

Chapter 7: Ornithology

Chapter 7

Ornithology

Introduction

7.1 This chapter presents the findings of the assessment of likely significant effects of the Proposed Development on ornithological features associated with the construction, operation and decommissioning of the Proposed Development. The specific objectives of the chapter are to:

- Describe the ornithological baseline;
- Describe the methodology and significance criteria used in completing the assessment;
- Describe the potential significance of unmitigated effects (direct or indirect) on Important Ornithological Features (IOFs);
- Describe the mitigation measures proposed to address likely significant effects (if required); and
- Assess the residual effects remaining following the implementation of mitigation (if required) and enhancement, including cumulatively with other projects.

7.2 This chapter is supported by the following figures and appendices which are referred to throughout the text:

- **EIA Report Volume 3a: Figures**
 - **Figure 7.1: Site Boundary and Study Areas**
 - **Figure 7.2: Vantage Points and Viewsheds: September 2020 to mid-March 2022**
 - **Figure 7.3: Vantage Points and Viewsheds: mid-March 2022 to November 2022**
 - **Figure 7.4: Ornithological Designated Sites within 20 km**
 - **Figure 7.5: Raptor Activity: November 2020 to August 2022**
 - **Figure 7.6: Flight Activity Survey Records: Golden Eagle**
 - **Figure 7.7: Golden Eagle Topographical (GET) Model**
 - **Figure 7.8: Flight Activity Survey Records: Goshawk**
 - **Figure 7.9: Flight Activity Survey Records: Hen Harrier**
 - **Figure 7.10: Flight Activity Survey Records: Marsh Harrier**
 - **Figure 7.11: Flight Activity Survey Records: Merlin**
 - **Figure 7.12: Flight Activity Survey Records: Peregrine Falcon**
 - **Figure 7.13: Flight Activity Survey Records: Red Kite**
 - **Figure 7.14: Flight Activity Survey Records: Short-Eared Owl**
 - **Figure 7.15: Flight Activity Survey Records: White-Tailed Eagle**
 - **Figure 7.16: Breeding Curlew Activity: 2021 and 2022**
 - **Figure 7.17: Breeding Golden Plover Activity: 2021 and 2022**
 - **Figure 7.18: Breeding Lapwing Activity: 2021 and 2022**
 - **Figure 7.19: Non-Breeding Wader Activity: September 2020 to August 2022**

- **Figure 7.20: Flight Activity Survey Records: Curlew**
- **Figure 7.21: Flight Activity Survey Records: Golden Plover**
- **Figure 7.22: Flight Activity Survey Records: Lapwing**
- **Figure 7.23: Goose, Swan and Gull Activity: September 2020 to August 2022**
- **Figure 7.24: Flight Activity Survey Records: Greylag Goose**
- **Figure 7.25: Flight Activity Survey Records: Herring Gull**
- **Figure 7.26: Flight Activity Survey Records: Pink-Footed Goose.**
- **EIA Report Volume 4: Appendices**
 - **Appendix 7.1: Ornithology (including Annexes A – G).**
 - **Appendix 7.3: Shadow Habitats Regulations Appraisal (HRA).**
- **EIA Report Volume 5: Confidential Documents**
 - **Confidential Appendix 7.2: Confidential Ornithology.**
 - **Confidential Figure 7.2.1: Barn Owl Activity: September 2020 to August 2022**
 - **Confidential Figure 7.2.2: Merlin Activity: September 2020 to August 2022**
 - **Confidential Figure 7.2.3: Short-Eared Owl Activity: September 2020 to August 2022.**

Statement of Competence

7.3 The ornithology assessment was undertaken by MacArthur Green in accordance with NatureScot (formerly Scottish Natural Heritage, SNH) guidelines. All staff contributing to this chapter have undergraduate and/or postgraduate degrees in relevant subjects, have extensive professional ornithological impact assessment and ornithology survey experience, hold professional membership of the Chartered Institute of Ecology and Environmental Management (CIEEM), and abide by the CIEEM Code of Conduct.

7.4 Surveys by Wood Group UK Limited (hereafter referred to as 'Wood') were undertaken between September 2020 and August 2021. The data was provided to MacArthur Green in shapefile and excel format. **Appendix 7.1 Annex F¹** contains an overview of the Wood personnel (and their qualifications) involved in these surveys.

Methodology

Effects Scoped In to the Assessment

7.5 This assessment concentrates on the effects of construction, operation and decommissioning of the Proposed Development upon those IOFs identified during the review of desk-based information and field surveys (the extents of the survey and study areas are set out in the Method of Baseline Characterisation section below).

7.6 As detailed in the Scoping Report, there is considered to be potential for connectivity between the Proposed Development and pink-footed goose populations associated with the Firth of Forth Special Protection Area (SPA), Greenlaw Moor SPA and Fala Flow SPA. Consequently (and in conjunction with confirmation from NatureScot in their Scoping Response, **Table 7.1**), the Firth of Forth SPA (and associated Firth of Forth Site of Special Scientific Interest (SSSI) and Ramsar site), Greenlaw Moors SPA (and associated SSSI) and Fala Flow SPA (and associated SSSI) in the context of their pink-footed goose populations have been scoped in to the assessment.

7.7 The key ornithological effects relating to the Proposed Development have been identified as follows:

¹ Annex F is an interim report produced by Wood Group UK using a different project title (Fallago Rig 3).

- Permanent or temporary direct habitat loss for birds through construction, operation and decommissioning of the Proposed Development;
- Permanent or temporary disturbance-displacement of birds due to construction/decommissioning activities, turbine and substation operation and maintenance, or visitors. This also includes barrier effects to commuting or migrating birds due to the presence of wind turbines;
- Death or injury through collision with wind turbine blades or other types of infrastructure associated with the Proposed Development;
- The influence of turbine lighting on bird behaviour, whether resulting in displacement or attraction; and
- Cumulative effects of the Proposed Development during construction and operation when considering wind farms and other projects.

Effects Scoped Out of the Assessment

7.8 On the basis of baseline data, experience from other relevant projects and policy guidance or standards (e.g., SNH 2018a²), the following species will be ‘scoped out’ since significant effects are unlikely:

- Common and/or low Nature Conservation Importance (NCI) species not recognised in statute as requiring special conservation measures (i.e., not listed as Annex 1 or Schedule 1 species);
- Common and/or low NCI conservation species not included in non-statutory lists (i.e., not listed as Amber or Red-listed Birds of Conservation Concern (BoCC) (Stanbury *et. al* 2021³) species), showing birds whose populations are at some risk either generally or in parts of their range; and
- Passerine species, not generally considered to be at risk from wind farm developments (SNH 2016a⁴, 2017⁵), unless being particularly rare or vulnerable at a national level.

7.9 As detailed in the Scoping Report, there is considered to be no connectivity between the Proposed Development and the Firth of Forth SPA for all qualifying features, with the exception of pink-footed goose. These are either true seabirds or are migratory waterfowl for which the Site is unsuitable. Consequently (and in conjunction with confirmation from NatureScot in their Scoping Response, **Table 7.1**), all qualifying features of the Firth of Forth SPA (and associated Firth of Forth SSSI and Ramsar site) have been scoped out of the assessment, except for pink-footed goose.

Consultation

7.10 In undertaking the assessment, consideration has been given to the Scoping Responses and other consultation which has been undertaken as detailed in **Table 7.1**.

Table 7.1: Consultation responses

Consultee and Date	Scoping/Other Consultation	Issue Raised	Response/Action Taken
East Lothian Council 08/04/2022	Scoping	Previous windfarms development in the area provided some mitigation for black grouse and undertook ornithological monitoring. As far as the council is aware there remains an aspiration to promote recolonisation of the Lammermuirs from the Moorfoots which have a more robust population. Potential for habitat degradation and fragmentation as a result of the wind farm development could further hamper	GWCT, Lothian and Borders Raptor Study Group (LBRSG) and South Scotland Golden Eagle Project (SSGEP) were contacted to request data relating to black grouse,

² Scottish Natural Heritage (2018a). Assessing significance of impacts from onshore windfarms on birds out with designated areas. Version 2.

³ Stanbury, A., Eaton, M., Aebischer, N., Balmer, D., Brown, A., Douse, A., Lindley, P., McCulloch, N., Noble, D., and Win, I. (2021). Birds of Conservation Concern 5: The population status of birds in the UK, Channel Islands and Isle of Man and second ICUN Red List assessment of extinction risk for Great Britain. *British Birds* 114: 723-747.

⁴ Scottish Natural Heritage (2016a). Environmental Statements and Annexes of Environmentally Sensitive Bird Information; Guidance for Developers, Consultants and Consultees. Version 2.

⁵ Scottish Natural Heritage (2017). Recommended Bird Survey Methods to inform impact assessment of Onshore Windfarms

Consultee and Date	Scoping/Other Consultation	Issue Raised	Response/Action Taken
		conservation measures therefore consideration should be of the whole population in this area. RSPB/Game and Wildlife Conservancy [Conservation] Trust [GWCT]Lammermuirs Moorland Group would likely have the most up to date records.	breeding Schedule 1 raptors/owls and golden eagle respectively. No black grouse were recorded during baseline surveys (either during targeted surveys for lekking activity or during any other surveys).
Royal Society for the Protection of Birds (RSPB) Scotland 08/04/2022	Scoping	RSPB agree with the methodology and scope of assessment proposed.	Noted.
		RSPB advise that GWCT is contacted for data relating to black grouse, SBC and/or The Wildlife Information Centre [TWIC] is contacted for data on breeding waders, and Wildfowl and Wetlands Trust [WWT] is contacted for data and/or information on migratory routes for designated feature wintering pink-footed geese relating to Fala Flow and Greenlaw Moor SPAs.	GWCT, LBRSG and SSGEP were contacted to request data relating to black grouse, breeding Schedule 1 raptors/owls and golden eagle respectively.
NatureScot 09/05/2022	Scoping	The application site is located within 20 km of the following SPAs all designated for non-breeding pink-footed geese: Fala Flow SPA, Greenlaw Moor SPA and Firth of Forth SPA. At this distance the SPA geese have the potential to have connectivity with the application site and therefore welcome the proposal to scope the SPA geese into the EIA.	Noted.
		While we are satisfied that a single year of vantage point (VP) survey work will be sufficient for this site, NatureScot noted that the current suite of VP surveys have not included September 2021. As September - November is the autumn migration period for geese, advised that the current surveys which were undertaken from October – November, may not provide an accurate representation of pink-footed geese flight activity across the site. As such, advised that the 2022 suite of VP surveys should continue from September – November to account for the missing autumn migration period in 2021. If it is not possible to extend the duration of the VP surveys until November then there may be data available for the autumn migration period for other wind farms in the area which could be used as proxy.	Additional flight activity surveys were undertaken in September, October and November 2022.
		Footnote 44 on P36 of the Scoping Report states – “It should be noted that survey areas have been created by buffering (as required for the survey type, e.g., 500 m for breeding waders) a developable area that was provided by the Applicant at the time of the survey (as opposed to the study areas which are buffered from the finalised turbine locations and associated infrastructure at the assessment stage)”. Advise that it would be helpful for a figure to be provided within the EIA report to visually show this difference, if any at application stage. If there is a difference, it should be acknowledged within the assessment along with any impact it may have on the findings of the surveys.	Figure 7.1 details the survey areas alongside the study areas and any gaps in coverage are detailed below in the Limitations and Assumptions section.

Consultee and Date	Scoping/Other Consultation	Issue Raised	Response/Action Taken
		Due to the VP locations being located within the application site with some being located near to potential turbine locations, it is considered that this may affect bird flight activity across the site during the surveys. In particular there is high potential for the location of VP6 to affect flight activity at T6 and T7. As a result of this, confidence in the VP survey results and collision risk modelling is likely to be reduced.	<p>The selection process for VP locations endeavoured to locate VPs as appropriately as possible taking into account the likely turbine positions and topography of the Site (it should be noted that the Site has some steep valleys/relatively flat-topped hills that limit the options for siting VPs). The aim of flight activity surveys is to collect a representative sample across a suite of locations that cover the Proposed Development area that can then be combined in the collision modelling.</p> <p>Regarding the location of VP 6, it is over 300 m from T6 and over 1 km from T7 and so there is considered to be limited effects to flight behaviour around these turbine locations from the presence of a surveyor at VP 6. Furthermore, it should be noted that bird surveyors endeavour to be as unobtrusive as possible during flight activity surveys (e.g., not moving about during the survey and dressing in muted tones).</p>
		Confirmed that the IOFs and designated sites proposed for assessment are appropriate.	Noted.
Scottish Borders Council (SBC) May 2022	Scoping	Potential noise disturbance of breeding moorland birds during the operational phase should be considered within the EIAR.	The 'potential operational effects – displacement' section below considers all forms of displacement.
		Consideration should also be given to the ongoing re-establishment of Golden Eagles in the region (SSGEP). It is likely that released birds could occupy former home ranges and young birds are now foraging and commuting to certain areas within Scottish Borders. Further information may be available from the project team: https://www.goldeneaglessouthofscotland.co.uk/	GWCT, LBRSG and SSGEP were contacted to request data relating to black grouse, breeding Schedule 1 raptors/owls and golden eagle respectively.
		It would be preferable if black grouse and raptor surveys were carried out for another season. Bird numbers can vary considerably from year to year and the currently available data from one breeding season seems insufficient.	Scarce breeding bird surveys were undertaken during the 2021 and 2022 breeding seasons.

Consultee and Date	Scoping/Other Consultation	Issue Raised	Response/Action Taken
			Black grouse surveys were undertaken during the 2022 breeding season.
		SBC recommend that LBRSG is consulted for records of Schedule 1 raptors. Any sensitive information on protected species should be contained within a confidential annex.	LBRSG was contacted to request information. A summary is provided in the baseline section of this chapter for relevant species and detail is contained in Confidential Appendix 7.2 .
Energy Consents Unit May 2022	Scoping	It is recommended by the Scottish Ministers that decisions on bird surveys – species, methodology, vantage points, viewsheds and duration – site specifics and cumulative – should be made following discussion with NatureScot.	Noted.
Game and Wildlife Conservation Trust (GWCT) April 2023	Data request	A request was made for any black grouse data the GWCT may hold for the area.	Receipt of the email was acknowledged but despite a follow up email from the consultants, no further response has been received.
Lothian and Borders Raptor Study Group (LBRSG) April 2023	Data request	A request was made for any information relating to breeding Schedule 1 raptors/owls the LBRSG may hold for the area.	The LBRSG informed the consultant that they do not have recent coverage of the Lammermuir Hills area.
South Scotland Golden Eagle Project (SSGEP) April 2023	Data request	The SSGEP was contacted to check for any newly forming golden eagle territories within 6 km of the Proposed Development.	No response was received from the SSGEP (a follow up email to the original request was sent).

Committed Design Considerations

Project Assumptions, Good Practice Measures and Embedded Design

7.11 This chapter has been prepared on the basis of the assumptions/embedded mitigation listed below.

- All electrical cabling between the proposed turbines and the associated infrastructure will be underground in shallow trenches which would be reinstated post-construction and, in most cases, follow the proposed access tracks;
- Any ground disturbance areas around permanent infrastructure during construction will be temporary and land will be reinstated or restored before the construction period ends;
- To ensure all reasonable precautions are taken to avoid negative effects on ornithological interests during construction and decommissioning, the Applicant will appoint a suitably qualified Ecological Clerk of Works (ECoW) prior to the

commencement of construction and decommissioning, and they will advise the Applicant and the Principal Contractor on all ornithological matters (with the assistance of a suitably qualified/licenced ornithologist if required). The ECoW will be required to be present onsite during the construction and decommissioning periods and will carry out monitoring of works and briefings with regards to any ornithological sensitivities on the Site to the relevant staff within the Principal Contractor and subcontractors;

- A Bird Disturbance Management Plan (BDMP) will be implemented during construction of the Proposed Development. The BDMP will detail measures to ensure legal compliance and safeguard breeding birds known to be in the area and will include species-specific guidance. The BDMP shall include pre-construction surveys and good practice measures during construction. Pre-construction surveys will be undertaken to check for any new breeding bird activity in the vicinity of the construction works. The ECoW will oversee the implementation of the above measures; and
- Work on the Proposed Development, including vegetation clearance and construction of the site access tracks, turbine hardstandings and site compound and erection of the turbines, is predicted to last for approximately 19 months. The number of bird breeding seasons potentially disrupted would depend on the month in which construction commences and the breeding season of the potentially affected species. The main breeding season of most birds at the Site extends from March to August. For the purposes of this assessment, it is assumed that, for any given species of bird, construction activities would commence during the breeding season and would therefore potentially affect a maximum of up to two breeding seasons. This, therefore, represents a worst-case scenario.

7.12 Furthermore, the assessment of potential effects is based on the Proposed Development description outlined in **Chapter 3: Development Description**, with the relevant specifications used to determine the 'worst-case' Proposed Development.

7.13 Breeding locations and key foraging areas of target species were taken into consideration from the early stages of the Proposed Development design process to minimise the risk of disturbance, displacement and collision effects. In summary, the following steps have been taken in the design process to minimise the risk of significant effects on IOFs:

- Avoidance of the recorded merlin nesting location by at least 500 m; and
- Minimising new tracks/utilising existing wind farm tracks to minimise potential displacement of breeding waders.

Method of Baseline Characterisation

Extent of the Study / Survey Area

7.14 A range of surveys were employed to accurately record baseline ornithological conditions within the Site and appropriate survey buffers. Terms referred to are as follows:

- 'Survey area' is defined as the area covered by each field survey type at the time of survey; and
- 'Study area' is defined as the area of consideration, based on the likely spatial extent of impacts on each species at the time of assessment and as the area used for any desk-based study (**Figure 7.1**).

7.15 The spatial extent of each survey area is listed in **Paragraph 7.18** below and detailed in **Appendix 7.1**.

7.16 The ornithology assessment considers the following study areas which are based on the final turbine layout and associated infrastructure (with the exception of the cumulative Natural Heritage Zone (NHZ) scale as these are pre-defined by NatureScot):

- Designated sites – the Proposed Development and a 20 km study area buffer (from the proposed turbines) (based on the greatest foraging range provided in SNH 2016b⁶) (**Figure 7.4**);
- Collision risk modelling – the results of the flight activity surveys have been used to inform collision modelling. A Collision Risk Analysis Area (CRAA) has been created using GIS Delaunay triangulation⁷ from the proposed turbine locations to create a wind farm area which has been buffered by 500 m (as per SNH 2017⁵) (see **Figure 7.2** and subsequent relevant figures);

⁶ Scottish Natural Heritage (2016b). Assessing connectivity with Special Protection Areas (SPAs). Version 3.

⁷ Delaunay triangulation is a form of mathematical/computational geometry where a given set of points (in this case the turbine locations) are all joined to create discrete triangles. Further information is available here: <https://uk.mathworks.com/help/matlab/math/delaunay-triangulation.html>

- Scarce⁸ breeding birds – the Proposed Development and a 2 km (turbines) / 800 m (access track) study area buffer (SNH 2017⁵) (**Figure 7.1**);
- Black grouse – the Proposed Development and a 1.5 km (turbines) / 750 m (access track) study area buffer (SNH 2017⁵);
- Breeding upland waders and wintering waders, raptors, owls and wildfowl – the Proposed Development and a 500 m study area buffer (around both turbines and infrastructure) (SNH 2017⁵) (**Figure 7.1**);
- Cumulative assessment – as per NatureScot guidance (SNH 2018b⁹), the NHZ level is considered practical and appropriate for breeding species of wider countryside interest.

Desk Study

7.17 The following data sources have informed the assessment:

- LBRSG for records relating to breeding raptors and owls within 2 km;
- SSGEP for information on the formation of any new golden eagle breeding territories in the surrounding area; and
- GWCT for records relating to breeding black grouse within 2 km.

Field Surveys

7.18 All field surveys were conducted following the recommended NatureScot survey guidance (SNH 2017⁵). Fieldwork within and surrounding the Site was undertaken between September 2020 and November 2022. This covered two breeding seasons (2021 and 2022), two non-breeding seasons (2020/2021 and 2021/2022) and an additional partial non-breeding season (2022/2023). The following surveys were undertaken (see **Appendix 7.1** for details):

- Flight activity surveys – September 2020 to November 2022 (refer to **Figure 7.2** and **Figure 7.3** for viewshed coverage);
- Scarce breeding bird surveys – spring/summer 2021 and 2022;
- Black grouse surveys – spring 2022;
- Breeding bird surveys– spring/summer 2021 and 2022; and
- Winter walkover surveys – autumn/winter 2021/2022.

Criteria for the Assessment of Effects

Outline Assessment Process

7.19 This section defines the methods used to assess the significance of effects through the process of an evaluation of the sensitivity of a feature (a combination of NCI and conservation status) and magnitude of effect. The assessment considers the Proposed Development as described in **Chapter 3**.

7.20 The evaluation for wider-countryside interests (i.e., interests unrelated to European Sites, but including SSSIs and Ramsar sites) has been made using the following process:

- Identifying the potential effect associated with the Proposed Development on an ornithological feature;
- Considering the likelihood of occurrence of the potential effect;
- Defining the sensitivity of a feature to effects via the NCI of the species present and its conservation status;
- Establishing the magnitude of the effect (both spatial and temporal);

⁸ Scarce breeding birds are those listed on Annex 1 of the EU Birds Directive or Schedule 1 of the Wildlife and Countryside Act 1981 (as amended) and in the case of the Proposed Development consists of any raptor and owl species listed on either Annex 1 or Schedule 1.

⁹ Scottish Natural Heritage (2018b). Assessing the cumulative impacts of onshore wind farms on birds.

- Based on the above criteria, making a judgement as to whether or not the resultant effect on an ornithological feature is significant with respect to the EIA Regulations¹⁰;
- If a potential effect is determined to be significant, suggesting measures to mitigate or compensate the effect where required; and
- Considering residual effects after mitigation, compensation or enhancement.

Habitats Regulations Appraisal Process

7.21 The method for assessing the likely significant effects on a European site (in this context, an SPA) is different from that outlined above for wider-countryside ornithological interests. This is based on the Habitats Directive, which is transposed into domestic legislation by the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended in Scotland) Regulation 48 and includes a number of steps to be taken by the competent authority before granting consent (these are referred to here as an HRA). In order of application, the first four are:

- Step 1: consider whether the proposal is directly connected to or necessary for the management of the SPA (Regulation 48(1)(b)).
- If not, Step 2: consider whether the proposal (alone or in combination) is likely to have a significant effect on the SPA (Regulation 48(1)(a)).
- If so, Step 3: make an Appropriate Assessment of the implications for the SPA in view of that SPA's conservation objectives (Regulation 48(1)(a)).
- Step 4: consider whether it can be ascertained that the proposal will not adversely affect the integrity of the SPA ("Integrity Test") having regard to the manner in which it is proposed to be carried out or to any conditions or restrictions subject to which they propose that the consent, permission or other authorisation should be given (Regulation 48(5) and 48(6)).

7.22 It can clearly be established that the Proposed Development does not meet the criteria for Step 1. Where likely significant effects have been identified (Step 2), the results of baseline surveys and scientific conclusions presented in this chapter are therefore used to inform the HRA process and allow the competent authority to conduct an Appropriate Assessment (Step 3), and to conclude any adverse effects onsite integrity (Step 4) if required.

Criteria for Assessing Sensitivity of Features

7.23 The sensitivity of ornithological features on or near to the Proposed Development Site is assessed in line with best practice guidance, legislation, statutory designations and/or professional judgement.

7.24 Determination of the level of sensitivity of an ornithological feature is based on a combination of the feature's NCI and conservation status. There are three levels of NCI as detailed in **Table 7.2**.

Table 7.2: Determining Factors of a Feature's Nature Conservation Importance (NCI)

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 breeding species listed on Schedule 1 of the Wildlife and Countryside Act 1981 (as amended). The presence of breeding species listed in Annex I of the Birds Directive (but population does not meet the designation criteria under selection guidelines). The presence of rare, Red-listed breeding species noted on the latest BoCC Red list (Stanbury <i>et al.</i> 2021 ³).

¹⁰ Environmental Impact Assessment (EIA) under The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017 (as amended).

Importance	Description
	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.

7.25 IOFs (as per CIEEM 2018¹¹) to be assessed for the purposes of the EIA Report, are taken to be those species of high or medium NCI.

7.26 As defined by NatureScot (SNH 2018a²), 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 NatureScot (SNH 2018a²) 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.”

7.27 NatureScot (SNH 2018a²) 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.*”

7.28 In the case of non-designated sites in Scotland, the relevant regional scale for breeding species is usually considered to be the appropriate NHZ (Wilson *et al.* 2015¹²) which the Site falls within. The Proposed Development is within NHZ 20 (Border Hills). In some cases, other geographical scales may be more appropriate and have more data available, e.g., distinct subpopulations, reintroduced populations or established ‘regions’ that have formed the basis of national censuses or other long-term monitoring programmes.

7.29 For wintering or migratory species, the national UK population or flyway population is considered to be the relevant scale for determining effects on the conservation status, unless there are other more appropriate geographical populations to use for a species.

Criteria for Assessing Magnitude of Effect

7.30 An effect 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.

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

¹¹ CIEEM (2018). Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine version 1.1. Chartered Institute of Ecology and Environmental Management, Winchester.

¹² Wilson, M. W., Austin, G. E., Gillings S. and Wernham, C. V. (2015). Natural Heritage Zone Bird Population Estimates. SWBSG Commissioned report number SWBSG_1504. pp72. Available from: www.swbsg.org

7.32 The sensitivity of individual species to anthropogenic activities is considered when determining spatial and temporal magnitude of effect and is assessed using guidance described by Bright *et al.* (2006¹³), Hill *et al.* (1997¹⁴) and Goodship and Furness (2022¹⁵).

7.33 Effects are judged in terms of magnitude in space and time. There are five levels of spatial and temporal effect magnitude as detailed in **Table 7.3** and **Table 7.4** respectively.

Table 7.3: Spatial Magnitude of Effect

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.
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 (or no discernible) 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 7.4: Temporal Magnitude of Effect

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 15-25 years or longer (see above).
Medium-term	Approximately 5-15 years.
Short-term	Up to approximately 5 years.
Negligible	< 12 months.

¹³ Bright, J. A., Langston, R. H. W., Bullman, R., Evans, R. J., Gardner, S., Pearce-Higgins, J. & Wilson, E. (2006). Bird Sensitivity Map to provide locational guidance for onshore Windfarms in Scotland. Royal Society for the Protection of Birds.

¹⁴ Hill, D.A., D. Hockin, D. Price, G. Tucker, R. Morris, and J. Treweek. (1997). Bird disturbance: improving the quality of disturbance research. *Journal of Applied Ecology* 34:275-288.

¹⁵ Goodship, N.M. and Furness, R.W. (MacArthur Green) Disturbance Distances Review: An updated literature review of disturbance distances of selected bird species. NatureScot Research Report 1283.

Criteria for Assessing Significance

7.34 The predicted 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 7.5** below. Major and moderate effects are considered significant in the context of the EIA Regulations.

Table 7.5: Significance criteria

Significance of Effect	Definition
Major	The effect is likely to result in a long-term significant effect on the integrity of a feature.
Moderate	The effect is likely to result in a medium term or potentially significant effect on the integrity of a feature.
Minor	The effect is likely to affect a feature at an insignificant level by virtue of its limitations in terms of duration or extent, but there will probably be no effect on its integrity.
Negligible	No material effect.

Criteria for Assessing Cumulative Effects

7.35 NatureScot (SNH 2018b⁹) has provided guidance on assessing the cumulative effects on birds. This assessment follows the principles set out in that guidance.

7.36 Cumulative effects may include cumulative disturbance-displacement, collision mortality, habitat loss or barrier effects. Some cumulative effects, such as collision risk, may be summed quantitatively, but according to NatureScot (SNH 2018b⁹) *“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”*.

7.37 The main projects likely to cause similar effects on ornithological features are other operational wind farm developments, or those under construction, consented, or in the planning process, located within NHZ 20.

Limitations and Assumptions

7.38 Limitations exist with regard to the knowledge base on how some species, and the populations to which they belong, react to effects. A precautionary approach is taken in these circumstances, and as such it is considered that these limitations do not affect the robustness of this assessment.

7.39 In general, survey effort either met or exceeded the minimum requirements stipulated in NatureScot guidance (SNH 2017⁵) with weather conditions appropriate for the surveys (refer to **Appendix 7.1** for details). As noted in **Table 7.1**, following the completion of the first year of surveys (September 2020 to August 2021), flight activity surveys for year two started in November 2021. To account for not covering all of the autumn migration period of the 2021/2022 non-breeding season, flight activity surveys for the second year were continued until November 2022.

7.40 As shown on **Figure 7.1**, two small portions of the 500 m study area were not covered by the 500 m breeding wader survey area (one portion on the western side where the Proposed Development meets the operational Fallago Rig Wind Farm and a second portion along the access track in the east). Neither of these areas are considered to represent a ‘data gap’ as they were covered by the scarce breeding bird survey area (**Figure 7.1**) and whilst not the focus of these surveys, target waders were still recorded/mapped during these surveys. A small portion of the scarce breeding bird study area (southernmost portion of the access track, **Figure 7.1**) is also not covered by the scarce breeding bird survey area, however this is not considered to represent a ‘data gap’ as all survey access was taken along this track across the two year baseline survey period and this provided sufficient scope for identifying any breeding Schedule 1 raptors/owls within this area. Furthermore, it should be noted that whilst surveyors focus their attention within the survey area relating to their particular survey, they will map any target species they spot (regardless of location) and often be scanning over the survey area and beyond it at the same time depending on the topography.

Baseline Conditions

7.41 The sections below provide information on statutory designations, a summary of target species recorded during flight activity surveys and a summary of all survey results per target species (grouped into species groups). For each target species recorded it is also determined, based on baseline survey results and/or historic data, whether they can be reasonably scoped out of the assessment at this stage as a result of a lack of likely significant effects at a population level.

Designated Sites

7.42 There are no statutory designations with ornithological features within the Site, however there are three SPAs (alongside the associated SSSIs and Ramsar sites that underpin these SPAs) within 20 km of the Proposed Development (**Figure 7.4**).

- Greenlaw Moor SPA (underpinned by the Greenlaw Moor SSSI and Ramsar): approximately 11.1 km to the south-east of the nearest turbine, designated for non-breeding pink-footed goose.
- Fala Flow SPA (underpinned by the Fala Flow SSSI and Ramsar): approximately 15.1 km to the west of the nearest turbine, designated for non-breeding pink-footed goose.
- Firth of Forth SPA (underpinned by the Firth of Forth SSSI and Ramsar): approximately 18.3 km to the north of the nearest turbine, designated for non-breeding bar-tailed godwit, common scoter, cormorant, curlew, dunlin, eider, golden plover, goldeneye, great crested grebe, grey plover, knot, lapwing, long-tailed duck, mallard, oystercatcher, pink-footed goose, red-breasted merganser, red-throated diver, redshank, ringed plover, sandwich tern (passage), scaup, shelduck, Slavonian grebe, turnstone, velvet scoter, wigeon and waterfowl assemblage.

Flight Activity Summary

7.43 A summary of all target species recorded during flight activity surveys at the Site is presented in **Table 7.6**. This includes all flights observed during the baseline survey period (September 2020 to November 2022) during the flight activity surveys regardless of the location of the flights in relation to the Proposed Development. For further details of the flight activity surveys, refer to **Appendix 7.1**.

7.44 A summary of the collision risk model (CRM) results is presented in **Table 7.6** (refer to **Appendix 7.1 Annex E** for detailed results). Three species (merlin, red kite and short-eared owl) were recorded during flight activity surveys, but no flights were considered to be 'at-risk' (i.e., the flights were outside of the CRAA and associated viewshed and/or were only recorded flying below/above the rotor swept area) and are therefore not included in **Table 7.7**.

Table 7.6: Target Species Recorded During Flight Activity Surveys, September 2020 to November 2022

Species	Total Number of Flights Recorded	Total Number of Birds Recorded	Total Bird Seconds ¹⁶ Recorded
Curlew ¹⁷	77	127	7,816
Golden eagle	2	2	913
Golden plover	247	4,389	1,341,207
Goshawk	17	18	2,220
Greylag goose	173	915	57,703
Hen harrier	27	27	2,185
Herring gull	18	78	4,439

¹⁶ Bird seconds are calculated for each observation as the product of flight duration and number of individuals. This has then been summed to provide the total bird seconds for each species recorded over the entire survey period.

¹⁷ Curlew or lapwing were not considered as target species during the flight activity surveys undertaken by Wood between September 2020 and August 2021.

Species	Total Number of Flights Recorded	Total Number of Birds Recorded	Total Bird Seconds ¹⁶ Recorded
Lapwing ¹⁷	31	254	11,442
Marsh harrier	6	6	925
Merlin	8	8	157
Peregrine falcon	75	77	6,199
Pink-footed goose	35	2,388	228,381
Red kite	22	23	3,675
Short-eared owl	49	52	5,752
White-tailed eagle	2	2	70

Table 7.7: Predicted Collision Rates

Species	Mean Breeding Season	Mean Non-Breeding Season	Mean Annual	Equivalent to One Bird Every X Years
Curlew ¹⁸	0.1208	0.0059	0.1267	7.9
Golden eagle	0.0082	0	0.0082	122
Golden plover	0.0734	31.2575	31.3310	0.03
Goshawk	0	0.0009	0.0009	1082
Greylag goose	0.0073	0.0665	0.0738	13.5
Hen harrier	0	0.0035	0.0035	287
Herring gull	0.0048	0.0002	0.0050	201
Lapwing ¹⁸	0	0.0032	0.0032	314
Marsh harrier	0.0005	0	0.0005	2068
Peregrine falcon	0.0240	0.0301	0.0540	18.5
Pink-footed goose	0	0.1310	0.1310	7.6
Red kite	0.0478	0	0.0478	20.9
White-tailed eagle	0.0040	0	0.0040	249

Black Grouse

7.45 Black grouse surveys were undertaken in April and May 2022. No evidence of lekking black grouse was located. Furthermore, no evidence of black grouse (lekking or otherwise) was recorded during any survey within the full baseline survey period (September 2020 to November 2022).

¹⁸ Curlew or lapwing were not considered as target species during the flight activity surveys undertaken by Wood between September 2020 and August 2021, consequently the collision modelling for these species is based on one year of data.

7.46 Considering the lack of black grouse within 2 km of the Site, black grouse is scoped out of the assessment.

Raptors and Owls

Barn Owl

7.47 Barn owl were recorded on six occasions and were identified to be roosting at two locations (identified as BO_1 and BO_2 on **Confidential Figure 7.2.1** and in **Table 7.8**) however no evidence of breeding was identified. Guidance from Shawyer (2011¹⁹) for continuous activity disturbance distances provides a range of 20 m (pedestrian movement) to 175 m (heavy construction works) for breeding barn owl. No turbines are within 175 m of either roost location and whilst a short section of track is within 175 m of BO_2, the only work expected would be some upgrading works on the existing track and the construction of a small stretch of new track. Furthermore BO_2 is situated in an existing estate building and barn owl present in this location are likely habituated to human activity (from both activity relating to the operational Fallago Rig Wind Farm and estate works). To minimise any potential disturbance to barn owl present at BO_2, a buffer of 60 m (continuous general building and landscape works, Shawyer 2011¹⁹) will be applied to this location during construction with mitigation recommendations such as speed limits and restrictions on pedestrian movements within this buffer detailed in the BDMP.

Table 7.8: Barn Owl Roosting Locations – Distance to Nearest Infrastructure

Nest/Roost ID	Distance to Nearest Turbine	Distance to Nearest Infrastructure
BO_1	3.08 km	334 m (existing track)
BO_2	1.34 km	65 m (existing track)

7.48 Considering the measures to be deployed to avoid disturbance to barn owl at BO_2 and the limited activity within the rest of the study area, barn owl is scoped out of the assessment.

Golden Eagle

7.49 Golden eagle were recorded on four occasions during walkover surveys in the 2022 breeding season (**Figure 7.5**). Adults were recorded in April and July 2022 and a juvenile female was recorded one occasion in May 2022 (this bird was also seen later the same day outwith the survey area).

7.50 Flight activity surveys recorded two flights (**Table 7.6, Figure 7.6**), of which both were identified to be 'at-risk', predicting a worst-case collision risk of one bird every 122 years (**Table 7.7**).

7.51 Considering the SSGEP and the request from SBC to consider the project (**Table 7.1**), and that golden eagle have been recorded within the study area, golden eagle is scoped in to the assessment.

Goshawk

7.52 Goshawk were recorded on seven occasions during walkover surveys, in March and April 2021, and January and March 2022 (**Figure 7.5**). No evidence of breeding was located within 2 km of the Site however it was suspected in 2021 that a pair were present at a territory within Harecleugh Forest to the south of the Site (over 2 km from the nearest turbine).

7.53 Flight activity surveys recorded 17 flights (**Table 7.6, Figure 7.8**), of which one was identified to be 'at-risk', predicting a worst-case collision risk of one bird every 1,082 years (**Table 7.7**).

7.54 Considering this species' lack of breeding activity, low records within the study area and negligible predicted risk of collision, goshawk is scoped out of the assessment.

¹⁹ Shawyer, C. R. 2011. Barn owl *Tyto alba* Survey Methodology and Techniques for use in Ecological Assessment: Developing Best Practice in Survey and Reporting. IEEM, Winchester.

Hen Harrier

7.55 Hen harrier were recorded on seven occasions during walkover surveys in November 2020, March and June 2021, and January, May and August 2022 (**Figure 7.5**). No evidence of breeding or roosting was located within 2 km of the Site.

7.56 Flight activity surveys recorded 27 flights (**Table 7.6, Figure 7.9**), of which six were identified to be 'at-risk', predicting a worst-case collision risk of one bird every 287 years (**Table 7.7**).

7.57 Considering this species' lack of breeding activity, low records within the study area and negligible predicted risk of collision, hen harrier is scoped out of the assessment.

Marsh Harrier

7.58 A marsh harrier was recorded on one occasion during walkover surveys in May 2022 (**Figure 7.5**). No evidence of breeding was located within 2 km of the Site.

7.59 Flight activity surveys recorded six flights (**Table 7.6, Figure 7.10**), of which one was identified to be 'at-risk', predicting a worst-case collision risk of one bird every 2,068 years (**Table 7.7**).

7.60 Considering this species' lack of breeding activity, limited records within the study area and negligible predicted risk of collision, marsh harrier is scoped out of the assessment.

Merlin

7.61 Merlin were confirmed to be breeding at one location in 2021 (identified as ML_1 on **Confidential Figure 7.2.2** and in **Table 7.9**) and birds were recorded during walkover surveys on 13 occasions during the 2021 breeding season (**Confidential Figure 7.2.2**). Merlin were observed during walkover surveys on two occasions during the 2021/2022 non-breeding season (November 2021 and January 2022, **Confidential Figure 7.2.2**) and during walkover surveys on three occasions during the 2022 breeding season (May and June 2022, **Confidential Figure 7.2.2**), however no evidence of breeding was identified during the 2022 breeding season.

Table 7.9: Merlin Breeding Locations – Distance to Nearest Infrastructure

Nest ID	Distance to Nearest Turbine	Distance to Nearest Infrastructure
ML_1	1.4 km	1.3 km (proposed new track)

7.62 Flight activity surveys recorded eight flights (**Table 7.6, Figure 7.11**), which were not identified to be 'at-risk' and therefore no risk of collision is predicted.

7.63 Considering the nearest known merlin nest site is over 1 km from the Proposed Development and no predicted risk of collision, merlin is scoped out of the assessment.

Osprey

7.64 An osprey was recorded on one occasion in August 2022 (**Figure 7.5**) and an incidental record of a bird fishing to the east of the Site at Watch Water reservoir was also recorded in August 2022. No evidence of breeding was located within 2 km of the Site.

7.65 Considering this species' lack of breeding activity and limited records within the study area, osprey is scoped out of the assessment.

Peregrine Falcon

7.66 Peregrine falcon were recorded on 12 occasions during walkover surveys from March to August 2021, and January, February, June and July 2022 (**Figure 7.5**). No evidence of breeding was located within 2 km of the Site.

7.67 Flight activity surveys recorded 75 flights (**Table 7.6, Figure 7.12**), of which 27 were identified to be 'at-risk', predicting a worst-case collision risk of one bird every 18.5 years (**Table 7.7**).

7.68 Considering this species' lack of breeding activity, low records within the study area and low predicted risk of collision, peregrine falcon is scoped out of the assessment.

Red Kite

7.69 Red kite were recorded on ten occasions during surveys in April and July 2021, and March, June and July 2022 (**Figure 7.5**). No evidence of breeding was located within 2 km of the Site. Flight activity surveys recorded 22 flights (**Table 7.6, Figure 7.13**), of which nine were identified to be 'at-risk', predicting a worst-case collision risk of one bird every 20.9 years (**Table 7.7**).

7.70 Considering this species' lack of breeding activity, low records within the study area and low predicted risk of collision, red kite is scoped out of the assessment.

Short-Eared Owl

7.71 Short-eared owl were confirmed to be breeding at two locations in 2021 with at least one chick fledged from each nest (identified as SE_1 and SE_2 on **Confidential Figure 7.2.3** and in **Table 7.10**). Short-eared owl were present at the Site during the 2022 breeding season with birds seen to be displaying some evidence of breeding behaviour in four broad areas identified to be of suitable nesting habitat (**Confidential Figure 7.2.3** shows 2022 breeding season activity and indicates the areas where potential breeding behaviour was recorded using SE_A, SE_B, SE_C and SE_D), however no nests or fledglings were located. The nearest of these four potential breeding areas in 2022 was over 1.5 km from the proposed turbine locations.

Table 7.10: Short-Eared Owl 2021 Breeding Locations – Distance to Nearest Infrastructure

Nest ID	Distance to Nearest Turbine	Distance to Nearest Infrastructure
SE_1	303 m	42 m (proposed new track)
SE_2	3.0 km	248 m (existing track)

7.72 Flight activity surveys recorded 49 flights (**Table 7.6, Figure 7.14**), which were not identified to be 'at-risk' and therefore no risk of collision is predicted.

7.73 Considering this species' breeding activity within the Site, short-eared owl is scoped in to the assessment.

White-Tailed Eagle

7.74 Flight activity surveys recorded two flights (**Table 7.6, Figure 7.15**), of which one was identified to be 'at-risk', predicting a worst-case collision risk of one bird every 249 years (**Table 7.7**).

7.75 No further recorded of white-tailed eagle were recorded during walkover surveys and there is no evidence of breeding within 2 km.

7.76 Considering this species' lack of breeding activity, limited records within the study area and negligible predicted risk of collision, white-tailed eagle is scoped out of the assessment.

Waders

7.77 **Table 7.11** contains a summary of estimated numbers of breeding territories of target wader species (i.e., Annex I, BoCC Red-listed) within the 500 m study area and within 500 m of proposed turbine locations, with all recorded activity during the breeding season shown on **Figure 7.16, Figure 7.17** and **Figure 7.18**.

Table 7.11: Breeding Wader Activity, 2021 and 2022 – Estimated Number of Territories within the 500 m Study Area and Within 500 m of the Proposed Turbines

Species	2021: total within 500 m Study Area	2021: within 500 m of Proposed Turbines	2022: total within 500 m Study Area	2022: within 500 m of Proposed Turbines
Curlew	9 – 10	4	19 – 27	9 – 12

Species	2021: total within 500 m Study Area	2021: within 500 m of Proposed Turbines	2022: total within 500 m Study Area	2022: within 500 m of Proposed Turbines
Golden Plover	7 – 9	5 – 6	9 – 13	6 – 9
Lapwing	4 – 7	2 – 4	22 – 24	1 – 2

Curlew

7.78 Breeding bird walkover surveys recorded breeding curlew within the 500 m study area both years (**Figure 7.16**) with an estimated minimum of nine and maximum of 27 territories in any one year (**Table 7.11**). Non-breeding curlew were also recorded during the 2021 and 2022 breeding seasons (**Figure 7.19**).

7.79 Flight activity surveys recorded 77 flights (**Table 7.6, Figure 7.20**), of which 14 were identified to be ‘at-risk’, predicting a worst-case collision risk of one bird every 7.9 years (**Table 7.7**).

7.80 Considering this species’ breeding activity within the Site, curlew is scoped in to the assessment.

Golden Plover

7.81 Breeding bird walkover surveys recorded breeding golden plover within the 500 m study area both years (**Figure 7.17**) with an estimated minimum of seven and maximum of 13 territories in any one year (**Table 7.11**). Non-breeding golden plover were also recorded during the 2021 and 2022 breeding seasons and 2021/2022 non-breeding season with flocks of up to 50 birds recorded (**Figure 7.19**).

7.82 Flight activity surveys recorded 247 flights (**Table 7.6, Figure 7.21**), of which 83 were identified to be ‘at-risk’, predicting a worst-case collision risk of 31 birds per year (**Table 7.7**).

7.83 Considering this species’ breeding activity within the Site, and predicted collision rates, golden plover is scoped in to the assessment.

Lapwing

7.84 Breeding bird walkover surveys recorded breeding lapwing within the 500 m study area both years (**Figure 7.18**) with an estimated minimum of four and maximum of 24 territories in any one year (**Table 7.11**). Non-breeding lapwing were also recorded during the 2021 and 2022 breeding seasons and 2021/2022 non-breeding season with flocks of up to 100 birds recorded (**Figure 7.19**).

7.85 Flight activity surveys recorded 31 flights (**Table 7.6, Figure 7.22**), of which one was identified to be ‘at-risk’, predicting a worst-case collision risk of one bird every 314 years (**Table 7.7**).

7.86 Considering this species’ breeding activity within the Site, lapwing is scoped in to the assessment.

Ringed Plover

7.87 A single ringed plover (**Figure 7.19**) was recorded in August 2022 with no evidence of breeding.

7.88 Considering this species’ lack of breeding activity, ringed plover is scoped out of the assessment.

Wood Sandpiper

7.89 A single record of three wood sandpiper (**Figure 7.19**) was recorded in August 2022 with no evidence of breeding.

7.90 Considering this species’ lack of breeding activity, wood sandpiper is scoped out of the assessment.

Wildfowl and Gulls

Pink-Footed Goose

7.91 Pink-footed geese were recorded during walkover surveys on ten occasions between September 2020 and March 2021, and four occasions between November 2021 and April 2022 (**Figure 7.23** details records where birds were in flight over the Site/were able to be observed).

7.92 Flight activity surveys recorded 35 flights (**Table 7.6, Figure 7.26**), of which 11 were identified to be 'at-risk', predicting a worst-case collision risk of one bird every 7.6 years (**Table 7.7**).

7.93 Considering this species' inclusion as a non-breeding feature on the designations for the Greenlaw Moor SPA, Fala Flow SPA and Firth of Forth SPA and the potential for connectivity between these SPAs and the Site, the SPA populations of pink-footed goose are scoped in to the assessment.

Greylag Goose

7.94 Greylag geese were recorded during walkover surveys on 21 occasions between October 2020 and April 2021 and on 68 occasions between January 2023 and July 2023 (**Figure 7.23**). The records are considered to be predominately of resident greylag geese given the timing of the records and the behaviour recorded (and the presence of chicks during the breeding season), however there were some records more likely to be of migratory greylag geese based on their behaviour, larger flock sizes and timings. Records relating to migratory greylag geese were predominately focussed around Watch Water Reservoir (over 3 km from the nearest proposed turbine) to the east of the Site (five records of flocks of between five and 95 birds across October 2020, January 2021 and March 2022), with five further records likely to be of migratory birds overflying the Site in October 2020 and March 2021 (flocks of between nine and 55 birds).

7.95 Flight activity surveys recorded 173 flights (**Table 7.6, Figure 7.24**), of which 39 were identified to be 'at-risk', predicting a worst-case collision risk of one bird every 13.5 years (**Table 7.7**).

7.96 Considering the evidence that the Site is of limited foraging or roosting importance to migratory birds (as birds were only recorded overflying the Site rather than utilising it) and the low predicted risk of collision, greylag goose is scoped out of the assessment.

Barnacle Goose

7.97 A single barnacle goose was recorded (with a flock of Canada geese) overflying the site in May 2022 (**Figure 7.23**).

7.98 Considering this species' lack of activity on the Site, barnacle goose is scoped out of the assessment.

Whooper Swan

7.99 Whooper swan were recorded in flight over the Site on one occasion, two birds in March 2021 (**Figure 7.23**). No evidence of whooper swan foraging on or roosting on the Site was identified across the baseline survey period.

7.100 Considering this species' lack of activity on the Site, whooper swan is scoped out of the assessment.

Herring Gull

7.101 Herring gull were infrequently recorded during walkover surveys across the Site as either individual birds or small flocks of up to five birds (**Figure 7.23**). No evidence of breeding was recorded.

7.102 Flight activity surveys recorded 18 flights (**Table 7.6, Figure 7.25**), of which five were identified to be 'at-risk', predicting a worst-case collision risk of one bird every 201 years (**Table 7.7**).

7.103 Considering this species' lack of breeding activity and negligible predicted risk of collision, herring gull is scoped out of the assessment.

Future Baseline in the Absence of the Proposed Development

7.104 In the absence of the Proposed Development, assuming the continuation of current predominately commercial estate land management practices within and around the Site and allowing for changes in bird behaviour and distribution related to climate change, the bird populations are likely to continue to be present in largely similar abundances and distributions to those described in the baseline. Any changes in numbers and diversity of species are likely to be a reflection of their wider population trends and influences such as climate change (e.g., delayed breeding, reduced or increased breeding success depending on the species range, Pearce-Higgins 2021²⁰) rather than site-specific factors.

Assessment of Likely Significant Effects

7.105 The assessment of effects is based on the project description as outlined in **Chapter 3** and the embedded mitigation by design described in **Chapter 2: Site Selection and Design Strategy**. An Outline Construction Environmental Management (CEMP) has also been prepared and is included in **Appendix 3.1**. Unless otherwise stated, potential effects identified are considered to be adverse.

Summary of Scoped In Important Ornithological Features

7.106 The assessment is applied to those scoped-in IOFs of medium or high NCI (**Table 7.12**), as confirmed through survey results and consultations outlined above. These are: curlew, golden plover, lapwing, pink-footed goose (in relation to the Greenlaw Moor, Fala Flow and Firth of Forth SPAs), golden eagle and short-eared owl.

Table 7.12: Scoped In IOFs

Feature	NCI	Reason for Inclusion
Curlew	Medium	BoCC Red listed, priority bird species for assessment in Scotland (SNH 2018a ²).
Golden plover	Medium	Annex I listed, priority bird species for assessment in Scotland (SNH 2018a ²).
Lapwing	Medium	BoCC Red listed, priority bird species for assessment in Scotland (SNH 2018a ²).
Pink-footed goose	High	Greenlaw Moor SPA, Fala Flow SPA and Firth of Forth SPA connectivity. BoCC Amber listed, migratory species.
Golden eagle	Medium	Annex I and Schedule 1 listed (also included on Schedule 1A and A1, refer to Appendix 7.1 Annex A). Priority bird species for assessment in Scotland (SNH 2018a ²).
Short-eared owl	Medium	Annex I listed, BoCC Amber listed. Priority bird species for assessment in Scotland (SNH 2018a ²).

7.107 The conservation status of these IOFs is detailed in **Table 7.13**.

Table 7.13: Conservation Status of Scoped In IOFs

IOF	Conservation Status	Information
Curlew	BoCC Red list (BDp ² , BDMp ¹ , WDMp ¹ , BI)	The most recent national breeding curlew population estimate was 59,000 pairs in 2016 (Woodward <i>et al.</i> 2020 ²¹) and there has been a significant long-term decline across Scotland. The continued inclusion of the species on the BoCC Red list suggests that the national and NHZ/regional populations are in unfavourable conservation status .

²⁰ Pearce-Higgins, J.W. (2021). Climate Change and the UK's Birds. British Trust for Ornithology Report, Thetford, Norfolk.

²¹ Woodward, I., Aebischer, N., Burnell, D., Eaton, M., Frost, T., Hall, C., Stroud, D.A. & Noble, D. (2020). Population estimates of birds in Great Britain and the United Kingdom. *British Birds* 113: 69–104.

IOF	Conservation Status	Information
		The NHZ 20 population was estimated to be 1,400 (1,261-1,539) pairs in 2005 (Wilson <i>et al.</i> 2015 ¹²).
Golden plover	Annex I, BoCC Green list	<p>The British wintering population is estimated to be 400,000 individuals (Woodward <i>et al.</i> 2020²¹) with the Scottish population estimated to be up to 60,000 individuals in the autumn, 35,000 in mid-winter and 30,000 in the spring (Forrester <i>et al.</i> 2012²²). The Lothian and Upper Forth coastal estimates represent around 15 % of the Scottish coastal total which would indicate a regional spring, autumn and winter population between 4,500 and 9,000 individuals. Given that in the region of 15,000 to 20,000 birds also winter inland across Scotland and that rocky coasts are not included in the coastal estimates (Forrester <i>et al.</i> 2012²²), the adjusted regional non-breeding golden plover population for the Lothian and Upper Forth region is estimated to lie between 7,500 and 12,000 birds. Golden plover continues to be included on the BoCC Green list (Stanbury <i>et al.</i> 2021). Overall, the regional (and national) wintering population is considered to be in favourable conservation status.</p> <p>The most recent national breeding golden plover population was estimated to be 32,500-50,500 pairs in 2016 (Woodward <i>et al.</i> 2020²¹) and the Scottish population is estimated to be between 15,000 pairs (Forrester <i>et al.</i> 2012²²). The BTO Bird Trends website²³ states that there has been no change in the UK breeding population between 1995 and 2020. Overall, the breeding population is considered to in favourable conservation status.</p> <p>The NHZ 20 population was estimated to be 1,058 (979-1,136) pairs in 2005 (Wilson <i>et al.</i> 2015¹²).</p>
Lapwing	BoCC Red list (BDp ² , ERLOB, BDMP ¹ , WDMp ¹)	<p>The most recent national breeding lapwing population was estimated to be 98,000 pairs in 2016 (Woodward <i>et al.</i> 2020²¹) and the Scottish population is estimated to be between 71,500 and 105,600 pairs (Forrester <i>et al.</i> 2012²²).</p> <p>Woodward <i>et al.</i> (2020²¹) have reported a national breeding decline of 59 % across the UK, with Scottish densities highest in Orkney, Shetland and the Outer Hebrides.</p> <p>The NHZ trend is unknown but the regional and national populations are on balance likely to be in unfavourable conservation status.</p>
Pink-footed goose	BoCC Amber list (WL, WI)	<p>The Scottish population is estimated to be 200,000 individuals in autumn (October) and 100,000-150,000 individuals in winter/spring (Forrester <i>et al.</i> 2012²²), with Wilson <i>et al.</i> (2015¹²) estimating a peak wintering abundance of 47,407 in NHZ 20 in 2005. Mitchell and Hearn (2004²⁴) noted that pink-footed goose populations have increased greatly from the mid-1950s (20,000-30,000 birds) to mid-1990s (200,000-250,000 birds) and Woodward <i>et al.</i> (2020²¹) estimating a winter UK population of 510,000 individuals. Pink-footed goose has remained on the Amber list between the BoCC 3 (2009²⁵) and BoCC 5 (2021³) reports. Overall, the wintering population is considered to be in favourable conservation status.</p> <p>The Greenlaw Moor SPA²⁶ population is stated to be an average peak of 14,200 birds (1987/88 to 1991/92) and in the latest assessed condition (September 2007), the population is listed as favourable maintained.</p>

²² Forrester, R.W., Andrews, I.J., McInerney, C.J., Murray, R.D., McGowan, R.Y., Zonfrillo, B., Betts, M.W., Jardine, D.C. & Grundy, D.S. (eds) 2012. The Digital Birds of Scotland. The Scottish Ornithologists' Club, Aberlady.

²³ <https://www.bto.org/understanding-birds/birdfacts/golden-plover> (accessed May 2023)

²⁴ Mitchell, CR & RD Hearn. 2004. Pink-footed Goose Anser brachyrhynchus (Greenland/Iceland population) in Britain 1960/61 – 1999/2000. Waterbird Review Series, The Wildfowl & Wetlands Trust/Joint Nature Conservation Committee, Slimbridge.

²⁵ Eaton M.A., Aebischer N.J., Brown A.F., Hearn R.D., Lock L., Musgrove A.J., Noble D.G., Stroud D.A. and Gregory R.D. (2015). Birds of Conservation Concern 4: the population status of birds in the United Kingdom, Channel Islands and Isle of Man. British Birds 108, 708–746.

²⁶ <https://sitelink.nature.scot/site/8509> (accessed May 2023)

IOF	Conservation Status	Information
		<p>The Fala Flow SPA²⁷ population is stated to be an average of 2,400 birds and in the latest assessed condition (December 2009), the SPA population is listed as favourable maintained. WeBS counts at the SPA give a current five year mean of 385 individuals (Austin <i>et. al</i> 2023²⁸).</p> <p>The Firth of Forth SPA²⁹ population is stated to be an average peak of 10,852 birds (1993/94 to 1997/98) and in the latest assessed condition (March 2015), the SPA population is listed as favourable maintained. WeBS counts at the SPA give a current five year mean of 17,392 individuals (Austin <i>et. al</i> 2023²⁸).</p>
Golden eagle	Annex I, BoCC Green list	<p>The Scottish golden eagle population has been relatively stable over the last few decades and has more recently shown signs of increasing, from a total of 442 breeding pairs estimated at the 2003 Scottish national census (Eaton <i>et al.</i> 2007³⁰) to 508 territories following the 2015 Scottish national census (Hayhow <i>et al.</i> 2017³¹).</p> <p>The NHZ 20 golden eagle population was determined by Whitfield <i>et al.</i> (2008³²) to be three pairs and whilst the NHZ was not 'formally tested', Whitfield <i>et al.</i> (2008³²) considered the region to be in unfavourable conservation status given low reproduction and expansion rates.</p>
Short-eared owl	Annex I, BoCC Amber list (BDMr ^{1/2})	<p>The most recent national breeding short-eared population was estimated to be 320-2,200 pairs between 2007-2011 (Woodward <i>et al.</i> 2020²¹) and the Scottish population is estimated to be between 500 and 1,000 pairs (Forrester <i>et al.</i> 2012²²), with high densities in the Southern Uplands.</p> <p>The population is essentially nomadic, linked to cyclic populations of field voles, and so difficult to monitor, the Scottish Raptor Study Group (SRSG) note that "<i>Monitoring for this species is currently too variable to produce any rigorous trends</i>³³". The national and regional population trends are therefore unknown. The NHZ 20 population was estimated by Wilson <i>et al.</i> (2015¹²) to be 35 (range 5-64) pairs in 2013.</p>
<p>BoCC Red-list criteria (Stanbury <i>et al.</i> 2021³)</p> <p>HD = historical decline in the breeding population.</p> <p>BDp^{1/2} = severe breeding population decline over 25 years/longer term.</p> <p>BoCC Amber-list criteria (Stanbury <i>et al.</i> 2021³)</p> <p>ERLOB = threatened in Europe.</p> <p>BDMp^{1/2} = moderate breeding population decline over 25 years/longer term.</p> <p>BDMr^{1/2} = moderate breeding range decline over 25 years/longer term.</p> <p>WDMp¹ = moderate non-breeding population decline over 25 years/longer term.</p> <p>BI = breeding international importance.</p> <p>WL = non-breeding localisation.</p> <p>WI = non-breeding international importance.</p>		

²⁷ <https://sitelink.nature.scot/site/8497> (accessed May 2023)

²⁸ Austin, G.E., Calbrade, N.A., Birtles, G.A., Peck, K., Shaw, J.M. Wotton, S.R., Balmer, D.E. and Frost, T.M. 2023.

Waterbirds in the UK 2021/22: The Wetland Bird Survey and Goose & Swan Monitoring Programme. BTO/RSPB/JNCC/NatureScot. Thetford

²⁹ <https://sitelink.nature.scot/site/8499> (accessed May 2023)

³⁰ Whitfield, D.P., Fielding, A.H., McLeod, D.R.A., Morton, K., Stirling-Aird, P. & Eaton, M.A. (2007). Factors constraining the distribution of Golden Eagles *Aquila chrysaetos* in Scotland. *Bird Study*, 54, 199-211.

³¹ Daniel B. Hayhow, Stuart Benn, Andrew Stevenson, Patrick K. Stirling-Aird & Mark A. Eaton (2017): Status of Golden Eagle *Aquila chrysaetos* in Britain in 2015, *Bird Study*, DOI: 10.1080/00063657.2017.1366972

³² Whitfield, D P, Fielding, A H, McLeod, D R A and Haworth, P F (2008). A conservation framework for golden eagles: implications for their conservation and management in Scotland. Scottish Natural Heritage Commissioned Report No.193 (ROAME No. F05AC306).

³³ <https://raptormonitoring.org/srms-species/strigiformes/short-eared-owl>

Habitats Regulations Appraisal

7.108 A Shadow Habitats Regulations Assessment (HRA) is provided in **Appendix 7.3**.

Potential Construction Effects

7.109 The main potential effects of construction activities due to the Proposed Development are the displacement and disruption of breeding, foraging or roosting 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).

7.110 Effects 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 effects 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.* 1997¹⁴).

7.111 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, turbines and substation). This has the potential to affect breeding or foraging individuals.

Curlew

7.112 Effect: breeding curlew may be displaced from the Site during construction, either temporarily by disturbance or temporarily or permanently via direct habitat loss.

7.113 Sensitivity: medium NCI (**Table 7.12**) with the NHZ and national populations considered to be of unfavourable conservation status. Consequently, curlew sensitivity in the context of the Site is considered to be medium-high.

7.114 Magnitude of effect: an estimated 9-10 and 19-27 curlew territories in 2021 and 2022 respectively were recorded within 500 m of infrastructure (**Figure 7.16, Table 7.11**). The curlew NHZ 20 breeding population is estimated to be 1,400 pairs (Wilson *et al.* 2015¹²), and this represents up to 1.9 % of the breeding population.

7.115 It is considered unlikely that all breeding curlew within 500 m of infrastructure would be lost from the population in any year because construction activities would not take place simultaneously across the whole Site during the breeding season. Furthermore, 4-12 of these territories are within 500 m of the existing access tracks (related to the operational Fallago Rig Wind Farm), rather than proposed turbine locations. Whilst there will be some widening/upgrade works at various points on these existing tracks alongside increased traffic use during the construction phase, the works will be less intensive than those around the turbines and new tracks and will be of a shorter duration (likely to be undertaken over a maximum of three months with works consisting of localised areas or widening/repair/surface finishing and expected to take two weeks per 1 km of track).

7.116 It should be noted that the BDMP (and associated pre-construction surveys) and presence of ECoW during the construction period will ensure that any disturbance to breeding curlew is minimised during construction, however some birds may still be displaced prior to breeding as a result of construction. As a worst-case, assuming some breeding pairs would be temporarily lost to the NHZ population during the construction phase, an effect of low and short-term magnitude is predicted.

7.117 Significance of effect: the unmitigated effect on the NHZ 20 curlew population as a result of construction is considered to be minor and therefore **not significant** in the context of the EIA regulations.

Golden Plover

7.118 Effect: breeding golden plover may be displaced from the Site during construction, either temporarily by disturbance or temporarily or permanently via direct habitat loss.

7.119 Sensitivity: medium NCI (**Table 7.12**) with the NHZ and national populations considered to be of favourable conservation status. Consequently, golden plover sensitivity in the context of the Site is considered to be medium.

7.120 Magnitude of effect: an estimated 7-9 and 9-13 golden plover territories in 2021 and 2022 respectively were recorded to be within 500 m of infrastructure (**Figure 7.17**). The golden plover NHZ 20 breeding population is estimated to be 1,058 pairs (Wilson *et al.* 2015¹²), and this represents up to 1.23 % of the breeding population.

7.121 It is considered unlikely that all breeding golden plover within 500 m of infrastructure would be lost from the population in any year because construction activities would not take place simultaneously across the whole Site during the breeding season. Furthermore, 2-4 of these territories are within 500 m of the existing access tracks (related to the operational Fallago Rig Wind Farm), rather than proposed turbine locations. Whilst there will be some widening/upgrade works at various points on these existing tracks alongside increased traffic use during the construction phase, the works will be less intensive than those around the turbines and new tracks and will be of a shorter duration (likely to be undertaken over a maximum of three months with works consisting of localised areas or widening/repair/surface finishing and expected to take two weeks per 1 km of track).

7.122 Golden plover were also established to use the Site during the non-breeding season (**Figure 7.19**), however whilst there may be some displacement by construction activities, wintering/migratory birds forage more widely and any disturbance is likely to be temporary/limited and is unlikely to affect the ability of individuals to forage and survival rates therefore will not be affected.

7.123 It should be noted that the BDMP (and associated pre-construction surveys) and presence of ECoW during the construction period will ensure that any disturbance to breeding golden plover is minimised during construction, however some birds may still be displaced prior to breeding as a result of construction. As a worst-case (where breeding would be lost rather than displaced), an effect of low and short-term magnitude is predicted.

7.124 Significance of effect: the unmitigated effect on the regional golden plover population as a result of construction is considered to be minor and therefore **not significant** in the context of the EIA regulations.

Lapwing

7.125 Effect: breeding lapwing may be displaced from the Site during construction, either by disturbance or direct habitat loss.

7.126 Sensitivity: medium NCI (**Table 7.12**) with the NHZ and national populations considered to be of unfavourable conservation status. Consequently, lapwing sensitivity in the context of the Site is considered to be medium-high.

7.127 Magnitude of effect: an estimated 4-7 and 22-24 lapwing territories in 2021 and 2022 respectively were recorded within 500 m of infrastructure (**Figure 7.16, Table 7.11**). The lapwing NHZ 20 breeding population is unknown but based on the Scottish population of 98,000 pairs presented in Woodward *et al.* (2020²¹), a minimum of 5,000 pairs are likely to be within NHZ 20, and this represents up to 0.48 % of the breeding population.

7.128 It is considered unlikely that all breeding lapwing within 500 m of infrastructure would be lost from the population in any year because construction activities would not take place simultaneously across the whole Site during the breeding season. Furthermore, 3-20 of these territories are within 500 m of the existing access tracks (related to the operational Fallago Rig Wind Farm), rather than proposed turbine locations. Whilst there will be some widening/upgrade works at various points on these existing tracks alongside increased traffic use during the construction phase, the works will be less intensive than those around the turbines and new tracks and will be of a shorter duration (likely to be undertaken over a maximum of three months with works consisting of localised areas or widening/repair/surface finishing and expected to take two weeks per 1 km of track).

7.129 It should be noted that the BDMP (and associated pre-construction surveys) and presence of ECoW during the construction period will ensure that any disturbance to breeding lapwing is minimised during construction, however some birds may still be displaced prior to breeding as a result of construction. As a worst-case (where breeding would be lost rather than displaced), an effect of low and short-term magnitude is predicted.

7.130 Significance of effect: the unmitigated effect on the regional lapwing population as a result of construction is considered to be minor and therefore **not significant** in the context of the EIA regulations.

Pink-Footed Goose (Greenlaw Moor SPA, Fala Flow SPA and Firth of Forth SPA populations)

7.131 Effect: non-breeding pink-footed geese may be displaced from the Site during construction, either by disturbance or direct habitat loss.

7.132 Condition: The Greenlaw Moor, Fala Flow and Firth of Forth SPA populations are considered to be in favourable condition.

7.133 Effects on the Greenlaw Moor SPA, Fala Flow SPA and Firth of Forth SPA: pink-footed geese were not recorded foraging or roosting within the Site (**Figure 7.23**). A review of pink-footed goose feeding distributions provided by Mitchell

(2012³⁴) indicates that the nearest feeding area is over 4 km to the south of the Site with the next nearest over 13 km to the south-east (**Figure 7.4**). There are therefore considered to be no effects of construction activities or habitat loss on foraging pink-footed geese. As such there is considered to be **no adverse effects on the integrity of the Greenlaw Moor SPA, Fala Flow SPA or Firth of Forth SPA** due to construction. It also follows that there would be **no significant effects on the constituent Ramsar sites and SSSIs** within the context of the EIA Regulations.

Golden Eagle

7.134 Effect: foraging golden eagle may be displaced from the site during construction, either by disturbance or direct habitat loss.

7.135 Sensitivity: medium NCI (**Table 7.12**) with the south Scotland population in unfavourable conservation status. Consequently, golden eagle sensitivity in the context of the Site is considered to be medium-high.

7.136 Magnitude of effect: no breeding golden eagle territory (considered to be 6 km) is known to overlap with the Site. A total of six observations of golden eagle were recorded during the baseline survey period between April and July 2022 (considered to be potentially three different birds, two adults and a juvenile female). Golden Eagle Topographical (GET) modelling of the Lammermuir Hills area predicts that much of the Site is likely to be of potentially suitable topography for foraging golden eagle (**Figure 7.7**) and so some temporary loss of foraging habitat due to disturbance from construction activities may occur. The GET model does however also show that large areas of the wider Lammermuir Hills area are likely to be favourable for foraging (**Figure 7.7**). Considering that there are not known to be any breeding golden eagle in the Lammermuir Hills area, any foraging golden eagles within the Site will be non-breeding individuals which are able to roam widely, and therefore any short-term, localised loss of foraging habitat is unlikely to impact on an individual's survival probability. As a worst-case, an effect of negligible and short-term magnitude is predicted.

7.137 Significance of effect: the unmitigated effect on the regional golden eagle population as a result of construction is considered to be minor and therefore **not significant** in the context of the EIA regulations.

Short-Eared Owl

7.138 Effect: breeding or foraging short-eared owl may be displaced from the site during construction, either by disturbance or direct habitat loss.

7.139 Sensitivity: medium NCI (**Table 7.12**) with the NHZ 20 and national populations of unknown (but potentially unfavourable) conservation status. Consequently, short-eared owl sensitivity in the context of the Site is considered to be medium-high.

7.140 Magnitude of effect: Two short-eared owl breeding attempts were confirmed within the study area during the 2021 breeding season (**Confidential Figure 7.2.3**), followed by short-eared owl displaying potential breeding behaviour within the study area during the 2022 breeding season (**Confidential Figure 7.2.3**). Short-eared owl are generally nomadic breeders and breeding density and productivity are strongly linked to cyclic populations of field voles. Therefore, although an area close to a section of track near T13 was the focus of breeding activity in 2021, it is unlikely that in future years birds would return to nest at exactly the same location. Furthermore, short-eared owl breeding activity was predominately recorded away from the turbine area in 2021 and 2022 (**Confidential Figure 7.2.3**) and therefore unlikely to be disturbed by construction activities. It is therefore considered likely that there will continue to be suitable breeding habitat available for short-eared owl outwith potential disturbance zones associated with the Proposed Development. As such, an effect of negligible and short-term magnitude is predicted.

7.141 Significance of effect: the unmitigated effect on the NHZ 20 short-eared owl population as a result of construction is considered to be minor and therefore **not significant** in the context of the EIA regulations.

³⁴ Mitchell, C. (2012). Mapping the distribution of feeding Pink-footed and Iceland Greylag Geese in Scotland. Wildfowl & Wetlands Trust / Scottish Natural Heritage Report, Slimbridge.

Potential Operational Effects – Displacement

7.142 The displacement of nesting, foraging or roosting birds from the Proposed Development has the potential to extend beyond the construction phase, as described above, and to occur during the operational phase.

7.143 Evidence of displacement away from operational turbines has been found to occur in a number of individual wind farm studies, although the effects vary considerably between sites and species. 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.

Curlew

7.144 Effect: nesting or foraging curlew may be at risk of displacement from habitat around turbines, thereby affecting productivity or survival rates.

7.145 Sensitivity: medium-high.

7.146 Magnitude of effect: an estimated range of between four and 9-12 curlew territories in 2021 and 2022 respectively were recorded to be within 500 m of turbines (**Figure 7.16**). The curlew NHZ 20 breeding population is estimated to be 1,400 pairs (Wilson *et al.* 2015¹²), and the potential permanent loss of between four and 12 curlew territories (ranges based on minimum and maximum breeding activity) would result in a loss of 0.28 % to 0.85 % of the breeding population. It is however considered unlikely that all territories and pairs within 500 m of turbines would be lost. Evidence at the adjacent operational Fallago Rig Wind Farm indicates that curlew are not wholly displaced from operational turbines, with surveys in 2013 and 2014 for the extension application (Fallago Rig II – not consented) finding that five of the seven, and six of the 15 territories recorded in 2013 and 2014 respectively were within approximately 500 m of the Fallago Rig I turbines, operational at the time of surveys. This was consistent with the seven territories recorded in the same area during the baseline surveys in 2005 for Fallago Rig Wind Farm (i.e. prior to the turbines but in the same area), as reported in the Fallago Rig II assessment. Nevertheless, as a worst-case (where it is assumed that most breeding birds would be lost from the population, rather than remain or be displaced into adjacent areas), an effect of low and long-term magnitude is predicted.

7.147 Significance of effect: the unmitigated effect on the regional curlew population as a result of operational displacement is considered to be minor-moderate adverse and therefore **potentially significant** in the context of the EIA regulations.

Golden Plover

7.148 Effect: nesting or foraging golden plover may be at risk of displacement from habitat around turbines, thereby affecting productivity or survival rates.

7.149 Sensitivity: medium.

7.150 Magnitude of effect: an estimated range of 5-6 and 6-9 golden plover territories in 2021 and 2022 respectively were recorded to be within 500 m of turbines (**Figure 7.16**). The golden plover NHZ 20 breeding population is estimated to be 1,058 pairs (Wilson *et al.* 2015¹²), and the potential permanent loss of between five and nine golden plover territories (ranges based on minimum and maximum breeding activity) would result in a loss of 0.47 % to 0.85 % of the breeding population.

7.151 Evidence suggests that complete displacement of pairs within 500 m is unlikely. Pearce-Higgins *et al.* (2012³⁵) found population densities of golden plover were not affected by the presence of wind farms, and years since construction and the relative overlap between the survey area and the wind farm were unrelated to golden plover densities. A lack of displacement effects for breeding golden plover has also been reported from operational monitoring at Beinn Tharsuinn Wind Farm (Douglas *et al.* 2011³⁶) and Farr Wind Farm (Fielding and Haworth 2013³⁷). Sansom *et al.* (2016³⁸) did show in their study that breeding

³⁵ Pearce-Higgins, J.W., Stephen, L., Douse, A. and Langston, R.H.W. (2012). Greater impacts of Windfarms on bird populations during construction than subsequent operation: results of a multi-site and multi-species analysis. *Journal of Applied Ecology* 49: 386-394.

³⁶ Douglas, D.J.T., Bellamy, P.E. & Pearce-Higgins, J.W. (2011). Changes in the abundance and distribution of upland breeding birds at an operational wind farm. *Bird Study*, 58, 37–43.

³⁷ Fielding, A.H. & Haworth, P.F. (2013). Farr wind farm: A review of displacement disturbance on golden plover arising from operational turbines 2005-2013. Haworth Conservation, Isle of Mull.

³⁸ Sansom, A., Pearce-Higgins, J. W. and Douglas, D. J. T. (2016), Negative impact of wind energy development on a breeding shorebird assessed with a BACI study design. *Ibis*, 158: 541–555. doi:10.1111/ibi.12364

golden plover abundance may be reduced by 79 % up to 400 m away from operational turbines, although hatching and fledging success were not affected by proximity to turbine locations.

7.152 Results at the adjacent operational Fallago Rig Wind Farm supports evidence that breeding golden plover displacement from operational turbines is limited, with surveys in 2013 and 2014 for the extension application EIA (Fallago Rig II – not consented) finding that five of the seven and six of the 14 territories recorded in 2013 and 2014 respectively were within approximately 500 m of the Fallago Rig I turbines, operational at the time of surveys. This was broadly consistent with the nine territories recorded in the same area during the baseline surveys in 2005 for Fallago Rig Wind Farm (i.e. prior to the turbines but in the same area), as reported in the Fallago Rig II assessment.

7.153 Thus, as a precautionary approach, it is possible that a proportion of existing golden plover territories within c.400 m of turbines may be affected, although suitable habitat does not appear to be a limiting factor onsite, and a small displacement within the study area is a more likely consequence for most pairs than a loss to the breeding population. As a worst-case (where breeding birds would be lost rather than displaced), an effect of low and long-term magnitude on the NHZ 20 breeding population is predicted.

7.154 Significance of effect: the unmitigated effect on the regional golden plover population as a result of operational displacement is considered to be minor adverse and therefore **not significant** in the context of the EIA regulations.

Lapwing

7.155 Effect: nesting or foraging lapwing may be at risk of displacement from habitat around turbines, thereby affecting productivity or survival rates.

7.156 Sensitivity: medium-high.

7.157 Magnitude of effect: an estimated range of 2-4 and 1-2 lapwing territories in 2021 and 2022 respectively were recorded to be within 500 m of turbines (**Figure 7.16**). The lapwing NHZ 20 breeding population is unknown but based on the Scottish population of 98,000 pairs presented in Woodward *et al.* (2020²¹), a minimum of 5,000 pairs are likely to be within NHZ 20. The potential permanent loss of between one and four lapwing territories (ranges based on minimum and maximum breeding activity) would result in a loss of 0.02 % to 0.08 % of the lapwing population. It is considered unlikely that all breeding lapwing would be lost from the population as there is additional suitable breeding habitat surrounding infrastructure. However, in a worst-case scenario (where breeding birds would be lost rather than displaced), an effect of negligible and long-term magnitude on the NHZ 20 population is predicted.

7.158 Significance of effect: the unmitigated effect on the regional lapwing population as a result of operational displacement is considered to be minor adverse and therefore **not significant** in the context of the EIA regulations.

Pink-Footed Goose (Greenlaw Moor SPA, Fala Flow SPA and Firth of Forth SPA)

7.159 Effect: the turbines and operational activities (e.g., turbine maintenance) may displace birds flying between established foraging and roosting areas or disturb birds from roosting and foraging areas near the proposed infrastructure.

7.160 Condition: favourable for all three SPA populations.

7.161 Effects on the Greenlaw Moor SPA, Fala Flow SPA and Firth of Forth SPA: as detailed in paragraph 7.133, pink-footed geese were not established to be foraging within the Site or directly adjacent to the Site with the nearest known foraging areas over 4 km to the south (Mitchell 2012³⁴). Furthermore, when reviewing the known foraging areas provided by Mitchell (2012³⁴) in the wider context of the location of the Proposed Development in relation to the Greenlaw Moor SPA, Fala Flow SPA or Firth of Forth SPA, foraging activity is clearly concentrated nearer the SPAs (**Figure 7.4**) so the likelihood of the Proposed Development displacing regular flightpaths between foraging areas and the Greenlaw Moor SPA, Fala Flow SPA or Firth of Forth SPA is very low.

7.162 As such there is considered to be **no adverse effects on the integrity of the Greenlaw Moor SPA, Fala Flow SPA or Firth of Forth SPA** due to operational displacement. It also follows that there would be **no significant effects** on the constituent Ramsar sites and SSSIs within the context of the EIA Regulations.

Golden Eagle

7.163 Effect: golden eagle may be at risk of displacement from nesting, roosting or foraging habitat, thereby affecting productivity, fitness and survival rates.

7.164 Sensitivity: medium-high.

7.165 Magnitude of effect: no breeding golden eagle territory is known to overlap with the Site. A total of six observations of golden eagle were recorded during the baseline survey period between April and July 2022 (considered to be potentially three different birds, two adults and a juvenile female), and therefore current site usage by the species is very low, and likely limited to non-breeding birds.

7.166 A review of golden eagle conservation and management opportunities in South Scotland by Fielding and Haworth (2014³⁹) identified that in the Lammermuir Hill region:

- There were no known historic nest sites for golden eagle;
- There is sufficient continuous space in the south-west of the area to support one pair of breeding golden eagle;
- There is limited crag nesting habitat available, and so tree nesting is more likely;
- 12 % of high suitability ridge habitat was lost to wind farms and woodland at the time of study (and could increase to 20 %);
- Persecution of birds of prey in the region could affect eagle success: “*Unfortunately this group of hills had the third largest number of recorded persecution incidents during 2000-2011*”; and
- The Lammermuir Hills could provide “*a significant area of habitat available to non-breeding birds if the southern Scotland population expands*”.

7.167 GET modelling of the Lammermuir Hills area predicts that much of the Site is likely to be of preferred conditions for foraging golden eagle (**Figure 7.7**) so some loss of potential foraging habitat due to operational displacement may occur. The GET model does however also show that a large part of the wider Lammermuir Hills area is likely to be favourable for foraging (**Figure 7.7**) and that there appears to be enough continuously suitable foraging habitat present to potentially support non-breeding individuals, and potentially a breeding pair. A review of the 1:25,000 km basemapping indicated that the habitat directly surrounding the Site does not contain any suitable crag nesting habitat. The nearest area of trees likely to be large enough to contain suitable trees for nesting is Harecleugh Forest which is over 2 km from the nearest turbine and the Proposed Development would therefore not be considered to prevent any potential nesting attempt.

7.168 Considering that there are not known to be any breeding golden eagle in the Lammermuir Hills area, any foraging golden eagle within the Site will be non-breeding individuals which are able to roam widely, and therefore any loss of foraging habitat is unlikely to impact on survival rates and therefore unlikely to create a significant effect on the regional population as a whole. When considering any future territories that may establish in the Lammermuirs as a result of the SSGEP, the GET modelling for the Lammermuirs indicates that there is 31,416.61 ha of suitable habitat⁴⁰ available (i.e., habitat scoring 6 or over as shown on **Figure 7.7**). The Proposed Development would equate to a loss of 1.2 % (based on a 300 m buffer around the turbines), As a worst-case, an effect of negligible and long-term magnitude is predicted.

7.169 Significance of effect: the unmitigated effect on the regional golden eagle population as a result of operational displacement is considered to be minor adverse and therefore **not significant** in the context of the EIA Regulations.

Short-Eared Owl

7.170 Effect: short-eared owl may be at risk of displacement from foraging habitat, thereby affecting productivity, fitness and survival rates.

7.171 Sensitivity: medium-high.

³⁹ Fielding, A.H. and Haworth, P.F. 2014. Golden eagles in the south of Scotland: an overview. Scottish Natural Heritage Commissioned Report No. 626.

⁴⁰ Open water, forestry, A and B category roads and operational wind farms (plus a 300 m buffer) were excluded.

7.172 Magnitude of effect: Two breeding attempts were confirmed within the study area during the 2021 breeding season (**Confidential Figure 7.2.3**), followed by short-eared owl displaying potential breeding behaviour within the study area (the nearest of these potential breeding areas in 2022 was over 1.5 km from the proposed turbine locations) during the 2022 breeding season (**Confidential Figure 7.2.3**). Short-eared owl are generally nomadic breeders, and breeding density and productivity are strongly linked to cyclic populations of field voles. Therefore, although an area near T13 was the focus of breeding activity in 2021, it is unlikely that in future years birds would return to nest at exactly the same location. Furthermore, short-eared owl breeding activity was predominately recorded away from the turbine area in 2021 and 2022 (**Confidential Figure 7.2.3**) and it is therefore considered likely that there will continue to be suitable breeding habitat available for short-eared owl outwith the Proposed Development. As such, an effect of negligible and short-term magnitude is predicted.

7.173 Significance of effect: the unmitigated effect on the regional short-eared owl population as a result of operational displacement is considered to be minor adverse and therefore **not significant** in the context of the EIA regulations.

Potential Operational Effects – Collision Risk

7.174 Effect (all IOFs): Birds that utilise the airspace within the Proposed Development at potential collision heights may be at risk of collision with wind turbines, thereby increasing the annual mortality rate of the population above background levels. For the CRM methods used see **Appendix 7.1**. Short-eared owl were not identified to be flying 'at-risk' and consequently are not considered below.

Golden Eagle and Lapwing

7.175 Sensitivity: medium-high.

7.176 Magnitude of effect: as shown in **Table 7.7**, the CRM predicts very low (one collision every 122 years for golden eagle and one collision every 314 years for lapwing) collision rates for these species. From these predictions, it can be reasonably concluded that the magnitude of effect for these IOFs is negligible, long-term. Furthermore, for golden eagle even should activity rates increase in the area the risk of collisions is very low based on results of satellite tag data for birds in Scotland (Fielding *et al.* 2021⁴¹).

7.177 Significance of effect: the unmitigated effects on golden eagle and lapwing from collision risk is considered to be negligible and therefore **not significant** in the context of the EIA Regulations.

Curlew

7.178 Sensitivity: medium-high.

7.179 Magnitude of effect: curlew were recorded regularly during the breeding seasons (2021 and 2022) and were not recorded on the Site between August and February. Flight activity was largely associated with breeding territories with around 18 % of flights recorded during flight activity surveys identified to be 'at-risk'. A mean annual collision rate of 0.1267 (one every 7.9 years) is predicted for curlew (**Table 7.7, Appendix 7.1 Annex E**). The NHZ 20 breeding population is estimated to be 1,400 pairs (Wilson *et al.* 2015¹²) and the additional mortality due to collision would be an increase over the baseline mortality rate (0.264, BTO BirdFacts⁴²) of 0.017 %. The increase in baseline mortality for curlew is considered to be of negligible and long-term magnitude.

7.180 Significance of effect: the unmitigated effect on the breeding NHZ 20 curlew population from collision risk is considered to be minor adverse and is therefore **not significant** in the context of the EIA regulations.

Golden Plover

7.181 Sensitivity: medium.

⁴¹ Fielding AH, Anderson D, Benn S, Dennis R, Geary M, Weston E, et al. (2021) Non-territorial GPS-tagged golden eagles *Aquila chrysaetos* at two Scottish wind farms: Avoidance influenced by preferred habitat distribution, wind speed and blade motion status. PLoS ONE 16(8): e0254159. <https://doi.org/10.1371/journal.pone.0254159>

⁴² <https://www.bto.org/understanding-birds/birdfacts/curlew> (accessed May 2023)

7.182 Magnitude of effect: golden plover were identified to be utilising the Site for both breeding and as a wintering habitat. Of the 247 flights recorded, 188 (around 76 %) were between August and mid-April⁴³ and are considered to be non-breeding birds.

7.183 A mean breeding collision rate of 0.0734 birds (one every 13.6 breeding seasons) is predicted for golden plover (**Table 7.7, Appendix 7.1 Annex E**). The NHZ 20 breeding population is estimated to be 1,058 pairs (Wilson *et al.* 2015¹²) and the additional mortality due to collision would be an increase over the baseline mortality rate (0.27, BTO BirdFacts⁴⁴) of 0.01 %. The increase in baseline mortality for breeding golden plover is considered to be of negligible and long-term magnitude.

7.184 A mean collision rate of 31 birds each non-breeding season is predicted for golden plover (**Table 7.7, Appendix 7.1 Annex E**). It should be noted that this collision rate has been skewed by a record of a large flock (400 birds) being spooked by low flying jets and spending 27 minutes flocking over the Site as a result. If this record is excluded from the collision model, the mean non-breeding season collision rate is reduced to 6.1 birds (reduction for the 2021/2022 non-breeding season from 53.9 to 3.7 birds). Furthermore, the higher non-breeding collision rates predicted are relatively unlikely as there has been no evidence of mass mortality events involving golden plover at wind farms in Scotland (including the adjacent operational Fallago Rig Wind Farm).

7.185 The regional Lothian and upper Forth wintering population is estimated to be 7,500 to 9,000 birds (**Table 7.13**) and the additional mortality due to collision would be an increase over the baseline mortality rate (0.27, BTO BirdFacts⁴⁵) of up to 1.54 %. The increase in baseline mortality for non-breeding golden plover is considered to be of low and long-term magnitude.

7.186 Significance of effect: the unmitigated effect on the non-breeding and breeding regional golden plover populations from collision risk is considered to be minor adverse and is therefore **not significant** in the context of the EIA regulations.

Pink-Footed Goose (Greenlaw Moor SPA, Fala Flow SPA and Firth of Forth SPA)

7.187 Condition: favourable for all three SPAs.

7.188 Effects on the Greenlaw Moor SPA, Fala Flow SPA and Firth of Forth SPA: pink-footed goose were recorded on 35 occasions during flight activity surveys, with around 31 % of flights identified to be 'at-risk'. CRM predicted a mean annual collision rate of 0.1310, or one bird every 7.6 years.

7.189 The cited Greenlaw Moor SPA, Fala Flow SPA and Firth of Firth of Forth SPA wintering populations were estimated to be 14,200, 2,400 and 10,852 birds respectively (**Table 7.13**). The additional mortality due to collision would be an increase over the baseline mortality rate (0.171, BTO BirdFacts⁴⁶) of 0.005 %, 0.032 % and 0.007 % for each SPA respectively.

7.190 Scientific studies have found that geese are adept at avoiding wind turbines in all conditions. Large scale migratory flight movements tend to be at an altitude well above turbine heights and geese are able to easily adjust their flight paths (with limited additional effort/reduction in overall fitness) to avoid wind turbines. Furthermore, migratory geese tend to follow topographical features such as river valleys to avoid unnecessary altitude gains over higher ground. Considering the distance between the Site and the SPAs (5.8 km, 13.1 km and 18.1 km respectively) and the nearest known foraging area to the Proposed Development over 4 km (**Figure 7.4, Mitchell 2012³⁴**), any geese crossing the Proposed Development are considered to have had sufficient distance to gain the altitude required to fly above turbine height. Furthermore, migratory wildfowl in the region will be habituated to the presence of the operational Fallago Rig Wind Farm directly to the north-west of the Proposed Development and the adjustment required to flight paths as a result of the Proposed Development is considered to be negligible.

7.191 With such low increases in mortality rates for each SPA population, there is considered to be **no adverse effects on the integrity of the Greenlaw Moor SPA, Fala Flow SPA or Firth of Forth SPA** due to collision risk. It also follows that there would be **no significant effects on** the constituent Ramsar sites and SSSIs within the context of the EIA Regulations.

⁴³ Birds were still recorded flocking in large numbers (a behaviour associated with non-breeding birds) until the 14th April.

⁴⁴ <https://www.bto.org/understanding-birds/birdfacts/golden-plover> (accessed May 2023)

⁴⁵ <https://www.bto.org/understanding-birds/birdfacts/golden-plover> (accessed May 2023)

⁴⁶ <https://www.bto.org/understanding-birds/birdfacts/pink-footed-geese> (accessed May 2023)

Potential Operational Effects – Lighting

7.192 Where turbines have a maximum blade tip height over 150m, lighting would be required, in accordance with Article 222 of the UK Air Navigation Order (ANO) (in line with current guidance from the Civil Aviation Authority (CAA, 2016)). As advised by NatureScot (2020b⁴⁹), there are potential lighting effects on birds which require consideration within an EIA.

Pink-Footed Goose (Greenlaw Moor SPA, Fala Flow SPA and Firth of Forth SPA populations)

7.193 Effect: effects on pink-footed goose might arise as a consequence of deployment of obstruction lighting on turbines over 150 m to maximum blade tip height. Lighting could have various effects on birds: they may be attracted to lights and thereby placed at higher risk of collisions, have migration patterns disrupted, show avoidance of lights with a consequent displacement effect, or be subject to increased predation threat. NatureScot (2020b⁴⁷) has identified attraction (phototaxis) as posing the principal threat to birds, in relation to wind turbines.

7.194 Condition: favourable for all three SPA populations.

7.195 Magnitude of effect: It is widely recognised that nocturnal migrant birds can be 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.* (2016⁴⁸) 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.

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

7.197 Scientific studies have found that geese are adept at avoiding wind turbines in all conditions. Large scale migratory flight movements tend to be at an altitude well above turbine heights and geese are able to easily adjust their flight paths (with limited additional effort/reduction in overall fitness) to avoid wind turbines. Furthermore, migratory geese tend to follow topographical features such as river valleys to avoid unnecessary altitude gains over higher ground. Considering the distance between the Site and the SPAs (5.8 km, 13.1 km and 18.1 km respectively) and the nearest known foraging area to the Proposed Development over 4 km (**Figure 7.4**, Mitchell 2012³⁴), any geese crossing the Proposed Development are considered to have had sufficient distance to gain the altitude required to fly above turbine height. Furthermore, the distribution of foraging areas in the wider area in relation to the SPAs and the Proposed Development suggests that birds would not be making journeys in darkness from roosts on the SPAs to foraging areas that would cross the Site.

7.198 It should also be noted that migratory wildfowl in the region will be habituated to the presence of the operational Fallago Rig Wind Farm directly to the north-west of the Proposed Development and the adjustment required to flight paths as a result of the Proposed Development is considered to be negligible.

7.199 As such, it is considered that there is little evidence to indicate that any species would be significantly affected either negatively or positively by lighting requirements of the Proposed Development. Consequently, there is considered to be **no adverse effects on the integrity of the Greenlaw Moor SPA, Fala Flow SPA or Firth of Forth SPA** due to collision risk. It also follows that there would be **no significant effects** on the constituent Ramsar sites and SSSIs within the context of the EIA Regulations.

Other IOFs

7.200 Effect: effects on IOFs might arise as a consequence of deployment of obstruction lighting on turbines over 150 m to maximum blade tip height. Lighting could have various effects on birds: they may be attracted to lights and thereby placed at higher risk of collisions, have migration patterns disrupted, show avoidance of lights with a consequent displacement effect, or

⁴⁷ NatureScot (2020b). The Effect of Aviation Obstruction Lighting on Birds at Wind Turbines, Communication Towers and Other Structures. NatureScot Information Note.

⁴⁸ Watson, M.J., Wilson, D.R. and Mennill, D.J. 2016. Anthropogenic light is associated with increased vocal activity by nocturnally migrating birds. *Condor*, 118, 338-344.

be subject to increased predation threat. NatureScot (2020b⁴⁹) has identified attraction (phototaxis) as posing the principal threat to birds, in relation to wind turbines.

7.201 Sensitivity: medium to high.

7.202 Magnitude of effect: a literature review on the potential effects of artificial lighting on birds (**Appendix 7.1 Annex G**, going into further detail than the NatureScot (2020b⁴⁹) information note) concluded that 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 (a similar conclusion was reached in NatureScot 2020b⁴⁹). There is also very little, if any, effect of artificial light on photoperiod responses (e.g., daily period of time birds are active, or breeding or migratory cues) of wild birds.

7.203 It is widely recognised that nocturnal migrant birds can be 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.* (2016⁵⁰) 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.

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

7.205 Regarding potential displacement around turbines, Day *et al.* (2017⁵¹) 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.

7.206 In NatureScot's (2020a⁵²) advice on the scope of assessment for turbine lighting, it is identified that an assessment of the possible effects of lighting on birds may be required in the following three situations, where risk is greater: (i) wind turbines on or adjacent to a seabird colony that hosts burrow nesting species; (ii) wind turbines that are on or adjacent to protected areas that host large concentrations of wintering waterbirds, where such sites are located within open country away from other sources of artificial light; and (iii) where wind farms are located on migratory corridors or bottlenecks for nocturnally migrating passerines.

7.207 It is clear that the Proposed Development does not fit the first two situations. In the case of migrating species, there is no evidence to suggest that the Site is of any importance as a migration route. The habitats within the site are generally poor for foraging or roosting, the topography does not suggest that it would be a significant flight corridor (e.g., such as a natural feature such as a valley), and it is distant from coastal areas which would be of greater importance to continental migrants.

7.208 As such, based on the literature review in **Appendix 7.1 Annex G**, and guidance provided by NatureScot (2020a⁵², 2020b⁴⁹), it is considered that there is little evidence to indicate that any species would be significantly affected either negatively or positively by lighting requirements of the Proposed Development. An effect of negligible, long-term magnitude is therefore predicted for all IOFs.

7.209 Significance of effect: in conclusion, the magnitude of effect on IOFs associated with lighting is predicted to be negligible and **not significant** in the context of the EIA Regulations.

Potential Decommissioning Effects

7.210 Decommissioning effects for the Proposed Development are difficult to predict with any confidence because of the long timeframe until their occurrence. Decommissioning effects are considered for the purpose of this chapter to be similar in nature

⁴⁹ NatureScot (2020b). The Effect of Aviation Obstruction Lighting on Birds at Wind Turbines, Communication Towers and Other Structures. NatureScot Information Note.

⁵⁰ Watson, M.J., Wilson, D.R. and Mennill, D.J. 2016. Anthropogenic light is associated with increased vocal activity by nocturnally migrating birds. *Condor*, 118, 338-344.

⁵¹ Day, R.H., Prichard, A.K., Rose, J.R., Streever, B. and Swem, T. 2017. Effects of a hazing-light system on migration and collision avoidance of eiders at an artificial oil-production island, Arctic Alaska. *Arctic*, 70, 13-24.

⁵² NatureScot (2020a). General pre-application and Scoping advice for onshore wind farms. Guidance.

to those of construction effects but are likely to be of shorter duration. The significance of effects predicted in the construction section are therefore considered appropriately precautionary for assessing decommissioning effects on IOFs.

Mitigation and Residual Effects

Construction

7.211 No significant unmitigated effects were predicted for any IOF, and therefore no specific mitigation other than the embedded mitigation already outlined (BDMP, ECoW and pre-construction surveys) is required for and IOFs. These measures will aim to ensure that no breeding activity is disrupted by construction activities.

7.212 The residual construction effects for curlew, golden plover, lapwing, golden eagle and short-eared owl are considered to be unchanged to those predicted above and continue to be **not significant** in the context of the EIA regulations and for pink-footed goose SPA populations **no adverse effect on the integrity of the SPA**.

Operation

7.213 Potentially significant effects during operation were identified for curlew (minor-moderate adverse). Specific additional mitigation for curlew has been considered and is summarised below.

7.214 No significant unmitigated effects were predicted for any other IOF, and therefore no specific mitigation is required due to minor adverse effects, however the aims of the proposed Outline Restoration and Enhancement Plan (OREP) (see **Appendix 6.6**) would benefit all wader species.

7.215 The residual operational effects for golden plover, lapwing, golden eagle and short-eared owl are considered to be unchanged to those predicted above and continue to be **not significant** in the context of the EIA regulations and for pink-footed goose SPA populations **no adverse effect on the integrity of the SPA**.

Curlew

7.216 As identified above, nesting or foraging curlew may be at risk of displacement from habitat around turbines or other infrastructure. Curlew have been identified as a key ornithological feature in the OREP (**Appendix 6.6**), with Objectives 2, 4 and 5 specifically determined to deliver focussed habitat enhancement to maintain and increase the breeding curlew population. It should be noted that these objectives will also be of benefit to other breeding waders (including lapwing and golden plover).

7.217 Following the mitigation detailed above, the residual effect for curlew during operation of the Proposed Development is considered to be minor adverse and therefore **not significant** in the context of the EIA regulations.

Decommissioning

7.218 Similar embedded mitigation to that outlined during the construction phase will be undertaken (BDMP, ECoW and pre-decommissioning surveys).

7.219 Decommissioning effects for the Proposed Development are difficult to predict with any confidence because of the long timeframe until their occurrence. Decommissioning effects are considered for the purpose of this chapter to be similar in nature to those of construction effects but are likely to be of shorter duration. The significance of effects predicted in the construction section are therefore considered appropriately precautionary for assessing decommissioning effects on IOFs.

Potential Cumulative and In-Combination Effects

7.220 This section presents information about the potential cumulative effects of the Proposed Development combined with other projects that are located within the appropriate spatial context on the basis of the species considered.

7.221 Pink-footed goose are considered within an HRA context relating to the Greenlaw Moors SPA, Fala Flow and Firth of Forth SPA.

Methods

7.222 NatureScot (SNH 2018b⁹) have provided guidance on assessing the cumulative effects on birds. This assessment follows the principles set out in that guidance.

7.223 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 NatureScot “*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*” (SNH 2018b⁹).

7.224 The main projects likely to cause similar effects to those associated with the Proposed Development are other operational wind farm developments, or those under construction, consented, or in the planning process within NHZ 20 (**Table 7.14**).

7.225 Wind farm projects at Scoping stage have been scoped out of the cumulative assessment because they do not have sufficient information on potential effects to be included, either because the baseline survey period is ongoing or because results have not been published. Projects that have been refused (and no longer capable of appeal) or withdrawn have also been scoped out of the cumulative assessment.

7.226 Small wind farm 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. No other renewable or non-renewable projects within NHZ 20 were identified that could have a cumulative effect on the IOFs.

7.227 **Table 7.14** identifies the wind farm projects in NHZ 20 that have been scoped in to the cumulative assessment, and their last known status. This information was obtained from a combination of the last updated version of the NatureScot wind farm database (mid 2019) and an extensive search of the Edinburgh, Dumfries and Galloway, East Lothian, Scottish Borders, South Lanarkshire and West Lothian Council Planning portals and the Energy Consents Unit planning portals for changes in status or new projects between 2019 and April 2023. It should be noted that the consented Hopsrig and Cloich Forest will not be included in any cumulative assessments as they have re-submitted separate new applications for revised schemes (which will be included).

Table 7.14: Other NHZ 20 Wind Farm Projects

Wind Farm	Status	Number of Turbines	Information Available
Bowbeat Hill	Operational	24	ES - almost all ornithology redacted
Carlesgill Hill	Operational	4	No information
Clyde + Clyde Extension	Operational	206	No information
Craig	Operational	4	No information
Crossdykes	Operational	10	EIA and SEI
Crystal Rig I, II, III	Operational	91	No information
Dun Law + Extension	Operational	61	EIA
Ewe Hill	Operational	22	No information
Fallago Rig	Operational	48	EIA
Glenkerie	Operational	11	Appendix

Wind Farm	Status	Number of Turbines	Information Available
Keith Hill (revised proposal)	Operational	5	No information (previous Keith Hill refused)
Langhope Rig	Operational	10	EIA
Long Park	Operational	19	ES addendum
Minsca	Operational	16	ES
Pogbie	Operational	6	No information
Pogbie Ext.	Operational	6	EIA
Solwaybank	Operational	21	EIA, no ornithology chapter
Toddleburn	Operational	12	Non-technical summary, no information on ornithology included
Cloch Forest	Consented	18	No information.
Crystal Rig IV	Consented ⁵³	11	EIA
Hopsrig	Consented	12	EIA
Pines Burn (Fernieles)	Consented ⁵⁴	12	EIA
Priestgill	Consented ⁵⁵	7	No information
Whitelaw Brae	Consented	14	EIA
Windy Edge	Consented	12	No information
Little Hartfell	Consented	12	EIA
Bloch	Application	21	EIA
Cloch Forest (new submission)	Application	12	EIA
Faw Side	Application (Appeal)	45	EIA
Grayside	Application	21	EIA
Hopsrig (revised scheme)	Application	13	EIA
Millmoor Rig	Application	13	EIA
Scawd Law	Application	8	EIA

⁵³ Potentially under construction: <https://crystalrigwindfarm.com/planned-construction/> (accessed May 2023)

⁵⁴ It should be noted that an application to vary the height of four of the 12 turbines from 130 m to 149.9 m has been submitted.

⁵⁵ It should be noted that an application to extend the lifetime of the wind farm has been submitted.

Wind Farm	Status	Number of Turbines	Information Available
Teviot	Application	62	EIA
Wull Muir (reapplication)	Application	8	EIA
Loganhead	Application	9	EIA

Scope of the Assessment

7.228 Based on the conclusions of the assessment presented in the section above, and the committed mitigation outlined in the section above, the following can reasonably be scoped out of the cumulative assessment:

- Cumulative construction effects for curlew, golden plover, lapwing, golden eagle and short-eared owl – negligible effects when considering the embedded mitigation;
- Cumulative collision effects for short-eared owl, lapwing, golden plover, golden eagle and curlew due to low or no predicted collision risk;
- Cumulative operational displacement and lighting effects for golden plover, lapwing, golden eagle and short-eared owl – negligible effects when considering the proposed mitigation; and
- In-combination effects for pink-footed goose – no effects, or very small effects predicted from the Proposed Development alone.

7.229 The remaining cumulative effect is considered below:

- Cumulative operational displacement effects for curlew.

Potential Cumulative Operational Displacement Effects - Curlew

7.230 Curlew were recorded at 22 of the 34 project sites within NHZ 20, however it should be noted that for the remaining 12 projects, no information was available that pertained to curlew. Of these 21 sites where curlew were recorded, 12 were identified to have potential displacement impacts to breeding curlew (with a further five where the predicted impact was unclear in the available information). Of the 12 sites:

- Five sites are operational;
- Two sites are consented; and
- Five sites are in application (excluding the Proposed Development).

7.231 Combined, the operational and consented sites would potentially displace a minimum (due to unavailable data) of 23-27 pairs. The NHZ 20 breeding curlew population is estimated to be 1,400 pairs (Wilson *et al.* 2015¹²), and the potential permanent loss of at least 27 curlew territories, assuming all consented sites will be built, would result in a loss of at least 1.93 % of the breeding population.

7.232 Including the Proposed Development there are a further six sites in application that are identified to have potential displacement impacts to breeding curlew that may displace an additional 19-36 pairs assuming that all sites at application stage will be consented (of which, unmitigated the Proposed Development would account for a worst-case of 4-12 pairs). Combined with operational projects, this could result in the unmitigated loss of 42-63 pairs (3 % to 4.5 % of the breeding population).

7.233 As detailed above, evidence at the adjacent operational Fallago Rig Wind Farm indicates that curlew are not wholly displaced near operational turbines, and therefore the totals for each project are likely to be overestimates of actual losses.

7.234 Considering that worst-case displacement is unlikely to occur and the provision of Habitat Management Plans that would benefit curlew at other projects (e.g. Grayside) and the Proposed Development to further reduce potential effects, the residual

cumulative operational effect for curlew is considered to be low and long-term magnitude, which is classified as minor adverse and is therefore **not significant** in the context of the EIA Regulations.

Monitoring

7.235 Pre-construction surveys will be undertaken as part of the BDMP (as started in paragraph 7.11). These will focus on searching for nesting Schedule 1 (of the Wildlife and Countryside Act 1981, as amended) species within 500 m of the proposed infrastructure and access routes and will be undertaken monthly between March and July the breeding season directly prior to construction. Surveys will focus on searching for breeding merlin, barn owl and short-eared owl and will follow the same survey methodology as outlined for the baseline ornithology surveys in this chapter (refer to **Appendix 7.1 Annex B** for detail).

7.236 To monitor the success of objectives 1-5 of the OREP in relation to the improvement of breeding and foraging habitats for curlew within the Site, breeding wader surveys will be undertaken monthly between April and July in years 1, 2, 3, 5, 10, 15, 20 and 25 of the operational lifespan of the Proposed Development. Surveys will focus on establishing the number of breeding pairs of curlew, lapwing and golden plover, however surveys will also keep a watching brief for any breeding attempts by target raptor or owl species (likely to be barn owl, merlin and short-eared owl for this Site). Surveys will follow the same survey methodology as outlined for the baseline ornithology surveys in this chapter (refer to **Appendix 7.1 Annex B** for detail).

7.237 Any breeding attempts for target raptor or owl species located during monitoring surveys will be reported to the Scottish Raptor Monitoring Scheme annually to assist with ongoing analysis of national and regional trends for these species.

Summary

7.238 There are no significant effects on Ornithology due to the construction or operation of the Proposed Development.

Glossary/Abbreviations

Table 7.15: Abbreviations

Term in Full	Abbreviation
Bird Disturbance Management Plan	BDMP
Birds of Conservation Concern	BoCC
British Trust for Ornithology	BTO
Chartered Institute of Ecology and Environmental Management	CIEEM
Collision Risk Analysis Area	CRAA
Collision Risk Model	CRM
Ecological Clerk of Works	ECoW
Environmental Impact Assessment	EIA
European Union	EU
Game and Wildlife Conservation Trust	GWCT
Habitats Regulation Appraisal	HRA
Important Ornithological Feature	IOF
Lothian and Borders Raptor Study Group	LBRSG
Natural Heritage Zone	NHZ

Term in Full	Abbreviation
Nature Conservation Importance	NCI
Outline Restoration and Enhancement Plan	OREP
Royal Society for the Protection of Birds	RSPB
Scottish Borders Council	SBC
Scottish Natural Heritage	SNH
Scottish Raptor Study Group	SRSG
Site of Special Scientific Interest	SSSI
South Scotland Golden Eagle Reintroduction Project	SSGEP
Special Protection Area	SPA
The Wildlife Information Centre	TWIC
United Kingdom	UK
Vantage Point	VP
Wetland Bird Survey	WeBS
Wildfowl and Wetlands Trust	WWT