation measures, and if required, the exact distance of any disturbance-free zone would be agreed with SNH, within which any construction activity that is considered to be potentially disturbing would be prohibited in that area until chicks are fledged (or the core lekking period of March to May has passed in the case of black grouse).

9.7.2 Operational Phase

One of the aims of the Habitat Management Plan (HMP) for the proposed Development is to increase the amount of native woodland coverage within the land ownership boundary (see **Technical Appendix 8.7** for details). This mitigation measure would help compensate for any habitat loss or displacement effects on black grouse as well as enhance the existing habitat for species such as goshawk, and provide wider biodiversity improvements.

9.8 Residual Effects

131. As there is no mitigation required, the level of significance and therefore residual effects are unchanged for all IOFs (negligible or minor adverse, not significant).

9.9 Cumulative Assessment

132. The assessment of ornithological effects associated with the proposed Development alone predicted unmitigated non-significant effects for every IOF, due to the low suitability of habitat within the Site, lack of breeding records, and the low activity levels of IOFs recorded during baseline surveys. No breeding pairs of any IOF are likely to be significantly affected by the proposed Development. It is therefore considered that the magnitude of impacts of the proposed Development on IOFs would contribute very little to the overall cumulative effect for each potential impact at an NHZ 19 level. An NHZ-level cumulative assessment is therefore not considered necessary.

9.10 Summary

133. This chapter has assessed the potential effects associated with the construction and operation of the proposed Development on birds.

134. The compilation of baseline information for the ornithological assessment consisted of a desk-based assessment and field surveys conducted between September 2012 to August 2019 in accordance with SNH (2017, 2014, 2013 and 2010) guidance.

135. IOFs identified from the baseline assessment were black grouse, goshawk and osprey.

136. Effects from unmitigated construction activities were assessed as not significant in the context of the EIA Regulations. A BBPP and pre-construction surveys would be set up as standard to avoid the destruction or disturbance of any nest site, with species-specific temporal and spatial restrictions around construction works.

137. During the operational period, effects were also assessed as not significant in the context of the EIA Regulations. An HMP would increase the amount of native woodland coverage within the land ownership boundary and this would help compensate for any habitat loss or displacement effects on black grouse.

138. A cumulative assessment was not considered necessary as the magnitude of impacts of the proposed Development on IOFs would contribute very little to the overall cumulative effect for each potential impact at an NHZ 19 level.

139. As such, no significant effects, either due to the proposed Development alone, or cumulatively with other projects were predicted.

Table 9.10.1 Summary Table

Description of Effect	Significance of Potential Effect		Mitigation Measure	Significance of Residual Effect	
	Significance	Beneficial / Adverse		Significance	Beneficial / Adverse
During Construction					
Black grouse	Negligible (Not significant)	Adverse	BBPP and pre-construction surveys. Spatial and temporal restrictions of construction activity if required.	Negligible	Adverse
Osprey	Negligible (Not significant)	Adverse		Negligible	Adverse
Goshawk	Minor (Not significant)	Adverse		Minor	Adverse
During Operation: Displacement					
Black grouse	Negligible (Not significant)	Adverse	None required (HMP would provide enhanced habitat for black grouse)	Negligible	Adverse
Osprey	Negligible (Not significant)	Adverse	None required	Negligible	Adverse
Goshawk	Negligible (Not significant)	Adverse	None required (HMP would provide enhanced habitat for goshawk)	Negligible	Adverse
During Operation: Collision Risk					
Black grouse	Negligible (Not significant)	Adverse	None required	Negligible	Adverse
Osprey	Negligible (Not significant)	Adverse	None required	Negligible	Adverse
Goshawk	Minor (Not significant)	Adverse	None required	Minor	Adverse
During Operation: Lighting Effects					
All IOFs	Minor (Not significant)	Adverse	None required	Minor	Adverse
Cumulative Effects					
All IOFs	Cumulative assessment not considered necessary				

9.11 References

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