

8 Ornithology

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8 Ornithology

8.1 Executive Summary

- 8.1.1 This chapter provides an assessment of the potential effects associated with the Proposed Development on ornithological resources present.
- 8.1.2 Ornithological surveys have regularly taken place for wind farm projects in the immediate vicinity of the Proposed Development over the last 15 years and as a result, a number of adjacent sites' survey areas have at least in part overlapped spatially with the Proposed Development site. The baseline data for the current assessment, in accordance with appropriate Scottish Natural Heritage (SNH) guidance, utilises relevant data recorded for local wind farm sites as well as one season of field surveys in 2018. The baseline data are used to compare the potential impacts of the Proposed Development with that of the Existing Development.
- 8.1.3 In general, the bird assemblage recorded in 2018 corresponded with results of surveys undertaken for other wind farm projects in the local area, with few breeding target species present within the study area. Ornithological receptors taken forward in the assessment were curlew and golden plover. The ornithological assessment identified habitat loss and disturbance during the construction and decommissioning phases, and displacement, collision risk and lighting effects during the operational phase, as likely effects. Unmitigated effects from construction, operation and decommissioning activities were assessed as **minor adverse** and **not significant** in the context of the EIA Regulations.
- 8.1.4 A cumulative assessment was undertaken for curlew, and it was concluded that no further mitigation is required for the Proposed Development, and all cumulative effects are **not significant**.

8.2 Introduction

- 8.2.1 This chapter considers the potential impacts of the Proposed Development on the ornithological features present at the site. There is currently a wind farm operating on the site, the Existing Development, which has been generating power for 23 years and is now nearing the end of its operational life.
- 8.2.2 This chapter considers the potential effects on ornithology associated with the construction, operation and decommissioning of the Proposed Development which will replace the Existing Development. The specific objectives of the chapter are to:
- describe the ornithological baseline;
 - describe the assessment methodology and significance criteria used in completing the impact assessment;
 - describe the potential effects of predicted impacts (direct or indirect) on ornithological receptors;
 - describe the mitigation measures proposed to address likely significant effects; and
 - assess the residual effects remaining following the implementation of mitigation, including cumulatively with other wind farm projects.
- 8.2.3 This chapter is supported by Appendix 8.1, which contains the following Annexes:
- Annex A – Ornithological legal protection;
 - Annex B – Ornithological survey methodologies;
 - Annex C – Ornithological survey effort and general information;

- Annex D – Ornithological survey results;
- Annex E – Collision risk assessments;
- Annex F – Review of the effects of artificial light on birds in relation to deployment of obstruction lighting on wind turbines; and
- Annex G – Supplementary desk study information.

8.2.4 This chapter is supported by the following figures:

- Figure 8.1 – Ornithological Designated Sites within 20 km;
- Figure 8.2 – Wind Farm Projects within 2 km;
- Figure 8.3 – Site Boundaries and Study Areas;
- Figure 8.4 – Vantage Point and viewshed 2018;
- Figure 8.5 – Flight Activity Results: 2018 Breeding Season;
- Figure 8.6 – Wader Activity: 2018;
- Figure 8.7 – Raptor Activity: 2018; and
- Figure 8.8 – Cumulative Wind Farms within NHZ 19.

8.2.5 This ornithology assessment has been undertaken by MacArthur Green.

8.3 Legislation, Policy and Guidelines

Legislation

8.3.1 Relevant European legislation and guidance documents have been reviewed and taken into account as part of this ornithological assessment. Of particular relevance are the following European legislation:

- Directive 2009/147/EC on the Conservation of Wild Birds ('Birds Directive');
- Directive 92/43/EEC on Conservation of Natural Habitats and of Wild Fauna and Flora (as amended) ('Habitats Directive'); and
- Environmental Impact Assessment Directive 2014/52/EU.

8.3.2 The following national legislation is considered as part of the ornithology assessment:

- The Wildlife and Countryside Act 1981 (as amended);
- The Conservation (Natural Habitats &c.) Regulations 1994 (as amended) (The Habitats Regulations);
- The Nature Conservation (Scotland) Act 2004 (as amended); and
- The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017.

Planning Policy

8.3.3 Chapter 5 sets out the planning policy framework that is relevant to the EIA. The policies set out include those from the South Lanarkshire Local Development Plan 2015. This section also considers the relevant aspects of Scottish Planning Policy (SPP), Planning Advice Notes and other relevant guidance. Of relevance to the ornithology assessment presented within this chapter, regard has been had to the following policies:

- 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.

Guidance

8.3.4 Cognisance has been made of the following best practice guidelines/guidance etc:

- SERAD (Scottish Executive Rural Affairs Department) (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;
- European Commission (2010). Natura 2000 Guidance Document 'Wind Energy Developments and Natura 2000'. European Commission, Brussels;
- The UK Biodiversity Action Plan (BAP) and UK Post-2010 Biodiversity Framework (2012);
- Eaton MA, Aebischer NJ, Brown AF, Hearn RD, Lock L, Musgrove AJ, Noble DG, Stroud DA and Gregory RD (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;
- Scottish Natural Heritage (2000). *Windfarms and birds: calculating a theoretical collision risk assuming no avoidance action*. SNH Guidance Note;
- Scottish Natural Heritage (2012). *Assessing the Cumulative Impact of Onshore Wind Energy Developments*;
- Scottish Natural Heritage (2014a). *Recommended bird survey methods to inform impact assessment of onshore wind farms*;
- Scottish Natural Heritage (2014b). *Repowering onshore wind farms: bird survey requirements*.
- Scottish Natural Heritage (2016a). *Assessing connectivity with Special Protection Areas (SPAs)*. Version 3;
- Scottish Natural Heritage (2016b). *Environmental Statements and Annexes of Environmentally Sensitive Bird Information; Guidance for Developers, Consultants and Consultees* Version 2;
- Scottish Natural Heritage (2018a). *Assessing the cumulative impacts of onshore wind farms on birds*. SNH Guidance Note;
- Scottish Natural Heritage (2018b). *Assessing the impact of repowered wind farms on nature*, consultation draft;
- Scottish Natural Heritage (2018c). *Assessing significance of impacts from onshore windfarms on birds out with designated areas*. Version 2; and
- Scottish Natural Heritage (2018d). *Environmental Impact Assessment Handbook – Version 5: Guidance for competent authorities, consultation bodies, and others involved in the Environmental Impact Assessment process in Scotland*.

8.4 Consultation

8.4.1 During the application EIA process, SNH provided comment relating to an Ornithological Scoping Report (Appendix 4.1) for the Proposed Development, and specifically the collection of baseline

ornithology data which would be used to inform this assessment. A summary of the SNH response and how it was addressed in this Chapter is presented in Table 8.1.

Table 8.1 – Key Issues

Consultee	Summary of Key Issues	Where Addressed in Chapter
SNH 13 July 2018	Ornithology: - <i>'I note that you intend to follow the [SNH] 2014 guidelines. Overall the approach that you have set out will deliver sufficient information for a full assessment. Re flight activity, I agree that the presence of the existing turbines is problematic but the solution you suggest is a sensible pragmatic approach. I think that the long run of annual monitoring data from the existing site will help give a more stable baseline'</i> .	The methods and data sources considered for obtaining sufficient information to allow a robust assessment of the Proposed Development are presented in Section 8.5 and in Appendix 8.1.

8.5 Assessment Methodology and Significance Criteria

8.5.1 This chapter takes an appropriate and topic-specific approach to assessment of the Proposed Development within the parameters identified in Chapter 3: Proposed Development. This chapter provides a worst-case assessment of the Proposed Development for ornithology and presents sufficient information for consultees and the decision makers to comment on and determine the application within the parameters of the Proposed Development.

8.5.2 The field survey methods carried out for the 2018 breeding season are based on the advice presented in SNH (2014b) 'Repowering onshore wind farms: bird survey requirement'. The SNH consultation draft guidance 'Assessing the impact of repowered wind farms on nature' (June 2018b) is at an early stage of development, however it appears to follow closely the recommendations in the existing guidance note.

8.5.3 When assessing the effects for a repowering scheme, the bird activity around turbines on the existing Hagshaw Hill Wind Farm site is likely to be different from the expected bird activity on the restored site after decommissioning. Baseline bird activity should therefore be estimated using a qualitative, desk-based approach (SNH, 2018b). To assess potential collision risk for repowering schemes, SNH guidance (2014b) recommends a combination of at least two of the following methods:

- use bird data from similar sites in the local area;
- for breeding species, use nest site locations as an approximate indicator of likely flight activity; and
- use old flight activity data from the original site (if available).

8.5.4 SNH guidance also states that *'flight activity surveys should not be carried out over operational wind farms'* (SNH, 2014b), but *'if the proposal extends outside the footprint of the existing wind farm, then new survey is likely to be required in those areas, as it would for any normal wind farm extension'* (SNH, 2018b).

8.5.5 To meet the SNH (2014b) guidelines, potential collision risk for the site has been assessed through the combination of a desk-based study assessing bird data from similar wind farm sites surrounding the Proposed Development (providing data from 2003 to 2015) and recent field data on breeding birds within the site (survey data from 2018). The 2018 baseline surveys also collected flight activity data for the area of the site that extends outside the footprint of the Existing Development.

Site status and context

- 8.5.6 The Existing Development is an operational wind farm comprising 26 turbines. The Proposed Development involves a repowering of the Existing Development, by replacing the existing 26 turbines with 14 modern, larger turbines. Of these 14 turbines, seven will comprise Phase 1 of the Proposed Development, located on an area of land adjacent to the south of the Existing Development, required in order to accommodate the wake separation distances for modern, larger turbines, with the other seven comprising Phase 2, which would be within the Existing Development site boundary (Figure 8.2).
- 8.5.7 It is intended to commence development in the first phase, to the south of the Existing Development turbines, in advance of, or in parallel with, the decommissioning of the existing turbines.

Scope of Surveys

- 8.5.8 Consultation was undertaken with SNH to reach agreement on the scope of ornithological surveys required to inform the assessment (Table 8.1).
- 8.5.9 As per SNH (2014b) guidance, it is considered that one breeding season of survey effort is sufficient to allow a robust characterisation of the baseline ornithological assemblage and usage of the site and surrounding area, when used in combination with the substantial information collated for other nearby projects (see paragraph 8.13.3).
- 8.5.10 Ornithological surveys have regularly taken place for wind farm projects in the immediate vicinity of the Proposed Development over the last 15 years, as well as ongoing monitoring for the Hagshaw Hill Extension Wind Farm. As a result, a number of adjacent sites' survey areas have at least in part overlapped spatially with the Proposed Development site. It is therefore considered that the ornithological baseline conditions within the development site are well known.

Study Area

- 8.5.11 SNH (2014b) guidance suggests that distribution and abundance surveys should be carried out following SNH (2014a) guidance. The 2018 ornithology surveys therefore focused on the site and appropriate buffer areas (collectively the 'study areas') which were applied, as recommended by SNH (2014a) guidance.
- 8.5.12 The revised SNH guidance (2018a) '*Assessing the cumulative impacts of onshore wind farms on birds*' which closely follows recommendations in previous guidance (2012) suggests that the impacts of wind farm developments can be assessed at a number of scales ranging from the very local, regional (such as a Natural Heritage Zone (NHZ)) or a national scale (see paragraph 8.5.33). The Proposed Development overlaps with two NHZs (NHZ 19 Western Southern Uplands & Inner Solway and NHZ 17 West Central Belt), however as the uplands habitats and topography of the site are similar to those of NHZ 19 rather than NHZ 17, cumulative effects were assessed using the NHZ 19 national scale.
- 8.5.13 The specific study areas for the 2018 baseline surveys are as follows:
- ornithological designated sites: within 20 km of the site (Figure 8.1);
 - flight activity (Vantage Point) surveys: within a 500 m buffer of the outermost turbine locations, referred to for collision risk modelling purposes as the Collision Risk Analysis Area (CRAA) (see Appendix 8.1, Annex E and Figure 8.4);
 - scarce breeding birds (raptors, owls and black grouse): 2 km buffer around the site (Figure 8.3);
 - black grouse surveys: 1.5 km buffer around the site (Figure 8.3);
 - breeding birds (waders): within suitable upland habitat (non-forested), areas within the existing Hagshaw Hill Wind Farm site and the area of proposed turbine extension to the south (Figure 8.3); and

- cumulative effects: projects within NHZ 19 (Figure 8.8).

Information and Data Sources

- 8.5.14 The desk study gathered ornithological information that was available within Environmental Statements and associated Technical Appendices in the public domain relating to applications of the following six local wind farm projects (see Figure 8.2):
- Hagshaw Hill Extension Wind Farm (HH);
 - Nutberry Wind Farm (NU);
 - Galawhistle Wind Farm (GA);
 - Dalquhandy Wind Farm (DQ);
 - Cumberhead (Nutberry Extension) Wind Farm (CU); and
 - Douglas West Wind Farm (DW).
- 8.5.15 In addition, the desk study used information relating to the following proposed local wind farm project which was not taken forward for development:
- Douglas West Community Wind Farm (DWCW). The site boundary for this project largely overlapped with the Douglas West Wind Farm.
- 8.5.16 The desk study also used the following sources for ornithological data:
- SNH, including Sitelink (<http://gateway.snh.gov.uk/sitelink/index.jsp>); and
 - A report by Dunnock Environmental Services called 'Final Breeding Raptor Survey Report 2015 of the Proposed Douglas West & Dalquhandy DP Renewable Energy Project' (DES, 2015). The DES (2015) report contains information provided by the South Strathclyde Raptor Study Group (SSRSG).

Desk Study

- 8.5.17 Table 8.2 outlines the timeline of baseline ornithology surveys carried out for local wind farm projects listed in paragraph 8.5.14. Specific periods of baseline survey were:
- HH: April 2003 to July 2004;
 - NU: April 2004 to March 2006;
 - GA: September 2007 to August 2009;
 - DWCW: November 2009 to November 2010, a scoping visit was also carried out at the DWCW site in September 2009;
 - DQ: November 2011 to November 2012;
 - CU: May 2013 to August 2014; and
 - DW: September 2014 to September 2015.
- 8.5.18 A range of ornithology data was collected at these wind farms during breeding and non-breeding seasons. Each wind farm covered some or all of the following survey types:
- flight activity surveys (summer vantage point watches and autumn migration vantage point watches);
 - scarce breeding bird surveys (walkover surveys for raptors and any other species listed in Schedule 1 of the Wildlife and Countryside Act 1981);

- black grouse surveys; and
- upland breeding bird surveys (waders and any other species of conservation concern).

Table 8.2 – Timeline of Baseline Ornithology Surveys Undertaken for Nearby Wind Farm Sites

Wind Farm	Year (2003 to 2017)																
	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17		
HH							Operational Monitoring										
NU																	
GA																	
DWCW																	
DQ																	
CU																	
DW																	

Field Surveys

8.5.19 Ornithological fieldwork commenced in March 2018 and was completed in August 2018, and comprised the following surveys (see Appendix 8.1, Annexes B and C for further details):

Flight activity surveys:

8.5.20 Flight activity surveys were carried at one vantage point each month between March and August 2018, following SNH (2014a) guidance. Out of a target survey effort of 36 hours per vantage point per season as per SNH (2014) guidance, a total of 34 hours was achieved during optimal conditions, with a further hour occurring during periods of poorer visibility (<1 km).

Scarce breeding bird surveys:

8.5.21 Monthly surveys from April to July 2018 for breeding raptors and any other species listed in Schedule 1 of the Wildlife and Countryside Act 1981 took place within the site and a survey area buffer of up to 2 km, following Hardey *et al.* (2013) and Gilbert *et al.* (1998) guidance.

Black grouse surveys:

8.5.22 Black grouse surveys took place within the site boundary and a survey area buffer of up to 1.5 km in 2018 in April and May 2018, following Gilbert *et al.* (1998) guidance.

Upland breeding bird surveys:

8.5.23 One breeding season focussed on recording breeding waders and any other species of conservation concern found within the site and a 500 m buffer, following Brown & Shepherd (1993) guidance. A total of four breeding bird surveys took place from April to July 2018.

Assessment of Potential Effect Significance

8.5.24 This section defines the methods used to assess the significance of effects through the process of an evaluation of sensitivity of receptor (a combination of Nature Conservation Importance (NCI) and Conservation Status) and magnitude of impact for each likely impact. The assessment focuses on a 'worst-case' Proposed Development as described below.

8.5.25 The evaluation for wider-countryside interests (not relating to Natura 2000 sites covered by the Habitats Regulations Appraisal (HRA) process) 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 NCI and Conservation Status of the bird populations present to establish level of sensitivity;

- establishing the magnitude of 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 with respect to 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 or enhancement are considered.

8.5.26 The assessment is based on the Proposed Development layout as described in Chapter 3: EIA. In relation to describing impacts on ornithological receptors, the relevant specifications used to determine the ‘worst-case’ Proposed Development involves:

- 14 turbines with a tip height of 200 m, a hub height of 122.5 m, a blade length of 76 m and a rotor diameter of 155 m. Each turbine will have a typical generating capacity of around 6 MW.

Sensitivity of Receptor

8.5.27 Determination of the level of sensitivity of a feature is based on a combination of the feature’s NCI and Conservation Status.

8.5.28 There are three levels of NCI as detailed in Table 8.3.

Table 8.3 – Determining Factors of a Population’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 rare breeding species noted on the latest Birds of Conservation Concern (BoCC) Red list (Eaton <i>et al.</i> 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.

8.5.29 Important Ornithological Features (IOFs) to be assessed were taken to be those species of High and Medium NCI.

8.5.30 As defined by SNH (2018c), 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*”. Conservation status is considered by SNH (2018c) 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”.
- 8.5.31 SNH (2018c) 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.”
- 8.5.32 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. For the purpose of this assessment, the site is considered to be located within NHZ 19 (see paragraph 8.5.12). 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.

Magnitude of Impact

- 8.5.33 An impact is defined as a change of a particular magnitude to the abundance and/or distribution of a population as a result of the Proposed Development. Effects can be adverse, neutral or favourable.
- 8.5.34 In determining the magnitude of impacts, the resilience of a population to recover from temporary adverse conditions is considered in respect of each potentially affected population.
- 8.5.35 The sensitivity of individual species to disturbance during relevant behaviours is considered when determining spatial and temporal magnitude of effect and is assessed using guidance described by Bright *et al.* (2006), Hill *et al.* (1997) and Ruddock and Whitfield (2007).
- 8.5.36 Impacts are judged in terms of magnitude in space and time. There are five levels of spatial impacts and temporal impacts as detailed in Table 8.4 and Table 8.5 respectively.

Table 8.4 – Spatial Magnitude of Impact

Spatial Magnitude	Description
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.
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.

Spatial Magnitude	Description
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 8.5 – Temporal Magnitude of Impact

Temporal Magnitude	Description
Permanent	Effects continuing indefinitely beyond the span of one human generation (taken as approximately 25-30 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.

Potential Cumulative Effects

- 8.5.37 The Cumulative Assessment section (section 8.10) presents information about the potential cumulative effects of the Proposed Development combined with other operational, consented or proposed wind farm projects that are located within NHZ 19.
- 8.5.38 SNH (2018a) has provided guidance on assessing the cumulative effects on birds. This assessment follows the principles set out in that guidance.
- 8.5.39 Cumulative effects may include cumulative disturbance-displacement, collision mortality, habitat loss or barrier effects. Some cumulative impacts, such as collision risk, may be summed quantitatively, but according to SNH (2018a) *“In practice, however, some effects such as disturbance or barrier effects may need considerable additional research work to assess impacts quantitatively. A more qualitative process may have to be applied until quantitative information becomes available for developments in the area, e.g. from post-construction monitoring or research”*.
- 8.5.40 The main projects likely to cause similar effects to those associated with the Proposed Development are other operational wind farms, or those under construction, consented, or in the planning process within NHZ 19 (Table 8.6).
- 8.5.41 Wind farm projects at scoping stage have generally been scoped out of the cumulative assessment because they usually do not have sufficient information on potential effects to be included, as the baseline survey period is ongoing, or results have not been published. However, despite being at scoping stage, the proposed Douglas West Extension and revised Cumberhead projects are included

due to their proximity to the site, and because sufficient information is available for inclusion in the assessment. Cumberhead Wind Farm has been approved for 11 turbines (see Table 8.6), but a scoping report has recently been submitted for Cumberhead Wind Farm for a re-design and larger turbines. As there are no collision risk data yet available for the re-designed Cumberhead Wind Farm, the cumulative assessment in this chapter assumes that impacts of the re-designed site will be similar to the current approved wind farm. No collision risk modelling has been undertaken to date for Douglas West Extension, but based on results of baseline surveys for the Proposed Development and Douglas West Wind Farm, and the predominance of commercial conifer plantation habitat, very low flight activity rates, and negligible collision risks are likely. Similarly, no breeding IOFs are likely to be present based on survey results at the two neighbouring sites.

8.5.42 Projects that have been refused or withdrawn have been scoped out of the cumulative assessment.

8.5.43 Small projects with three or fewer turbines have also been scoped out from the cumulative assessment as often these projects are not subject to the same level of detail of ornithological assessment, and so there are no directly comparable data. Because of the small scale of such projects, effects are likely to be negligible on the IOFs assessed here. Other small-scale renewable projects such as micro hydro schemes have also been scoped out for similar reasons. Table 8.6 identifies the wind farm projects that have been considered in the cumulative assessment.

Table 8.6 NHZ 19 Wind Farm projects included in cumulative assessment ordered by project status

Project	Status	Number of Turbines	Source of information
Installed wind farm projects			
Airies	Installed	14	ES chapter
Andershaw	Installed	14	ES chapter
Arcleoch	Installed	60	No info available
Artfield Fell	Installed	15	NTS
Auchrobert	Installed	12	No info available
Balmurrie Fell (Artfield Fell Extension)	Installed	7	NTS
Bankend Rig	Installed	11	Breeding and Wintering Bird Report 2010-11; Kennoxhead SEI cumulative assessment
Barlockhart Moor Wind Farm	Installed	4	from Barlockhart Moor Wind Farm Extension ES
Blackcraig	Installed	23	ES chapter
Carscreugh	Installed	18	ES chapter
Clyde	Installed	152	ES chapter
Dalswinton (Pennyland Moor)	Installed	15	ES chapter

Project	Status	Number of Turbines	Source of information
Dungavel	Installed	13	ES chapter
Galawhistle	Installed	22	ES chapter
Glenchamber	Installed	11	from Barlockhart Moor Wind Farm Extension ES
Hagshaw Hill Extension	Installed	20	ES chapter
Hare Hill Phase 1	Installed	20	No info available
Kilgallioch	Installed	96	ES chapter and addendum
Mark Hill	Installed	28	NTS
Minygap	Installed	10	No info available
Nutberry	Installed	6	ES chapter
Wether Hill	Installed	14	ES chapter
Windy Standard	Installed	36	Windy Standard Extension ES
Approved wind farm projects			
Afton	Approved	27	Variation ES, NTS
Bankend Rig Extension	Approved	3	ES chapter
Benbrack	Approved	18	ES chapter
Crookedstane	Approved	4	ES chapter
Dalquhandy	Approved	15	ES chapter
Dersalloch	Approved	23	ES chapter, 2006 and 2012 addendum
Douglas West	Approved	13	ES chapter
Dungavel Hill	Approved	13	ES chapter
Galawhistle	Approved	22	ES chapter
Gass	Approved	9	ES chapter

Project	Status	Number of Turbines	Source of information
Glen App	Approved	11	ES chapter
Glenmuckloch	Approved	8	ES chapter
Harestanes	Approved	68	ES chapter
Kennoxhead	Approved	19	ES chapter
Knockman Hill	Approved	5	Environmental Report
Kype Muir	Approved	26	ES chapter
Kype Muir Extension	Approved	18	ES chapter
Lion Hill	Approved	4	ES chapter
Middle Muir	Approved	15	ES chapter
Mochrum Fell	Approved	8	ES chapter
Penbreck	Approved	9	ES chapter
Plascow Wind Cluster	Approved	3	Environmental Report
Sandy Knowe	Approved	24	ES chapter
Sanquhar Community Windfarm	Approved	9	SEI chapter
South Kyle	Approved	50	ES chapter
Whiteside Hill	Approved	10	No info available
Windy Standard Extension (Brockloch Rigg Windfarm Limited)	Approved	30	ES chapter
Chirmorie	Approved	21	ES Chapter
Application wind farm projects			
Annabaglish	Applicatio n (appeal)	14	ES chapter
Ashmark Hill	Applicatio n	7	ES chapter

Project	Status	Number of Turbines	Source of information
Auchencrosh	Application	Unknown	No info available
Balunton	Application	9	ES chapter
Barlockhart Moor Extension	Application	4	ES chapter
Broken Cross	Application	7	ES chapter
Enoch Hill	Application	16	ES chapter
Garleffan	Application (appeal)	6	ES chapter and SEI
Glentaggart	Application	5	ES chapter
Hare Hill Phase 2	Application	39	ES chapter
Harestanes Extension	Application	7	ES chapter
Knockendurrick	Application	7	ES chapter
Kype Muir Extension	Application	15	ES chapter
Lethans	Application	22	ES chapter
Lorg	Application	15	ES chapter
Magheuchan Rig	Application	12	ES chapter and SEI
Margree	Application	25	ES chapter
Over Hill	Application	11	ES chapter

Project	Status	Number of Turbines	Source of information
Penbreck	Application	9	ES chapter
Pencloe	Application	19	ES chapter
Polquhairn	Application (appeal)	9	ES chapter
Red Moss Hotel & Truck Stop	Application	19	No info available
Stranoch	Application	24	ES chapter and addendum
Tormywheel Extension	Application	4	ES chapter
Twentyshilling Hill	Application	9	ES chapter
Ulzieside	Application	12	No info available
Wether Hill Extension	Application	11	ES chapter
Windy Rig	Application	12	SEI chapter
Scoping wind farm projects			
Douglas West Extension	Scoping	13	Baseline survey results conducted by MacArthur Green for the Applicant.
Cumberhead (consented but a scoping report recently submitted for a re-design and larger turbines)	Scoping	14	Original ES chapter

Statement of Significance

8.5.44 The potential significance of the effect was determined through a standard method of assessment based on professional judgement, considering both sensitivity and magnitude of change as detailed in Table 8.7. Major and moderate effects are considered significant in the context of the EIA Regulations.

Table 8.7 – Significance Criteria

Significance	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.

Requirements for Mitigation

8.5.45 Mitigation will be required if the Assessment of Potential Effects section (section 8.7) determines that there is an unmitigated moderate adverse or major adverse and therefore significant effect on any IOF identified in this chapter.

Even without any significant effects on IOFs, general mitigation will be applied in the form of a Breeding Bird Protection Plan (BBPP) to ensure that disruption to nesting IOFs and any disturbance to Schedule 1 breeding birds during the construction period is avoided.

Assessment of Residual Effect Significance

8.5.46 If a potential effect is determined to be significant, suggested measures to mitigate the effect will be considered and the revised significance of residual effects after mitigation will be assessed.

Limitations to Assessment

8.5.47 There can often be varying degrees of uncertainty over the sensitivity of receptors 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.

8.5.48 The following potential limitations to assessment have been identified:

- The loss of two hours of optimal VP surveys, one of which was due to poorer weather (visibility <1 km) (paragraph 8.5.20) is not likely to affect the robustness of the data analysis and the assessment in this chapter; and
- There is a difficulty in accurately predicting the baseline activity levels after decommissioning and subsequent habitat reinstatement when the original wind farm is still present. This has been dealt with by following SNH (2014b) guidance, which advises taking a qualitative approach where required.

8.6 Baseline Conditions

Designated Sites

8.6.1 There are no statutory nature conservation designations with an ornithological interest within the site. Table 8.8 details the designated sites located within 20 km of the Proposed Development that have ornithological interests. It should be noted that the two SSSIs are coincidental in extent with the Muirkirk and North Lowther Uplands SPA.

Table 8.8 – Designated sites within 20km of Hagshaw Hill Wind Farm

Name	Distance	Qualifying interests	Status
Muirkirk and North Lowther Uplands SPA	5 km	Hen harrier (<i>Circus cyaneus</i>), breeding	Unfavourable Declining
		Short-eared owl (<i>Asio flammeus</i>), breeding	Favourable Maintained
		Peregrine (<i>Falco peregrinus</i>)	Unfavourable No Change
		Golden plover (<i>Pluvialis apricaria</i>), breeding	Favourable Maintained
		Merlin (<i>Falco columbarius</i>), breeding	Unfavourable No Change
		Hen harrier (<i>Circus cyaneus</i>), non-breeding	Unfavourable Declining
North Lowther Uplands SSSI	5 km	Hen harrier (<i>Circus cyaneus</i>), breeding	Unfavourable No Change
		Breeding bird assemblage	Unfavourable Declining
Muirkirk Uplands SSSI	6 km	Hen harrier (<i>Circus cyaneus</i>), breeding	Favourable Maintained
		Short-eared owl (<i>Asio flammeus</i>), breeding	Favourable Maintained
		Hen harrier (<i>Circus cyaneus</i>), non-breeding	Unfavourable Declining
		Breeding bird assemblage	Favourable Maintained

Birds Recorded During Desk and Field Surveys

8.6.2 The following paragraphs summarise the baseline ornithological results for target species recorded during the 2018 field surveys (March to August 2018) and of the desk study that included seven local wind farm projects within the vicinity of the Proposed Development (surveys from 2003 to 2015). Full details of the results of 2018 surveys can be found within Appendix 8.1 Annex D, and Figures 8.5 to 8.7.

Target species presence

8.6.3 A review of the baseline data collected during the 2018 breeding season field surveys as well as the desk survey data presented within Environmental Statements, Technical Appendices and a Scoping report for seven proposed wind farm projects (see paragraph 8.5.14) found evidence of a number of target species, as outlined within Table 8.9.

8.6.4 Table 8.9 states whether each target species was found to be present (P) or whether there was no evidence (NE) recorded during surveys, or in the cases where information was not available (-).

Table 8.9 – Summary of desk-based findings for target species (raptors, waders and wildfowl) for the Proposed Development and nearby wind farm projects

Species	Conservation status and Legal Protection	Proposed Development	HH	NU	GA	DWCW	DQ	CU	DW
Barn owl	BoCC Green-listed, Schedule 1	NE	P	NE	P	NE	NE	NE	P
Black grouse	BoCC Red-listed, sensitive to wind farm impacts (SNH, 2018c).	NE	P	P	P	P	NE	NE	P
Common sandpiper	BoCC Amber-listed	P	NE	NE	P	P	P	P	P
Curlew	BoCC Red-listed; sensitive to wind farm impacts (SNH, 2018c)	P	P	P	P	P	P	P	P
Golden plover	BoCC Green-listed, Annex 1, Potential connectivity to Muirkirk and North Lowther Uplands SPA	P	P	P	P	P	P	P	P
Goshawk	BoCC Green-listed, Schedule 1	NE	NE	NE	NE	NE	NE	P	P
Green sandpiper	BoCC Amber-listed, Schedule 1	NE	NE	NE	P	NE	NE	NE	NE
Greylag goose	BoCC Amber-listed, Annex II (Part B), Schedule 2	NE	NE	P	P	P	P	P	P
Hen harrier	BoCC Red-listed, Annex I, Schedule 1, Potential connectivity to Muirkirk and North Lowther Uplands SPA	NE	P	P	P	P	P	P	P
Herring gull	BoCC Red-listed	P	-	-	P	P	P	P	-
Lapwing	BoCC Red-listed	P	-	P	P	P	P	P	P
Merlin	BoCC Red-listed, Annex I, Schedule 1, Potential connectivity to Muirkirk and North Lowther Uplands SPA	NE	P	P	P	P	P	P	P
Osprey	BoCC Amber-listed, Annex 1, Schedule 1	P	NE	P	P	P	P	NE	P

Species	Conservation status and Legal Protection	Proposed Development	HH	NU	GA	DWCW	DQ	CU	DW
Oystercatcher	BoCC Amber-listed	P	-	P	P	P	P	P	P
Peregrine	BoCC Green-listed, Annex 1, Schedule 1, Potential connectivity to Muirkirk and North Lowther Uplands SPA	P	P	P	P	P	P	P	P
Pink-footed goose	BoCC Amber-listed, Annex II (Part B), Schedule 2	NE	NE	P	P	P	P	P	P
Red kite	BoCC Green-listed, Annex 1, Schedule 1	NE	NE	P	P	NE	NE	NE	P
Redshank	BoCC Amber-listed	NE	NE	NE	NE	P	P	P	P
Ringed plover	BoCC Red-listed	P	-	NE	P	P	P	P	P
Short-eared owl	BoCC Amber-listed, Annex 1, Potential connectivity to Muirkirk and North Lowther Uplands SPA	NE	NE	P	P	NE	P	P	P
Snipe	BoCC Amber-listed	P	-	P	P	P	P	P	P
Whooper swan	BoCC Amber-listed, Annex II (Part B), Schedule 2	NE	NE	NE	P	P	P	P	P

2018 Flight Activity Surveys

8.6.5 A summary of all flight activity surveys for target species recorded during the 2018 breeding season at the site is presented in Table 8.10. This tallies all flights observed during 2018 and includes flights recorded out with the CRAA and site boundary and which are therefore not included in collision modelling since they would not be at risk of collision with a turbine. The total bird seconds represents the flight duration multiplied by the total number of individuals. For further details of seasonal breakdown and at-risk flights included in the collision model, see Appendix 8.1 Annex E.

Table 8.10 – Flight Activity Survey Summary for all flights recorded March to August 2018

Species	Total Flights Recorded	Total Individuals Recorded	Total Bird Seconds
Curlew	9	13	729
Golden plover	2	154	34,144
Herring gull	1	1	28
Lapwing	1	2	50
Osprey	1	1	90
Oystercatcher	1	1	32

Breeding bird surveys for target species

8.6.6 The following paragraphs provide a summary for each target species recorded during all breeding bird surveys including scarce breeding birds, black grouse and upland breeding birds.

Black grouse

8.6.7 The 2018 black grouse surveys did not record any lek locations within 1.5 km of the Proposed Development site.

- Black grouse leks have been recorded within 1.5 km of the following proposed wind farm sites surrounding the Proposed Development:
- Hagshaw Hill Extension: a total of 4-6 males (plus two females) were recorded lekking at four lek sites in 2003-04, located around 500 m to 1.5 km east of the Proposed Development site.
- one lek was recorded approximately 1.0 km from the Proposed Development site as part of surveys for the DWCW project in 2010; and
- a single lekking male was recorded over 1.0 km to the east of the Proposed Development site, as part of the Douglas West baseline surveys in 2015.

8.6.8 Lekking black grouse have also been recorded at other local project sites, although over 1.5 km from the Proposed Development: two lek sites were at the Nutberry site in 2004 and three lek sites were recorded at the Galawhistle site in 2008 and 2009. No black grouse leks were recorded for the Cumberhead site in 2013 and 2014, with only a few intermittent sightings of lone birds were recorded in any given survey year. No evidence of black grouse was recorded within the Dalquhandy site.

Goshawk

- 8.6.9 In 2018, goshawk was not recorded within 2 km of the Proposed Development site.
- 8.6.10 Goshawk was confirmed as breeding within the Cumberhead Forest complex in the Cumberhead site in 2013 and this species was probably breeding within the Cumberhead survey buffer area during the 2014 breeding raptor survey.
- 8.6.11 Goshawk was recorded flying within 2 km of the Douglas West site in 2015, but no breeding activity was recorded. SSRSG reported that goshawk had very probably bred in the 2 km buffer surrounding the Douglas West site or nearby during the preceding five years (2010 – 2015), particularly in the Long Plantation to the east/south-east of the site but the species was not recorded on a regular basis (DW Environmental Statement). Goshawk was the only breeding record of a Schedule 1 raptor that SSRSG held in its records within the Douglas West site and the 2 km boundary (DES, 2015).
- 8.6.12 No evidence of goshawk was recorded in either the breeding or non-breeding season at any other wind farm sites surrounding the Proposed Development site.
- 8.6.13 SSRSG reported successful nesting goshawk 2-3 km from the DWCW site prior to the scoping survey for that project in September 2009 (DES, 2015).

Hen harrier

- 8.6.14 In 2018, hen harrier was not recorded within 2 km of the Proposed Development site.
- 8.6.15 Hen harrier have been recorded flying within 2 km of the local wind farm sites surrounding the site, but no breeding activity has been recorded.
- 8.6.16 SSRSG reported regular sightings of hen harrier at the Douglas West site and in the 2 km buffer zone of the Douglas West site, although no breeding records (DES, 2015).
- 8.6.17 SSRSG identified that hen harrier has bred at distances of around 4 km and 7-8 km from the DWCW site (DES, 2015). Two female hen harriers were recorded through the DWCW site during a scoping visit in September 2009 and a male was recorded in July 2010 hunting between Arkney Hill and the edge of the former opencast site at a time when birds breeding locally (>4 km from the DWCW site) still had young in the nest (DES, 2015).

Merlin

- 8.6.18 In 2018, there were no breeding merlin recorded in the Proposed Development site. On one survey in late August, a juvenile merlin was present within the site, but the species was absent apart from on this survey, and the observations are likely to represent a dispersing bird rather than a local breeder.
- 8.6.19 Merlin have been recorded infrequently foraging over the local wind farm sites, but no breeding activity has been recorded.
- 8.6.20 SSRSG has reported occasional sightings of merlin at the Douglas West site and in the 2 km buffer zone of the Douglas West site, although no breeding records (DES, 2015). SSRSG has also reported possible nesting merlin 4 km from the DWCW site (DES, 2015).

Osprey

- 8.6.21 On two occasions in 2018 an osprey flew over the Proposed Development site, but there was no evidence of breeding activity within the 2 km survey area.
- 8.6.22 No evidence of osprey breeding activity was recorded in any survey for the proposed wind farm sites surrounding the site.
- 8.6.23 Two ospreys were recorded flying once over the DWCW site during the breeding season in April 2010. SSRSG reported successful nesting osprey breeding at 15 km to the south-east of the DWCW site prior to the scoping survey for that project in September 2009 (DES, 2015).

- 8.6.24 Two osprey flights were recorded for the Dalquhandy site, one in July 2011 and another one in August 2012. These single individuals were likely to be migrating birds as the Dalquhandy site is not considered to offer any value to osprey.
- 8.6.25 Two single observations of osprey were recorded during the non-breeding season flying over the Douglas West site in 2014 and 2015. SSRSG have reported occasional sightings of osprey at the Douglas West site and in the 2 km buffer zone of the Douglas West site, although no breeding records (DES, 2015).
- 8.6.26 One osprey was recorded in May 2009 at a distance of 4 km from the Galawhistle site.
- 8.6.27 No evidence of osprey was recorded in either the breeding or non-breeding season at any other wind farm sites surrounding the site.

Peregrine

- 8.6.28 In 2018, two sightings of peregrine (first sighting an individual and second sighting two birds together) were recorded flying over the Proposed Development site in April and May (outside of a flight activity survey), but there was no evidence of breeding activity within the 2 km survey area.
- 8.6.29 SSRSG reported occasional sightings of peregrine at the Douglas West site and in the 2 km buffer zone of the Douglas West site, although no breeding records (DES, 2015).
- 8.6.30 There were no peregrine nest sites recorded within 2 km from the DWCW site in 2010. Peregrine presence was recorded within 2 km of the Cumberhead site in 2013 and 2014; although no nest sites or evidence of nesting peregrine was recorded, a potentially suitable peregrine nest site was identified close to the Cumberhead site.

Barn owl

- 8.6.31 The 2018 surveys did not record barn owl within 2 km of the Proposed Development site.
- 8.6.32 There has been some evidence of barn owl breeding activity reported for proposed wind farm sites surrounding the Proposed Development site. In 2003/2004, barn owl was recorded breeding in valley sites within 2 km of the Hagshaw Hill Extension turbines, but as barn owls hunt mostly valley bottom sites it is unlikely that birds will utilise the higher ground within the site. Barn owl breeding was confirmed at one location within the Galawhistle site in 2008 and 2009 and a second pair bred close to the Galawhistle access track in 2009 and probably 2008; these birds may have been within 1 km of the Proposed Development, albeit with Galawhistle turbines now constructed on the hill separating the two locations.
- 8.6.33 No evidence of barn owl breeding activity was reported at any other wind farm sites surrounding the Proposed Development.

Short-eared owl

- 8.6.34 The 2018 surveys did not record short-eared owl within 2 km of the Proposed Development site.
- 8.6.35 Short-eared owl were recorded during surveys for Dalquhandy and Cumberhead, although there was no evidence of breeding behaviour.
- 8.6.36 There was no evidence of breeding attempts by short-eared owl in 2004 or 2005 at the Nutberry site, although observed flight activity and behaviour in suitable nesting habitat indicated that one pair might have bred in suitable habitat within 2 km of the Nutberry site boundary in 2004.
- 8.6.37 SSRSG has reported occasional sightings of short-eared owl at the Douglas West site and in the 2 km buffer zone of the Douglas West site, although no breeding records (DES, 2015). SSRSG has also reported that short-eared owl may nest 4 km away from the DWCW site (DES, 2015)

Other Raptors

- 8.6.38 On one survey in late August, a male hen harrier was recorded, likely dispersing from breeding grounds elsewhere.

- 8.6.39 In addition to the above target species, there were a few sightings of secondary species recorded during the 2018 surveys at the Proposed Development site including buzzard, kestrel and tawny owl.
- 8.6.40 One short golden eagle flight was recorded at the Galawhistle site in June 2008, but this species was not recorded at any other site.
- 8.6.41 Red kite was recorded flying over the Nutberry site in 2004, the Galawhistle site between 2007 and 2009 and the Douglas West site between 2014 and 2015, although no breeding evidence of this species was recorded. SSRSG has reported occasional sightings of red kite at the Douglas West site and in the 2 km buffer zone of the Douglas West site, although no breeding records (DES, 2015). SSRGS is aware of increasing red kite activity in the general area of Douglas West throughout the year, but it had no records of breeding prior to the DWCW surveys in 2009 and 2010. The nearest known red kite breeding site to the DWCW site is 6 km away to the north (DES, 2015).

Waders and other moorland breeding birds

Common sandpiper

- 8.6.42 In 2018, a common sandpiper was recorded alarm calling within 500 m of the Proposed Development site in June, but no breeding territories were recorded. One common sandpiper breeding territory was recorded out with the 500 m study area in 2018.
- 8.6.43 Small numbers of breeding common sandpiper have been recorded at the following proposed wind farm sites surrounding the site: two pairs recorded for the Galawhistle site in 2008 and 2009; two pairs recorded for the DWCW site in 2010 although the breeding attempts were probably unsuccessful; nine pairs recorded for the Dalquhandy site in 2012; a single pair recorded for the Cumberhead site in 2014; and up to five pairs were recorded for the Douglas West site in 2015.

Curlew

- 8.6.44 In 2018, one curlew breeding territory was recorded within 500 m of the Proposed Development site. A further two territories were recorded out with the 500 m study area approximately 1.2 and 2 km from the proposed turbines.
- 8.6.45 Curlew are known to breed in the local area around the site and this species has been recorded at all proposed wind farm sites surrounding the site including: five pairs within 300 m of the proposed extension turbines at the Hagshaw Hill site in 2003/2004; five pairs bred within 500 m in 2004/2005 at the Nutberry site; two to three pairs bred within the Galawhistle site in 2008 and 2009; six pairs bred on the DWCW site in 2010; three pairs bred or attempted to breed within the Dalquhandy site in 2012; six confirmed breeding territories were recorded in 2013 and one territory was recorded in 2014 at the Cumberhead site; and a total of five occupied territories were recorded for the Douglas West site in 2015.

Golden plover

- 8.6.46 Two golden plover flocks were recorded flying through the Proposed Development site during spring migration in April 2018, but they did not breed in the area.
- 8.6.47 At other proposed wind farm sites, small numbers of golden plover have been recorded as present during the non-breeding and breeding seasons, although breeding was not recorded.
- 8.6.48 Flocks of golden plover have been recorded flying through the majority of proposed wind farm sites surrounding the Proposed Development during the non-breeding season. The most frequent activity for golden plover in the local area was at Cumberhead Wind Farm between September 2012 and February 2014, when 11 flocks (one to 200 individuals per flight) were recorded (Table 8.13).
- 8.6.49 In the Nutberry ES, flocks of golden plover were recorded feeding in fields around Birkenhead in 2005 which were around 3 km north-east of the proposed Nutberry Wind Farm turbines and around 6 to 7 km north-west from the northern access track for the Proposed Development. Baseline surveys for the Galawhistle ES also produced some evidence that golden plovers occasionally forage

within that survey area; between September 2007 and August 2009, golden plovers were recorded flying within the Galawhistle Wind Farm site and occasionally heard calling 500 m north of the site during the flight activity surveys (although the exact location of these birds could not be established).

- 8.6.50 In the Dalquhandy ES, roosting golden plover were recorded during the 2011-12 non-breeding season on an island in a water body 500 m east of the Dalquhandy site (around 2 km north of the Proposed Development). In total, 29 golden plover flights were observed for the Dalquhandy site, the majority adjacent to the large water bodies within the 500 m Dalquhandy study area.

Lapwing

- 8.6.51 In 2018, two lapwings flew through the Proposed Development site in May, but they did not breed in the area.
- 8.6.52 Small numbers of lapwing are known to breed in the local area. The following proposed wind farm sites around the site have recorded breeding lapwing: two pairs recorded for the Galawhistle site in 2008 and 2009; one pair bred in 2010 at the DWCW site; nine pairs bred at the Dalquhandy site in 2012; and two pairs bred at the Douglas West site in 2015.
- 8.6.53 At Nutberry and Cumberhead, small numbers of lapwing were recorded as present, but breeding activity was not recorded.

Oystercatcher

- 8.6.54 In 2018, a small number of oystercatchers were recorded within 500 m of the Proposed Development site, but they did not breed in the area.
- 8.6.55 Breeding oystercatcher have been recorded at proposed wind farm sites surrounding the site including: five pairs in 2008 and 11 pairs in 2009 for the Galawhistle site; two pairs for the DWCW site in 2010; two pairs for the Dalquhandy site in 2012; and three pairs for the Douglas West site in 2015.
- 8.6.56 Oystercatcher were recorded as present but not breeding at the Nutberry site (2006) and Cumberhead site (2013/2014).

Ringed plover

- 8.6.57 In 2018, a ringed plover was recorded in May within 500 m of the Proposed Development site, but it is not known to have bred in the area.
- 8.6.58 Small numbers of breeding ringed plover have been recorded at proposed wind farm sites surrounding the site including: three pairs in 2008 and four pairs in 2009 at the Galawhistle site; four pairs at the DWCW site in 2010; five pairs at the Dalquhandy site in 2012; and two pairs at the Douglas West site in 2015.
- 8.6.59 Ringed plover was present but not breeding at the Cumberhead site in 2014.

Snipe

- 8.6.60 In 2018, three snipe breeding territories were recorded within 500 m of the Proposed Development site and a further two territories were recorded out with the 500 m study area.
- 8.6.61 Snipe are known to breed in the local area. The following proposed wind farm sites around the site all recorded breeding snipe: four pairs in 2004 and two pairs in 2005 at the Nutberry site; six pairs at the Galawhistle site in 2008 and 2009; six pairs at the DWCW site in 2010; five pairs at the Dalquhandy site in 2012; one probable and three possible territories at the Cumberhead site in 2014; and 13 territories at the Douglas West site in 2015.

8.7 Assessment of Potential Effects

8.7.1 The assessment of potential effects is based on the project description outlined in Chapter 3.

8.7.2 The assessment is made based on a comparison of likely conditions at the site after the decommissioning of the Existing Development, and subsequent restoration of land when infrastructure is removed, rather than existing conditions within the current operational Existing Development site. In the case of this repowering scheme it is however recognised that even if the Existing Development was decommissioned and the site restored, the existing Hagshaw Hill Extension turbines would continue to operate for many years to come on either side of the Existing Development site. Additional commentary is provided (see Table 8.15) on the potential difference in effects between the Proposed Development and the Existing Development.

Scoped in Important Ornithological Features

8.7.3 The assessment is applied to those ‘scoped-in’ IOFs of Medium or High Nature Conservation Importance (see Table 8.11) that are known to be present within the site or surrounding area (as confirmed through survey results and desk studies outlined above). These comprise: **curlew** and **golden plover** (Table 8.12).

Table 8.11 – Nature Conservation of IOFs

Species	Nature Conservation Importance	Reason
Curlew	Medium	BoCC Red-listed; sensitive to wind farm impacts (SNH, 2018c)
Golden plover	High	Annex 1

8.7.4 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 8.13 based on the following BoCC status in Eaton *et al.* (2015):

- 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); and
- BDMp = Breeding Population Decline. Moderate decline in the UK breeding population size, of more than 25%, over 25 years (BDMp1) or the entire period used for assessments since the first BoCC review, starting in 1969 (“longer-term”) (BDMp2).

Table 8.12 Conservation Status of Scoped In IOFs

Species	Conservation Status Information	Conservation Status
Curlew	BoCC Red List (BDMp1, BDp2)	The most recent national curlew population estimate recorded 68,000 pairs in 2009 (Massimino <i>et al.</i> 2017) and there has been a significant continued decline across Scotland, including in the south west. The recent inclusion of the species on the BoCC Red-list suggests that the national and NHZ/regional populations are in unfavourable conservation status. The NHZ 19 population was estimated to be 4,284 (3,851-4,717) pairs in 2005 (Wilson <i>et al.</i> 2015).

Species	Conservation Status Information	Conservation Status
Golden plover	BoCC Green List	<p>The UK golden plover breeding population is estimated to be 38,400-59,400 pairs (Musgrove <i>et al.</i> 2013), although Forrester <i>et al.</i> (2007) give a Scottish breeding population estimate of 15,000 pairs, stating that this represents 80% of the British breeding population.</p> <p>The spring passage population of golden plover in Scotland was estimated by Forrester <i>et al.</i> (2007) to be 10,000-30,000 individuals. BirdFacts estimated the UK winter population to be 400,000 individuals in 2006/07.</p> <p>The NHZ 19 population was estimated by Wilson <i>et al.</i> (2015) to be 778 (range 716-839) pairs in 2005.</p> <p>The BTO BirdTrends website (Massimino <i>et al.</i> 2017) states that the national population is in probable decline, and this is likely to reflect the regional/NHZ population.</p>

Scoped Out Designated Sites and Species

- 8.7.5 Based on listed SPA qualifying interests (Table 8.8), distance from the site (>5 km), and foraging ranges of SPA qualifying interests during the breeding season (Pendlebury *et al.* 2011; SNH, 2016a), it is concluded that there is no likely connectivity, and no likely significant effects associated with any qualifying interest of the Muirkirk and North Lowther Uplands SPA, or the component North Lowther Uplands SSSI and Muirkirk Uplands SSSI.
- 8.7.6 The following target species have been scoped out due to either very low, or no, 'at-risk' flights or breeding activity recorded during baseline surveys, and the lack of suitable habitats within the Proposed Development site (see breeding bird details in paragraph 8.6.6 and Appendix 8.1 Annex E for collision risk details):
- Target raptor species: goshawk, hen harrier, merlin, osprey, peregrine, red kite and short-eared owl. No breeding records within likely zone of influence of site, and low activity rates recorded during 2018 baseline surveys. Barn owl was also scoped out of the assessment; this species may have bred within 1 km of the Proposed Development in 2008/09, but no breeding activity or any other field signs of barn owl were recorded during the 2018 baseline surveys;
 - Black grouse: No leks were recorded within 1.5 km of the site during the 2018 baseline surveys;
 - Waders: common sandpiper, green sandpiper, oystercatcher, ringed plover, lapwing, oystercatcher and redshank. Breeding either occurred in low numbers within the context of NHZ populations or there were no breeding records within likely zone of influence of site. Activity rates for waders (not including curlew and golden plover, see paragraph 8.7.3) were low during 2018 baseline surveys;
 - Wildfowl: greylag geese, pink-footed geese and whooper swans. No breeding records within likely zone of influence of site and no records of any wildfowl species during the 2018 baseline surveys. Based on desk study results, no wildfowl are likely to utilise the site during winter months, with a lack of suitable habitat found within;
 - All gull species, which are unlikely to be subject to significant disturbance impacts, or collision rates; and
 - All passerine species, as per SNH (2014 and 2018c) guidance.

- 8.7.7 No significant effects were predicted to occur for all these scoped out species at other proposed wind farm developments surrounding the site. The Environmental Statements for the six wind farms that were developed all stated that after mitigation the residual significance of effects on any IOF were either minor adverse or negligible and therefore Not Significant in the context of the EIA Regulations.

Construction

Potential Effects

- 8.7.8 The following operational impacts are assessed in this section:
- displacement of birds around operational turbines; and
 - habitat loss impacting breeding or foraging birds.
- 8.7.9 The main potential impacts of construction activities across the site are the displacement and disruption of breeding and foraging birds as a result of noise and general 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).
- 8.7.10 Impacts on breeding birds would be confined to areas in the locality of temporary construction compounds, 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).
- 8.7.11 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). This has the potential to impact on breeding or foraging individuals.

Curlew

- 8.7.12 **Impact:** breeding curlews may be displaced from the site during construction, either by disturbance or direct habitat loss.
- 8.7.13 **Sensitivity:** as a Red-listed species sensitive to wind farm development, curlew is classified as Medium Nature Conservation Importance. The national and NHZ 19 populations are considered to be in unfavourable conservation status and the species' sensitivity is medium-high.
- 8.7.14 **Magnitude of Impact:** in the 2018 breeding bird surveys, curlews were mainly recorded in open moorland in areas south and south east of the site boundary, in particular at lower altitudes around Longhouse Hill and 1 km west of Windrow Wood (Figure 8.6). There were up to six flight paths recorded crossing the site boundary. Up to three pairs are likely to have been present during the 2018 baseline period, with one of these pairs within potential disturbance distances (taken to be up to 800 m from any infrastructure as a precautionary estimate). This suggests that up to 0.02 % of the NHZ 19 population (4,284 pairs) may be affected over the period of construction (at most three consecutive breeding seasons).
- 8.7.15 Construction activities are unlikely in practice to result in the loss of one curlew pair to the NHZ 19 population, with work during the breeding season likely to be restricted to particular areas of the site during each breeding season. If displaced, it is possible that birds may be able to move elsewhere within the site. The magnitude of impact of construction activities on the NHZ curlew population is considered to be negligible spatial and short-term temporal.
- 8.7.16 **Significance of Effect:** the unmitigated effect on the NHZ 19 curlew population is classified as **minor adverse** and **not significant** in the context of the EIA Regulations.

Golden Plover

- 8.7.17 **Impact:** breeding or non-breeding golden plovers may be displaced from the site during construction, either by disturbance or direct habitat loss.
- 8.7.18 **Sensitivity:** golden plover is an Annex I listed species, and the national and regional/NHZ 19 populations are likely to be in unfavourable conservation status. The species' sensitivity is medium-high.
- 8.7.19 **Magnitude of Impact:** there were no breeding golden plover recorded during the 2018 baseline period.
- 8.7.20 On the 23 April 2018, two spring passage golden plover flocks were recorded overflying the site, but there was no indication that habitats within the site were suitable or used by birds for roosting or feeding during this period. Construction disturbance to non-breeding birds is unlikely to be significant in terms of impacts on individual fitness or survival.
- 8.7.21 The impact of construction disturbance on the national passage population, over the construction period would result in an impact of negligible spatial and short-term temporal magnitude.
- 8.7.22 **Significance of Effect:** The unmitigated effect from construction on golden plover is classified as **minor adverse** and is **not significant** in the context of the EIA Regulations.

Operation

- 8.7.23 The following operational impacts are assessed in this section:

- displacement of birds around operational turbines;
- collisions with turbines; and
- increased lighting associated with operational turbines.

Potential Effects: Displacement

- 8.7.24 The displacement of nesting and foraging birds from the site has the potential to extend beyond the construction phase, as described above, and to occur during the operational phase.
- 8.7.25 Displacement away from operational wind turbines has been found to occur in a number of individual wind farm studies, although the effects vary considerably between sites and species. Considering a range of breeding bird species but predominantly waders and passerines at upland wind farms, Pearce-Higgins *et al.* (2012) showed that there were no displacement effects on any bird species from wind farms 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.
- 8.7.26 It is recognised that disturbance may occur due to maintenance or recreational activities throughout the operational phase, although since these are likely to be of shorter duration and smaller extent than construction activities, effects would be lower than those predicted for construction effects.
- 8.7.27 Pearce-Higgins *et al.* (2009) observed certain species experiencing localised population increases with proximity to wind farm 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 wind farms.

Curlew

- 8.7.28 **Impact:** nesting or foraging curlew may be at risk of displacement from habitat around wind turbines or other infrastructure, thereby impacting on breeding success, productivity or survival rates.
- 8.7.29 **Sensitivity:** medium-high.

8.7.30 **Magnitude of Impact:** up to three pairs are likely to have been present during the baseline period, with one of these pairs within potential displacement distances (using 800 m from any infrastructure as a precautionary estimate). This would represent around 0.02 % of the NHZ 19 population (4,284 pairs) that may be affected. An impact of negligible spatial and long-term temporal magnitude is predicted.

8.7.31 **Significance of Effect:** The unmitigated effect from operational displacement on the NHZ 19 curlew population is classified as **minor adverse** and **not significant** in the context of the EIA Regulations.

Golden Plover

8.7.32 **Impact:** foraging golden plover may be at risk of displacement from habitat around turbines or other infrastructure, thereby impacting on productivity or survival rates.

8.7.33 **Sensitivity:** medium-high.

8.7.34 **Magnitude of Impact:** breeding golden plover were not recorded during the 2018 baseline surveys. Two spring passage golden plover flocks were recorded overflying the site, but there was no indication that habitats within the site were suitable.

8.7.35 Golden plover was recorded flying through other proposed wind farm sites surrounding the Proposed Development. Other non-breeding season activity recorded for golden plover in the local area includes low levels of foraging and roosting activity. Foraging birds were recorded 3 km north-east from Nutberry in 2005 and also potentially 500 m north of Galawhistle between 2007 and 2009. Roosting golden plover were recorded during the non-breeding season at the proposed Dalquhandy site in 2011/12, on an island in a water body 500 m east of the Dalquhandy site (around 2 km north of the Proposed Development). However, non-breeding season activity was not considered to be significant in the context of EIA regulations for local wind farms, and displacement of non-breeding passage birds in the area around turbines within the site is unlikely to be significant in terms of impacts on individual fitness or survival.

8.7.36 **Significance of Effect:** The unmitigated effect on the national/flyway golden plover population from operational displacement is classified as **minor adverse** and is **not significant** in the context of the EIA Regulations.

Potential Effects: Collision Risk

8.7.37 Birds that utilise the airspace within the turbine area at potential collision heights would be at risk of collision with 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 wind farm'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).

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

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

8.7.39 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.

8.7.40 The assessment of overall collision risk associated with the Proposed Development requires the consideration of two factors:

- (i) the results of baseline flight activity surveys in 2018, which were carried out from a single vantage point overlooking the southern area within the site where the no turbines currently exist (and eight repowering turbines would be located – see Figure 8.4). These can be used for a quantitative collision risk assessment; and
- (ii) the potential level of flight activity and resultant collision risk associated with the other six repowering turbines where the Existing Development is located. As outlined in SNH (2014b), guidance for repowering schemes, the use of flight activity surveys within an existing wind farm site is not appropriate for quantifying collision rates, because bird activity may already be affected by the presence of operational turbines, thereby potentially underestimating collision risks. As such, a more qualitative approach can be undertaken, in this case, based on results from the 2018 baseline surveys within the south of the Proposed Development site, as well as results of neighbouring wind farm projects.

8.7.41 The CRM used a candidate turbine type with a tip height of 200 m, a hub height of 122.5 m, a blade length of 76 m and a rotor diameter of 155 m.

8.7.42 A summary of CRM for curlew and golden plover recorded within the site in 2018, as well as a summary of collision risk of these species for seven proposed wind farm projects surrounding the site (2003 – 2015) is presented in Table 8.13. Collision risk is presented in terms of the number of collisions per year as well as the number of years per collision for each target species in the breeding and non-breeding seasons. For full CRM details refer to Appendix 8.1 Annex E and Annex G.

Table 8.13 – Flight Activity Survey Summary for all flights recorded in local Wind Farm Projects (NA: Data Not Available)

Wind Farm site ¹ and Target Species	Breeding / Non-breeding season/Annual ²	Number of collisions per year ³	Number of years per collision
Proposed Development (2018)			
Curlew	Breeding (2018)	0.000 ⁴	-
Golden plover	Breeding (2018)	3.391 ⁴	0.29
Nutberry (2004 to 2006) 95% avoidance rate			
Curlew	Breeding (2005)	0.1779	5.6
Golden plover	Breeding (2005)	0.0579	17.3
	Non-breeding (2005)	0.1039	9.6
Galawhistle (2007 to 2009)			
Curlew	Breeding (2008 & 2009)	0.127	7.8

¹ CRM data is not available for Hagshaw Hill Extension Wind Farm.

² Annual CRM results are presented if breeding and non-breeding data is not analysed separately.

³ Values given using a 98% avoidance rate unless stated.

⁴ Collision rate for the eight repowering turbines located to the south of the Existing Development only.

Wind Farm site ¹ and Target Species	Breeding / Non-breeding season/Annual ²	Number of collisions per year ³	Number of years per collision
	Non-breeding (2007/08 & 2008/09)	0.164	6.1
Golden plover	Breeding (2008 & 2009)	0.021	47.6
	Non-breeding (2007/08 & 2008/09)	0.027	37.0
DWCW (2009 to 2010)			
Curlew	Breeding (2010)	0.0641	15.6
Dalquhandy (2011 to 2012)			
Curlew	Breeding (2011 & 2012)	0.0035	286.8
Golden plover	Annual ⁵ (2011 & 2012)	0.0222	44.9
Cumberhead (2013 to 2014)			
Curlew	Annual ⁶ (2013 & 2014)	0.013	77.9
Golden plover	Breeding (2013 & 2014)	0.016	64.0
	Non-breeding (2013)	0.612	1.6
Douglas West (2014 to 2015)			
Curlew	Breeding (2015)	0.0543	18.42
	Non-breeding (2014/2015)	0.0558	17.92

Curlew

- 8.7.43 **Impact:** curlew flying within the site may be subject to a collision risk with turbines or other infrastructure, thereby increasing the mortality rate of the population above background levels.
- 8.7.44 **Sensitivity:** medium-high.
- 8.7.45 **Magnitude of Impact:** curlew was recorded during the 2018 breeding season and distribution was largely associated with breeding territories in the south of the site. The 2018 baseline data predicted a breeding curlew collision rate of zero because all flights recorded within the CRAA occurred in survey height bands 0-40 m, which is below lower rotor tip height (45 m).
- 8.7.46 No flight activity surveys were undertaken overlooking the Existing Development as this may lead to an underestimation of collision risk associated with the replacement turbines, since birds may already be exhibiting avoidance behaviour around existing turbines. However, since the habitat where the Existing Development is located is of poorer suitability for curlew than to the south, being on steeper slopes and closer to plantation forest, baseline activity rates in the absence of turbines

⁵ Annual = October to May

⁶ Annual = May to August

would likely be lower than to the south. No collision risk has therefore been attributed to these turbines, with any curlew flights again likely taking place below rotor height.

- 8.7.47 This conclusion can be compared with other wind farm sites surrounding the Proposed Development which predicted low curlew collision rates (Table 8.11). The Galawhistle site predicted the highest rate for both breeding (rate = 0.127 and collision every 7.9 years) and non-breeding curlews (rate = 0.164 and collision every 6.1 years), indicating that the general risk of collisions to the local curlew population is low.
- 8.7.48 Collision risk for curlew associated with the Proposed Development is therefore considered to be of negligible spatial and long-term temporal magnitude.
- 8.7.49 **Significance of Effect:** despite the unfavourable status of the NHZ 19 curlew population, the overall effect is considered to be **minor adverse** and **not significant** in the context of the EIA Regulations.

Golden Plover

- 8.7.50 **Impact:** golden plover flying within the site may be subject to a collision risk with wind turbines or other infrastructure, thereby increasing the annual mortality rate of the population above background levels.
- 8.7.51 **Sensitivity:** medium-high.
- 8.7.52 **Magnitude of Impact:** two flocks of golden plover (one flock of 44 individuals and another of 110 individuals) were recorded flying through the site in April 2018 during the baseline surveys, although these birds did not remain to breed in the study area. The species is therefore considered to be present during the spring migration period only (for modelling purposes, taken to be from 1 March to 30 April). The 2018 baseline data predicted a collision rate of 3.391 birds per year during the spring passage, for the eight turbines that extend beyond the footprint of the Existing Development.
- 8.7.53 As outlined for curlew above, no flight activity surveys were undertaken overlooking the Existing Development. The collision rate for the whole Proposed Development therefore can be estimated by scaling up the collision rate estimated for the eight turbines, to the whole 14 turbine layout, by using a per-turbine rate. This is seen as being precautionary in this instance, since the habitat where the Existing Development is located is of poorer suitability for golden plover than to the south, being on steeper slopes and closer to plantation forest, meaning that baseline activity rates in the absence of turbines would likely be lower than to the south.
- 8.7.54 The per-turbine collision rate of 0.424 collisions per year, scaled up from eight to 14 turbines results in an overall collision rate of 5.934 per year for the Proposed Development.
- 8.7.55 Other wind farm sites surrounding the Proposed Development have predicted golden plover collisions (Table 8.11), but none of these sites have recorded breeding evidence, backing up the assertion that birds are present on migration only. The Cumberhead site predicted the highest collision rate for non-breeding golden plover (0.612 per year or one collision every 1.6 years).
- 8.7.56 The spring passage population of golden plover in Scotland was estimated by Forrester *et al.* (2007) to be 10,000-30,000 individuals. The additional mortality due to collisions (based on the 2018 baseline collision rate of 5.934) would be an increase over the baseline mortality rate (0.27, BTO BirdFacts) by 0.07 % to 0.2 %. This is considered to be of negligible spatial and long-term temporal magnitude.
- 8.7.57 **Significance of Effect:** the overall effect on golden plover is assessed as **minor adverse** and **not Significant** in the context of the EIA Regulations.

Potential Effects: Lighting

- 8.7.58 There are potential lighting impacts on birds where turbines have a 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, 2016).

Curlew & Golden plover

- 8.7.59 **Impact:** impacts on IOFs might arise as a consequence of deployment of obstruction lighting on wind turbines over 150 m to blade tip. Once installed on-site, some of these turbines would need to be lit with medium intensity (2000 candela) steady red aviation warning lights, mounted on the nacelle of the wind turbines and at intervals of no more than 52 m on the tower. Lighting could have two effects on IOFs: birds may be attracted and thereby placed at higher risk of collisions, or they may avoid the lights with a consequent displacement impact.
- 8.7.60 **Magnitude of Impact:** Annex F of Appendix 8.1 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.
- 8.7.61 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.
- 8.7.62 The evidence provided in the literature review indicates that lights on wind turbines may increase numbers of nocturnal migrant birds that collide, particularly if lights are steady rather than flashing. Obstruction lighting on wind turbines however appears to be several orders of magnitude less effective than the light from lighthouses and lightships in attracting nocturnal migrant birds.
- 8.7.63 Regarding potential displacement around wind 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.
- 8.7.64 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.
- 8.7.65 **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 **minor adverse** and **not significant** in the context of the EIA Regulations.

Decommissioning

- 8.7.66 Decommissioning effects for the Proposed Development are difficult to predict with any confidence because of the long timeframe until their occurrence (30 years). Decommissioning impacts are considered for the purpose of this chapter to be similar to those of construction effects in nature, but are likely to be of shorter duration. The significance of effects predicted in the *Construction Effects* section are therefore considered appropriately precautionary for assessing decommissioning effects on IOFs.

8.8 Mitigation

- 8.8.1 No significant effects were predicted for any IOF, and therefore no specific mitigation is required.
- 8.8.2 A BBPP would be set up as standard to avoid the destruction or disturbance of any nest site, and with species-specific temporal and spatial restrictions around construction works should any active nest be located.
- 8.8.3 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.

8.9 Residual Effects

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

8.10 Cumulative Assessment

8.10.1 The following section presents information about the potential cumulative effects of the Proposed Development combined with other nearby existing or proposed wind farm projects within NHZ 19 in accordance with SNH guidance (SNH, 2018a).

8.10.2 Table 8.14 provides a summary of the cumulative disturbance-displacement for projects within NHZ 19, for curlew (zero collisions were attributed to the Proposed Development and so a cumulative collision risk assessment has been excluded). It should be noted that information from other projects in a number of cases is incomplete, as although birds may have been present during surveys, curlew was not considered to be key species, and therefore was not taken forward for assessment.

8.10.3 As golden plover was not recorded breeding within the study area during the 2018 baseline surveys, they were not considered at risk of cumulative effects within the context of the NHZ 19 breeding population, and are therefore not included in the cumulative assessment.

Table 8.14 Predicted cumulative effects within NHZ 19 relating to curlew

Project	Disturbance displacement	Number displaced
Installed wind farm projects		
Airies	One pair, outside development area	-
Andershaw	Three territories within study area	3
Arecleoch	No info available	Unknown
Artfield Fell	No info available	Unknown
Auchrobert	No info available	Unknown
Balmurrie Fell (Artfield Fell Extension)	No info available	Unknown
Bankend Rig	No data available	Unknown

Project	Disturbance displacement	Number displaced
Barlockhart Moor Wind Farm	No info available	Unknown
Blackcraig	No records	-
Carscreugh	Seven territories within the site.	7
Clyde	106 pairs within whole study area but not assessed	Unknown
Dalswinton (Pennyland Moor)	Six pairs within survey area, three of which may be subject to displacement	3
Dungavel	No territories within 500 m of the site	-
Galawhistle	Up to three territories within site	3
Glenchamber	No info available	Unknown
Hagshaw Hill Extension	Five pairs of curlews within 300 m of turbines predicted to be displaced by Extension.	5
Hare Hill Phase 1	No info available	Unknown
Kilgallioch	Four to six pairs could be displaced	6
Mark Hill	No info available	Unknown
Minnycap	No info available	Unknown
Nutberry	Under the assumption that breeding birds within 500 m of the proposed turbines would be displaced this assessment predicts that five pairs of curlew would be displaced due to disturbance during construction.	5
Wether Hill	Two pairs within site	2
Windy Standard	No info available	Unknown
Approved wind farm projects		
Afton	No info available	Unknown

Project	Disturbance displacement	Number displaced
Bankend Rig Extension	All territories outside site - not assessed	Unknown
Benbrack	One territory over 600m from turbines	-
Crookedstane	Three pairs within site boundary. Single at-risk flight	3
Cumberhead	Curlew confirmed as breeding in relatively high numbers in suitable upland habitat particularly towards the west of the survey area (away from turbines) with nine confirmed territories and a further four probable territories	-
Dalquhandy	Three pairs bred or attempted to breed within the Dalquhandy site in 2012	3
Dersalloch	Four pairs within site boundary	4
Douglas West	Up to two territories may be affected	2
Dungavel Hill	No breeding pairs within 500 m	-
Galawhistle	Up to three territories within site	3
Gass	Not assessed	Unknown
Glen App	No breeding within 1 km	-
Glenmuckloch	Up to three territories	3
Harestanes	Five territories within site. Not assessed but assumed to be displaced as worst case	5
Kennoxhead	Up to 14 territories within site and 500m survey buffer	14
Knockman Hill	One pair - not assessed	Unknown
Kype Muir	One pair within 600 m may be displaced	1
Kype Muir Extension	No territories within 500 m	-
Lion Hill	Ten pairs within 1 km from site.	10
Middle Muir	13 territories within survey area	13

Project	Disturbance displacement	Number displaced
Mochrum Fell	No breeding curlews were recorded within 800 m of potential turbine locations.	-
Penbreck	Seven breeding pairs beyond 1 km from nearest turbine	-
Plascow Wind Cluster	One pair within 500 m of turbines	1
Sandy Knowe	Two probable pairs of curlew were recorded within the Proposed Development	2
Sanquhar Community Windfarm	No details	Unknown
South Kyle	One territory within 500 m of turbines	1
Whiteside Hill	No info available	Unknown
Windy Standard Extension (Brockloch Rigg Windfarm Limited)	Small number of flights. No breeding reported.	-
Chirmorie	Up to six pairs recorded in study area	6
Application wind farm projects		
Annabaglish	Four pairs, all >500m from infrastructure	-
Ashmark Hill	Displacement of two pairs	2
Auchencrosh	No info available	Unknown
Balunton	One breeding pair within 200 m of turbine. Unlikely to be disturbed by construction activity within forest	-
Barlockhart Moor Extension	One record.	-
Broken Cross	At least one territory within the site	1
Enoch Hill	Three curlew territories were recorded in 2013 but there were no confirmed territories within 600 m of the Proposed Development.	-

Project	Disturbance displacement	Number displaced
Garleffan	Up to seven pairs displaced	7
Glentaggart	Not assessed	Unknown
Hare Hill Phase 2	One pair bred within site	1
Harestanes Extension	Two territories within 620 m	2
Knockendurrick	Four territories are present with the turbine array area and 800 m buffer zone	4
Kype Muir Extension	No info available	Unknown
Lethans	Pair within potential disturbance distances	1
Lorg	Not assessed	Unknown
Magheuchan Rig	One breeding pair within the main survey area (beyond disturbance distance) and three to four breeding pairs on the access track.	-
Margree	Low numbers of breeding curlew were recorded near proposed access routes in 2014, and potential impacts to these can be avoided via suitable timing of construction and decommissioning activities.	-
Over Hill	Single territory	1
Penbreck	Seven breeding pairs beyond 1 km from nearest turbine	-
Pencloe	Two territories close to access track only	-
Polquhairn	No breeding territories	-
Red Moss Hotel & Truck Stop	No info available	Unknown
Stranoch	Assuming eight (average of four and 12) pairs of curlew nesting within 800 m of the turbines, displacement of 40 % of the number of pairs by construction activities would result in the loss of about three pairs of curlews from the area during construction.	8

Project	Disturbance displacement	Number displaced
Tormywheel Extension	Two pairs within 500 m buffer, one pair to be lost	1
Twentysilling Hill	Six to ten curlew pairs, three of which at risk.	3
Ulzieside	No info available	Unknown
Wether Hill Extension	Two territories within 800 m of turbines unlikely to be affected	2
Windy Rig	No records	-
Scoping wind farm projects		
Douglas West Extension	No records within 500 m of site	-
Cumberhead (consented but a scoping report recently submitted for a re-design and larger turbines)	Curlew confirmed as breeding in relatively high numbers in suitable upland habitat particularly towards the west of the survey area (away from turbines) with nine confirmed territories and a further four probable territories	-

Curlew: Disturbance and Displacement

- 8.10.4 Curlew was observed at the majority of projects within the NHZ 19, with breeding common, although the species was not always taken forward for assessment and so information provided is often limited.
- 8.10.5 One pair of curlews were identified as having the potential to be affected by disturbance-displacement due to the Proposed Development.
- 8.10.6 Of the installed or consented projects where curlew was recorded, plus, the Proposed Development, potential disturbance-displacement may occur to around 106 pairs, or 2.5 % of the NHZ population (4,284 pairs). Clyde Wind Farm has been excluded from the cumulative assessment as curlew was not taken forward for assessment in the project's ES. The number of pairs within potential disturbance distance from turbines is therefore unknown, although it is highly unlikely that a value near the 106 pairs recorded within the whole survey area (Clyde Wind Farm area plus a 2 km buffer) will have been affected.
- 8.10.7 When including the projects at Application stage, including the Proposed Development, the total amount of pairs affected may be up to 137 (3.2 % of the NHZ population). No further birds are predicted to be displaced by the proposed Douglas West Extension and revised Cumberhead projects which are at scoping stage.
- 8.10.8 The BBPP will ensure that direct destruction of curlew nest sites during the construction phase of the Proposed Development is avoided. It is likely that a similar consent condition will exist for a

number of other consented projects for nest site destruction to be avoided, and to ensure legal compliance.

- 8.10.9 It is acknowledged that some potential nesting or foraging habitat within the NHZ will be lost due to operational projects. However, habitat management measures identified at around one third of other projects, will likely benefit curlew due to enhanced breeding and foraging conditions (e.g. bog and heath management), and at least partly offset such losses of habitat.
- 8.10.10 The curlew population has suffered a long-term decline across Scotland, and this trend is likely to have been replicated at an NHZ 19 level. There is some evidence to suggest that curlew is sensitive to wind farm development, and that when numbers are suppressed during wind farm construction, they do not fully recover during the operational phase (Pearce-Higgins *et al.* 2012). However, it is unlikely that long-term displacement of pairs close to wind farms would be 100 %, and so the predicted losses across the NHZ is likely to be a worst-case estimate.
- 8.10.11 Overall, because of the planned BBPPs, habitat management plans, and other mitigation measures across NHZ 19 and the unlikely scenario that all application projects considered in this cumulative assessment will become operational, a low spatial and long-term temporal effect on the NHZ 19 population is predicted.
- 8.10.12 The predicted cumulative effect is classified as **minor adverse** and is therefore **not significant** in the context of the EIA Regulations. The Proposed Development's contribution to this effect is considered to be negligible.

8.11 Summary

- 8.11.1 This chapter has assessed the potential effects associated with the construction, operation and decommissioning of the Proposed Development on birds. The Proposed Development involves a repowering of the Existing Development, by replacing the existing 26 turbine wind farm with 14 modern, larger turbines.
- 8.11.2 The compilation of baseline information for the ornithological assessment consisted of a desk-based assessment and one season of field surveys in accordance with SNH guidance (2014b & 2018b) for repowering wind farm schemes. The desk-based assessment included bird monitoring data recorded for seven proposed wind farm developments surrounding the site (providing data from 2003 to 2015). Baseline surveys in 2018 collected breeding bird data for the site, plus flight activity data for the area that extends outside the footprint of the Existing Development.
- 8.11.3 IOFs identified from the baseline assessment were curlew and golden plover.
- 8.11.4 Unmitigated construction and decommissioning 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.
- 8.11.5 During the operational period, effects were also assessed as **not significant** in the context of the EIA Regulations.
- 8.11.6 A cumulative assessment was undertaken for curlew, and it was concluded that no further mitigation is required for the Proposed Development, and all cumulative construction and operational effects are **not significant**, particularly when taking into account proposed mitigation and enhancement for other wind farm projects within NHZ 19.

Table 8.15 – Summary Table

Description of Effect	Significance of Potential Effect		Mitigation Measure	Significance of Residual Effect		Comparison with the Existing Development
	Significance	Beneficial/ Adverse		Significance	Beneficial/ Adverse	
During Construction / Decommissioning						
Curlew: Disturbance and displacement	Minor (Not significant)	Adverse	BBPP and pre-construction surveys. Spatial and temporal restrictions of construction activity if required.	Not Significant		No greater significance of effects are anticipated beyond those arising from decommissioning of the Existing Development.
Golden plover: Disturbance and displacement	Minor (Not significant)	Adverse	BBPP and pre-construction surveys. Spatial and temporal restrictions of construction activity if required.	Not Significant		
During Operation						
Curlew: Displacement	Minor (Not significant)	Adverse	None required	Not Significant		No greater significance of effects are anticipated beyond those arising from operation of the Existing Development.
Golden plover: Displacement	Minor (Not significant)	Adverse	None required	Not Significant		
Curlew: Collision risk	Minor (Not significant)	Adverse	None required	Not Significant		
Golden plover: Collision risk	Minor (Not significant)	Adverse	None required	Not Significant		
Cumulative Effects						
Curlew: Disturbance and displacement	Minor (Not significant)	Adverse	No further mitigation required	Not Significant		No greater significance of effects are anticipated beyond those arising from operation of the Existing Development cumulatively with the operational, consented and proposed wind farms considered in the assessment.

8.12 References

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