CHAPTER 9: ORNITHOLOGY

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9. Ornithology

9.1 Executive Summary

9.1.1 This Chapter provides the assessment of the potential effects of Cloiche Wind Farm (the 'Proposed Development') on bird species of conservation concern and their supporting habitats.

9.1.2 The Proposed Development is located in Highland Region, within an extensive, elevated plateau in the western Monadhliath Mountains, approximately 11km east south-east of Fort Augustus. Wind turbines are proposed in two clusters, a western cluster of 28 and an eastern cluster of 8. The two clusters would lie to the immediate west and east of the existing Stronelairg Wind Farm, which is comprised of 66 wind turbines and was constructed between 2016 and 2018, becoming fully operational in December 2018.

9.1.3 The areas of the western and eastern clusters support a range of upland habitats including blanket bog, modified bog, acid grassland, acid flush, dry dwarf-shrub heath and various nutrient-poor lochs and lochans, including the artificial reservoir for Glendoe Hydroelectric Scheme. Allowing for a 500m buffer zone around the outermost proposed wind turbines, the western cluster would occupy an area of approximately 1,364ha, which ranges in elevation from 600m to 730m Above Ordnance Datum (AOD). The eastern cluster would occupy and area of approximately 473ha, ranging in elevation from 680m to 750m AOD.

9.1.4 There are no statutory or non-statutory natural heritage designations within the boundary of the Proposed Development (e.g. Sites of Special Scientific Interest (SSSIs) or Special Protection Areas (SPAs)). Approximately 100m to the east of the eastern cluster is the boundary of the Monadhliath SSSI and Special Area of Conservation (SAC). This area is designated at a European level for blanket bog habitats and at a national level for the aggregations of upland breeding birds that the site supports, including: dotterel, golden plover and dunlin. All other designated sites with ornithological interest present in the surrounding area (i.e. within c. 20km), such as Loch Knockie and Nearby Lochs SPA, have been scoped out of the assessment as no appreciable effects on their associated populations are predicted.

9.1.5 The assessment follows current best practice and focuses on the potentially significant effects of the Proposed Development on key bird receptors (i.e. bird populations of conservation concern and sensitivity to wind farm development and their supporting habitats). What is considered a 'significant' impact, in terms of the EIA Regulations, is determined by professional judgement following a standardised process, informed by available data from a range of sources including relevant published research and wind farm monitoring studies.

9.1.6 In summary, the Proposed Development has the potential to adversely affect birds through the following impacts:

- Noise and visual disturbance during construction, operation and site decommissioning;
- Collision with turbine rotor blades;
- Loss, degradation or fragmentation of supporting habitats; and
- Behavioural displacement from important habitats or flight paths due to the presence of the wind turbines.

9.1.7 The impact assessment process involves a number of steps. Initially, there is an evaluation of the importance (i.e. 'sensitivity') of the proposed development area for the species under consideration. The sensitivity evaluation is informed by data derived from a number of sources including the results of surveys of the proposed development area, completed between August 2018 and August 2019. Also considered is information from various other sources including: current national and regional population estimates (where available); data from a number of previous surveys of the area (i.e. from 2002 to 2019 related to the EIA; pre- and post-construction monitoring of Glendoe Hydroelectric Scheme and Stronelairg Wind Farm); and records of key species provided by the Royal Society for the Protection of Birds (RSPB) and Highland Raptor Study Group (HRSG).

9.1.8 The baseline surveys followed standard methods for the assessment of onshore wind farms, and were agreed in consultation with Scottish Natural Heritage (SNH) as part of the EIA Scoping process. It was agreed in this case that 12 months of baseline survey would be sufficient to inform the EIA process due the amount of existing information available for the general area of the Proposed Development from previous surveys and monitoring work (e.g. related to the Stronelairg Wind Farm development). Also agreed during scoping were the key species that should be the focus of the assessment and the range of potential effects that would need to be considered.

9.1.9 Surveys for breeding birds, with a particular focus on relatively scarce breeding raptors and upland waders (e.g. golden eagle, peregrine, hen harrier, merlin, golden plover, dunlin and greenshank) were completed during spring and summer 2019. Surveys for wild geese and swans, and use of the site by waders and moorland raptors outside of the breeding season, were completed during autumn 2018 to spring 2019, incorporating the peak migration periods.

9.1.10 A core survey area was established which included the western and eastern clusters and a 500m wide strip around the potential wind turbine development areas. For key raptor species the potential development area and a wider buffer zone, up to 2km wide, was also included in the survey.

9.1.11 The breeding bird surveys confirmed the presence of populations of breeding golden plover and dunlin within the western and eastern clusters. Breeding golden plover are not currently of national conservation concern but are a species that is considered vulnerable to the effects of wind farm construction and operation and at risk from cumulative effects at a regional-national level (i.e. the combined effects on the population from wind farm development generally). Dunlin is a breeding wader that appears to be less vulnerable to operational wind farm effects than golden plover but is of national conservation concern (UK Amber list, due to recent population declines). Both species are of conservation importance at the European level (i.e. listed on Annex I of the EC Birds Directive). The estimated number of territories within the survey area were confirmed to be of local-scale importance for golden plover and regional-scale importance for dunlin.

9.1.12 The western survey area was also used by breeding greenshank in 2019 and there are previous records of breeding activity in the vicinity of the eastern and western survey areas. Based on the survey findings and information collated from other sources, the western core survey area supports up to two breeding pairs and the eastern core survey area one pair, which is a population of regional importance. Greenshank is listed on Schedule 1 to the Wildlife & Countryside Act (1981, as amended) and is on the UK Amber List of Birds of Conservation Concern.

9.1.13 There was no evidence of any breeding attempts by any scarce birds of prey (e.g. peregrine, merlin, hen harrier, short-eared owl) within the raptor survey area during 2019 and no evidence of previous breeding activity from the data collated from other sources. In the surrounding area (i.e. >2km from the Proposed Development) there are up to five golden eagle territories, most of which were occupied by breeding pairs during 2018-2019. This is a population of regional importance. The extent to which the Proposed Development is used by golden eagle (hunting, display, territorial interactions etc.) has been a key focus of the baseline surveys, informed by data provided by HRSG and mathematical modelling of breeding and non-breeding golden eagle habitat use. Golden eagle is on Schedule 1 of the Wildlife & Countryside Act, Annex I of the EC Birds Directive and currently on the UK Green List. The golden eagle population with the region (i.e. the Central Highlands Natural Heritage Zone (NHZ)) has increased in recent years and is currently considered to be in 'favourable' conservation status.

9.1.14 Bird flight activity surveys were completed between August 2018 and August 2019. Suitable vantage points were established, overlooking the proposed wind farm, and watches were completed through the year and at different times of day to record flight activity by key species within the airspace that the wind turbines would occupy. Key species recorded during the flight activity surveys included golden eagle, white-tailed eagle, osprey, peregrine and red kite. Activity was much lower for all species during the winter 2018-19, in comparison to summer 2019, when the area was covered in snow for extended periods. Golden eagle activity was largely confined on the slopes and ridges around the periphery of the Proposed Development, this was consistent with the findings of the modelling studies. Flight activity by other key species was sporadic showing no clear spatial concentrations, with the exception of red kite where there was more activity by hunting birds recorded within and near to the eastern survey area.

9.1.15 The use of waterbodies within the survey area was also monitored regularly through the whole survey period. Red-throated diver (which breed in the surrounding area, i.e. >2km from the Proposed Development) were recorded occasionally using Glendoe Reservoir as were whooper swan and common scoter (which also breed in the surrounding area). There was no evidence of any areas of within or near to the Proposed Development (i.e. within 500m of the Site Boundary) being used regularly by appreciable numbers of wild geese or swans during the survey period. There was some migratory movement of geese, primarily greylag geese, through the survey area during September 2018, however most of this activity was above the collision risk zone.

9.1.16 The surveys provided data to allow a systematic evaluation of the use of all habitats within the proposed development area. The importance (or sensitivity) of the bird populations that use the proposed development area was determined with reference to the survey results and reliable information, where available, on current regional and national population sizes. This enabled the assessment of effects at various geographical scales (i.e. local, regional and national population levels) depending on what was appropriate for the species being considered.

9.1.17 The design of the Proposed Development has been modified to reduce the potential effects on sensitive species. Particular consideration has been given to moving wind turbines away from areas of importance to breeding golden eagle and greenshank.

9.1.18 The type and scale of the potential impacts of the proposed wind farm development on each species has been determined. Taking into consideration the conservation status, size and sensitivity of the populations affected and information available from the

scientific literature about the vulnerability of the species to the range of potential impacts from onshore wind farm development. Where there was uncertainty about the potential importance of the area for any particular species then this was accounted for in the assessment. For example, if there was suitable habitat present but no, or limited, presence of the species during the survey period and the realistic potential for use to increase in the future, then conservative assumptions were made in the sensitivity evaluation process. This provided the basis for a systematic, evidence-based assessment to be made of the potential impacts on each sensitive receptor.

9.1.19 There is the potential for construction works to have localised effects on bird breeding success for up to three breeding seasons. However, measures are proposed to help ensure that impacts on all breeding birds are minimised and that rarer species, which are specially protected from disturbance while nesting, are properly safeguarded. Pre-works breeding bird surveys are proposed so that up-to-date information is available to inform the construction process so that nest sites are effectively protected. In addition, a suitably experienced Ecological Clerk of Works would be appointed for the duration of the construction and site restoration phase to oversee the effective implementation of the bird protection measures. They would have the authority on site to stop any works that could be in breach of the agreed environmental commitments and the legislation protecting breeding birds.

9.1.20 No significant direct habitat loss was predicted for any species, taking into consideration the relatively small scale of permanent habitat loss from the construction of the wind farm. There is the potential for some degradation of surface waters (of importance to species such as greenshank for example) as a result of siltation and potential chemical pollution during the construction process. However, it is considered reasonable to assume that good practice pollution avoidance and control measures, as set out in the outline Construction Environmental Management Plan, would be effectively designed and implemented. This would help to ensure that potential impacts are avoided / minimised and that significant effects from habitat degradation would be avoided for all species.

9.1.21 The risk of bird mortality from collision with the proposed wind turbines has been assessed using data gathered during systematic flight activity surveys and using a standard wind farm EIA collision risk model. Whilst collisions are predicted, the levels are not considered to be of concern at a population level beyond a local-scale for all species. There is some recognised additional uncertainty with respect to collision risk for greenshank and so a conservative approach has been taken in the assessment of potential effects for this species. A pre-construction and operational monitoring plan (for various key species, including greenshank) is proposed. Additionally, measures undertaken for Stronelairg Wind Farm to reduce the risk to golden eagle (i.e. removal of deer carcases / gralloch from within the wind arm area and provision of winter larders in suitable locations) would also apply to the Proposed Development. Financial support for continued monitoring of golden eagle, as part of the Regional Eagle Conservation Management Plan, is also proposed.

9.1.22 Significant operational displacement effects are not predicted for any species. The extent to which the Proposed Development could result in habitat loss through the displacement of breeding golden eagles present in the surrounding area was considered in detail in the assessment. Mathematical modelling methods were used to predict potential habitats loss from displacement (i.e. in relation to effects on breeding and non-breeding eagles). Considering the Proposed Development in isolation, breeding range overlap was

predicted to be between 0.8 to 2.7% for the affected territories, this was not considered to be significant for any of the three affected golden eagle territories. Potential habitat displacement effects on wide-ranging young golden eagles was also determined to be non-significant. This is in the context of the relatively small extent of suitable habitat affected by the Proposed Development in comparison to habitat availability in the wider area and region.

9.1.23 The residual effects of decommissioning of the proposed wind farm are considered to be broadly similar to those during construction and are therefore not more than minor for all species and not significant. Prior to decommissioning, a thorough pre-works survey will be completed to determine the species present, their distribution and abundance and to inform the measures required to reduce any potentially significant impacts from disturbance and help ensure that the works proceed lawfully with respect to the legislation protecting breeding birds.

9.1.24 Careful consideration has also been given in the assessment to the potential for significant cumulative effects to occur from the Proposed Development in combination with existing and proposed wind farms in the wider region. The assessment considered information from published impact assessments where available. Species that were a focus for this aspect of the assessment include golden eagle, golden plover, dunlin and greenshank. Effects on golden eagle were considered initially in a local context and in terms of the wider regional breeding population (i.e. the Central Highlands NHZ). In relation to potential cumulative wind farm displacement effects, taking into account Stronelairg and two other proposed wind farms that could affect the same golden eagle territories as the Proposed Development, the combined predicted habitat loss was assessed as not significant for all territories affected and for the NHZ population as a whole.

9.1.25 Consideration was also given to potential cumulative operational displacement and collision mortality effects on the NHZ breeding populations of golden plover, dunlin and greenshank. The assessment concluded, on a precautionary basis, that significant cumulative operational effects (at the NHZ level) are possible for breeding golden plover. However, this conclusion would apply whether the Proposed Development was consented and built or not, on the assumption that all of the other proposed wind farms that could affect the golden plover NHZ population, as considered in the assessment, were consented and built. It was recognised in the assessment that there is currently some uncertainty about the long-terms effects of wind farm development on this species, as well as uncertainty about current NHZ population sizes, and that a non-significant cumulative effect is also realistically possible in the long-term.

9.1.26 In conclusion, the impact assessment considered the various potential adverse effects arising from the construction, operation and decommissioning of the proposed wind farm and evaluated the significance of these effects on key bird species in the context of the sensitivity of their populations, vulnerability to wind farm development and the scale of the potential effects. Following consideration of a range of best practice and mitigation measures for the construction, operational and decommissioning phases of the Proposed Development (in isolation), and the residual (i.e. mitigated) effects for all receptors would be not greater than minor in the long-term and would not be significant in terms of the EIA Regulations.

9.2 Introduction

9.2.1 This Chapter provides a systematic, evidence-based assessment of the potential effects of Cloiche Wind Farm (the 'Proposed Development') on bird populations and their supporting habitats. The assessment focuses on species considered to be potentially vulnerable to the effects of onshore wind farm development and whose populations are also of conservation concern internationally, nationally or in a regional context (referred to in this Chapter as 'sensitive ornithological receptors'). The potential effects on other fauna, habitats and flora are considered with in Chapter 8: Ecology.

9.2.2 This Chapter also provides a description and evaluation of the avifauna of the Proposed Development study area, based upon data derived from desk study sources and fieldwork with further detail provided in various technical appendices.

9.2.3 The specific objectives of the assessment, as detailed in this Chapter, are to:

- Set out the methodology used in completing the assessment;
- Describe and evaluate the ornithological receptors with a particular focus on species of conservation concern which are considered to be susceptible to the effects of onshore wind farm development;
- Identify the potential effects, including direct, indirect and cumulative;
- Assess the potentially significant effects associated with the construction, operation / maintenance and decommissioning of the Proposed Development;
- Define mitigation measures, where appropriate, to avoid, reduce and offset adverse effects; and
- Determine the level of residual effect, taking into consideration the proposed mitigation measures.

9.2.4 This assessment is informed by data derived from desk study and a set of baseline surveys. The methodologies and results of the desk study and baseline surveys are summarised and reported in this Chapter. Further detail and background information is provided in a set of technical appendices, listed as follows:

- Technical Appendix 9.1: Ornithological Desk Study & Survey Report
- Technical Appendix 9.2: Golden Eagle Topographical Model Report
- Technical Appendix 9.3: Collision Risk Model Report
- Technical Appendix 9.4: Outline Bird Protection Plan

9.2.5 A separate Confidential Annex to this Chapter (issued to the Scottish Ministers and Scottish Natural Heritage (SNH)) includes details of breeding locations of species at risk from human persecution and / or disturbance (i.e. raptor species listed on Schedule 1 of the Wildlife & Countryside Act 1981, as amended, (WCA)[1]) in accordance with the guidance on the publication of environmentally sensitive information (SNH 2016[2]).

9.2.6 The Confidential Annex also includes the full report of the Potential Aquila Territory (PAT) Model analysis completed to inform the wind turbine layout design and the assessment of the Proposed Development.

[1] Available from: http://www.legislation.gov.uk/ukpga/1981/69

[2] Scottish Natural Heritage (2016). Environmental Statements and Annexes of Environmentally Sensitive bird Information. Guidance for Developers, Consultants and Consultees. Available from: https://www.nature.scot/environmental-statements-and-annexes-environmentally-sensitive-bird-information

9.2.7 The ornithological baseline studies, evaluations and assessments presented in this Chapter were carried out by MBEC ecological consultants during 2018-2020, on behalf of the Applicant. All surveys and assessments were completed by suitably experienced ornithologists and EIA practitioners. MBEC is a Chartered Institute of Ecology and Environmental Management (CIEEM) Registered Practice and has extensive experience with onshore windfarm development planning in Scotland including baseline ornithological surveys, wind farm design advice, impact assessment, and mitigation. The lead assessor for the ornithology chapter has contributed to over 20 onshore windfarm EIAs during 18 years as a professional consultant.

9.3 Scope of the Assessment

9.3.1 A Scoping Report, outlining the Proposed Development, the range of potential effects, the proposed methods for the desk study, surveys and impact assessment, as well as a list of potential ornithological receptors for the ornithological study, was issued to statutory and non-statutory consultees in August 2018. A Scoping Opinion was subsequently provided by the Energy Consents Unit on 18 December 2018, a copy of which is included as Technical Appendix 5.1.

9.3.2 Table 9.1 summarises the key issues raised during Scoping relevant to this Chapter and describes how these issues are addressed.

Study Area

9.3.3 The Proposed Development is located in Highland Region, within an extensive, elevated plateau in the western Monadhliath Mountains, approximately 11km east south-east of Fort Augustus. The Proposed Development would be located within two large landholdings, Garrogie and Glendoe Estates. Wind turbines are proposed in two clusters, a western cluster of 28 and an eastern cluster of 8 wind turbines. The two clusters would lie to the immediate west and east of the existing Stronelairg Wind Farm, which is comprised of 66 wind turbines and was constructed between 2016 and 2018, becoming fully operational in December 2018

9.3.4 The locations of the western and eastern clusters support a range of upland habitats including blanket bog, modified bog, acid grassland, acid flush, dry dwarf-shrub heath and various nutrient-poor lochs and lochans, including the artificial reservoir for Glendoe Hydroelectric Scheme. Allowing for a 500m buffer zone around the outermost proposed wind turbines the western cluster would occupy an area of approximately 1,364ha, which ranges in elevation from 600m to 730m Above Ordnance Datum (AOD). The eastern cluster would occupy and area of approximately 473ha, ranging in elevation from 680m to 750m AOD.

9.3.5 The scope of the proposed surveys and the areas that would be covered were set out in the Scoping Report. Also included were details of the survey methods and background information, collated from various sources, which had informed decisions on the focal species for the baseline surveys and the proposed approach to the impact assessment.

9.3.6 The study / survey areas for this assessment vary in size in relation to the species under consideration, reflecting the potential 'zone of effect' from the construction and operation of onshore wind farm development for different species. The survey areas referred to within this Chapter are shown on Figures 9.2a-b: Ornithological Survey Areas along with the Site Boundary (i.e. redline boundary) for the Proposed Development. At the time that the ornithological surveys were being planned the final layout of the wind

farm was not known. Surveys focused on the western and eastern 'potential development areas' (PDAs) as they were defined at that time (as shown in the Scoping Report Figure 2: Proposed Development Areas) including various survey buffer zones beyond these boundaries. The proposed wind turbines are all located within the original western and eastern PDA boundaries. The locations of the two clusters of proposed wind turbines (west and east) are referred in this assessment as the western and eastern survey areas, with the extent of the study area varying in relation to the species under consideration.

9.3.7 The various survey areas are defined as follows:

- The 'core survey area' is defined as the area within the site boundary, plus an additional 500m wide buffer around the site boundary where wind turbines are proposed. Breeding activity by all bird species of conservation concern was surveyed within this area, this area was also the focus of the flight activity surveys and wintering waterbirds survey;
- The 'greenshank survey area' includes the site, and all areas of suitable breeding habitat up to 1km from the site boundary where wind turbines are proposed;
- The 'raptor survey area' refers to the site and all areas of suitable breeding habitat extending up to 2km (depending on the focal species) from the site boundary where wind turbines are proposed. This area was surveyed for breeding activity by all relevant Schedule 1 moorland raptors; and
- The 'waterbody survey area' refers to a survey of all lochs and lochans within the core survey area and within 2km of the site boundary, where wind turbines are proposed, for breeding waterbirds (i.e. focusing on divers, grebes and common scoter).

9.3.8 All survey areas outwith the 'core survey area' may also be referred to as the 'wider survey areas'.

9.3.9 The 'desk study area' refers to the local surrounding area up to approximately 10km from the site boundary, encompassing all breeding golden eagle territories that could potentially overlap with the Proposed Development. A larger desk study area, out to approximately 20km from the site boundary, was considered in determining the SPA populations that could be affected by the Proposed Development. The Central Highlands Natural Heritage Zone (NHZ) was treated as the appropriate regional-scale study area with respect to determining potential effect magnitude for the sensitive receptor populations at the sub-national scale.

Existing Data

9.3.10 The assessment is supported by data from annual raptor monitoring work (particularly in relation to breeding golden eagle) and a number of surveys previously completed within the vicinity of the Proposed Development, summarised as follows:

- Data collated for the EIA, (2002 and 2003 and 2004), and during construction and post-construction monitoring (2006-2014) for the Glendoe Hydroelectric Scheme;
- Bird survey data related to Stronelairg Wind Farm, including the results of baseline surveys and assessments (including breeding golden eagle territory modelling) completed for the EIA of Stronelairg Wind Farm, as reported in the Environmental Statement (ES) and associated Confidential Annexes (this included flight activity

data for golden eagle and other target species collected during summer 2009, winter 2009 / 10, summer 2010, winter 2010 / 11 and winter 2011 / 12);

- Results from pre-construction surveys and Ecological Clerk of Works monitoring completed prior to and during the construction of Stronelairg Wind Farm (during the period 2015-18);
- Data provided by Highland Raptor Study Group (HRSG) in relation to annual monitoring of breeding golden eagle and other Schedule 1 raptor species (covering the period 2015-2019); and
- Winter 2017 / 18 bird flight activity data for Stronelairg Wind Farm and the Proposed Development area collected by EnviroCentre for the Applicant.

9.3.11 The key findings from the above are provided in the baseline summary section of this Chapter with further details in Technical Appendix 9.1 and the Confidential Annex.

9.3.12 Based on a review of the existing data available for the Proposed Development it was determined that 1 year of bird survey effort would be sufficient to inform the EIA process. SNH confirmed that the proposed duration and scope of baseline surveys proposed to inform the EIA was acceptable at Scoping.

Consultation Responses

9.3.13 A summary of consultation responses received as part of the Scoping Opinion (see Technical Appendix 5.1) and comments / actions taken, with relevance to ornithology, is included in Table 9.1.

Table 9.1: Summary of Key Issues Raised During Scoping

Consultee	Key points raised in Scoping relevant to this assessment	Response & where addressed in this Chapter
SNH	Subject to bird survey work being carried out to SNH guidance, one year of bird survey work is considered suitable, with the addition of survey works for Glendoe Hydro and Stronelairg Wind Farm to provide background.	Discussed further in the methods and baseline sections of this chapter (Sections 9.5 and 9.6).
	Ornithological vantage points should be outwith the footprint / buffer of proposed turbines. Vantage points 2 and 3 are within the view sheds of other vantage points. To ensure there is no displacement effect from the presence of observers, watches should not take place simultaneously from VPs 2 & 3 or 3 & 4.	Most of the vantage points (VPs) are at least 500m from the proposed wind turbines (see Figure 9.3a-b: Vantage Point Locations and Viewsheds). Where that was not possible (e.g. due to topography or access restrictions) the VP location was within the viewshed of another VP, which was more than 500m from the turbines. This allowed bird activity to be remotely monitored, i.e. when the surveyor was not in position at the VP less than 500m from the turbines, to help address observer effect.

Consultee	Key points raised in Scoping relevant to this assessment	Response & where addressed in this Chapter
	A record of the activities taking place on the Stronelairg site during each survey period should be made. This information should be as detailed as reasonably possible and include information on whether personnel were on foot or in vehicles.	Potentially disturbing activities (including construction works), which could potentially affect bird behaviour / supress flight activity during the survey, were recorded for each watch period (see Technical Appendix 9.1).
	To minimise disturbance all golden eagle survey work should be co-ordinated with the monitoring undertaken by the HRSG and the Regional Eagle Conservation Management Plan (RECMP).	This was the case. Current and recent breeding golden eagle data relating to occupied territories relevant to the assessment, was collected and provided by HRSG (see the Confidential Annex for further details).
RSPB Scotland	The potential impacts of disturbance during construction and collision risk should be considered for Slavonian Grebe and Common Scoter at the Loch Knockie and Nearby Lochs Special Protection Area (SPA) and demonstrated in the EIA Report.	The potential effects from the Proposed Development, alone and in combination with other plans or projects, on the SPA qualifying species are considered in Section 9.3 and 9.6 of this Chapter.
	The potential impacts on Annex 1 species including hen harrier, merlin, golden eagle, osprey, red kites, golden plover and peregrine should be adequately covered in the EIA Report.	The potential impacts on these species are fully considered in Section 9.8. of this Chapter.
	The potential impacts on other important bird species likely to occur including dunlin, greenshank and black grouse should be adequately covered within the EIA report.	Potential impacts on all of these species are fully considered in this Chapter.
	Potential effects of the access route on habitats suitable for black grouse and breeding osprey should be adequately covered in the EIA Report.	Measures to avoid disturbance from use of the existing main access track (no new habitat loss would occur as a result of the Proposed Development) are outlined in Section 9.9 and Technical Appendix 9.4.
	More information should be provided to justify the proposed ornithological survey effort, and it will need to be demonstrated in the EIA Report that the survey data is adequate, robust and accurate.	See Section 9.5. of this Chapter for discussion of this issue.
	The cumulative assessment should fully accord with SNH (2018) guidance on "Assessing the cumulative impact of onshore wind farms on birds" and the SNH (2018) guidance on "Assessing the Significance of Impacts from Onshore Wind Farms Outwith Designated Areas".	See Section 9.5. of this Chapter for discussion of approach to the assessment generally and Section 9.11. for the approach to the cumulative assessment.

Consultee	Key points raised in Scoping relevant to this assessment	Response & where addressed in this Chapter
	In assessing cumulative impacts on species that are sensitive to wind energy developments such as golden eagle and hen harrier, it would be appropriate to consider impacts at the Natural Heritage Zone (NHZ) scale taking account of all existing and proposed wind energy schemes in NHZ 10.	Cumulative impacts, where relevant, have been assessed at the NHZ scale (i.e. NHZ 10: Central Highlands), see Section 9.11 of this Chapter.

Issues Scoped out of this Assessment

9.3.14 With the exception of the Monadhliath Site of Special Scientific Interest (SSSI), all designated sites with ornithological interest have been scoped out of this assessment due to the Proposed Development being located outside of the potential connectivity range for all relevant species, as defined in SNH guidance (2016).

9.3.15 Common moorland songbirds have also been scoped out of further consideration in this assessment, with the exception of the proposed Bird Protection Plan (BPP) and ensuring that all nesting birds are protected, in compliance with the Wildlife & Countryside Act 1981 (as amended), during construction works.

9.3.16 The potential effects on birds arising from the connection of the Proposed Development to the National Grid are not considered in any detail within this EIA. It is anticipated the Grid connection would connect to Melgarve Substation. The potential effects on all relevant ornithological receptors from the construction and operation of the Grid connection will be fully assessed as part of a separate consenting process.

Potential Ornithological Receptors

9.3.17 This assessment focuses on populations of bird species that are known to be sensitive to effects from the construction and / or operation of onshore wind farms. Particular consideration has been given in this assessment to those species whose populations are also of conservation concern in the UK and / or Europe. These include:

- Species listed on Annex I of the European Council Directive 2009/147/EC on the Conservation of Wild Birds (i.e. 'Annex I' species);
- Species listed on Schedule 1 to the Wildlife and Countryside Act 1981, as amended (i.e. 'Schedule 1' species); and
- Species of national conservation concern, not included within the above categories, but that are present within the study area in nationally or regionally important numbers.

9.3.18 Table 9.2 provides a list of potential receptor species, based on the above criteria, which were identified through the initial desk study process. Following completion of the baseline surveys, and emergence of the design for the Proposed Development, a focal list of potential ornithological receptors for the assessment was determined. Further detail is provided in Section 9.6 of this Chapter.

Table 9.2: List of potential receptor species, in taxonomic order, including their statutory and population conservation status at an international and national level.

Common Name	Scientific Name	Statutory Designations		National Conservation Status		
		Sch. 1 [i]	Ann. I [ii]	UK BoCC [iii]	SBL [iv]	UK BAP [v]
Whooper swan	*Cygnus cygnus*	✓	✓	Amber	✓	
Common scoter	*Melanitta nigra*	✓		Red	✓	✓
Black grouse	*Lyrurus tetrix*			Red	✓	✓
Red-throated diver	*Gavia stellata*	✓	✓	Green	✓	
Slavonian grebe	*Podiceps auritus*	✓	✓	Red	✓	
Osprey	*Pandion haliaetus*	✓	✓	Amber	✓	
Golden eagle	*Aquila chrysaetos*	✓	✓	Green	✓	
Hen harrier	*Circus cyaneus*	✓	✓	Red	✓	
Red kite	*Milvus milvus*	✓	✓	Green	✓	
White-tailed eagle	*Haliaeetus albicilla*	✓	✓	Red	✓	
Golden plover	*Pluvialis apricaria*		✓	Green	✓	
Dotterel	*Charadrius morinellus*	✓	✓	Red	✓	
Dunlin	*Calidris alpina schinzii*		✓	Amber	✓	
Greenshank	*Tringa nebularia*	✓		Amber		
Merlin	*Falco columbarius*	✓	✓	Red	✓	
Peregrine	*Falco peregrinus*	✓	✓	Green	✓	

i. Species listed on Schedule 1 to the Wildlife and Countryside Act 1981 (as amended).
ii. Species listed on Annex I of the EC Birds Directive (Directive 2009/147/EC on the conservation of wild birds - the codified version).
iii. Birds of Conservation Concern (BoCC) in the UK (Eaton *et al*. 2015).
iv. Species included on the Scottish Biodiversity List (Scott Wilson 2005), which is part of the Scottish Biodiversity Strategy (originally published by the Scottish Government in May 2004).
v. Priority species in the 2007 UK Biodiversity Action Plan. The UK BAP has been superseded by the UK Post-2010 Biodiversity Framework (JNCC 2012).

Potentially Significant Effects

9.3.19 The potential effects associated with construction, operation and decommissioning of the Proposed Development that are the focus of this assessment are outlined below.

9.3.20 Potential effects that may occur during the construction phase include:

- disturbance to breeding, passage and wintering birds from supporting habitats, during construction works (for example, through human presence, vehicle movements, noise, dust, vibration, light);
- short to medium-term loss and change to habitats through construction-related habitat damage (for example, from plant trafficking); and
- cumulative construction-related effects with other existing and proposed developments.

9.3.21 Potential effects that may occur during the operation of the wind farm include:

- long-term loss of and change to habitats associated with built structures and new permanent access tracks;
- risk of mortality from collision with wind turbines and other structures;
- behavioural displacement from important supporting habitats due to the presence of the wind turbines;

- potential effects on free movement (i.e. potential barrier effects) to and from roosting, feeding and nesting habitats;
- disturbance during maintenance and emergency works;
- potential effects of habitat management within the wind farm area; and
- cumulative operational-related effects with other existing and proposed developments.

9.3.22 Potential effects that may occur during the decommissioning phase include:

- works associated with the dismantling of the scheme infrastructure resulting in physical damage to habitats supporting bird species of conservation concern;
- disturbance to breeding birds arising from wind turbine dismantling and site restoration works; and
- cumulative decommissioning-related effects arising from other existing and proposed developments.

9.4 Legislation, Policy and Guidance

9.4.1 This impact assessment has been carried out in accordance with current best practice and in compliance with the provisions of the Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017. Particular consideration has been given to the following legislation, relevant national and local planning policy guidance:

- Annex I bird species, listed in Council Directive 2009/147/EC on the conservation of wild birds (the 'Birds Directive');
- The Conservation (Natural Habitats etc.) Regulations 1994 (as amended) (called "The Habitats Regulations") transposed from the EC Council Directive 92/43/EEC on the Conservation of Natural Habitats and Wild Fauna and Flora;
- Wildlife and Countryside Act 1981 (as amended);
- Nature Conservation (Scotland) Act 2004 (as amended);
- Wildlife and Natural Environment (Scotland) Act 2011;
- The UK Biodiversity Action Plan (UK BAP) / UK Post-2010 Biodiversity Framework;
- The Highland Biodiversity Action Plan 2015-2020 (HBAP);
- The Scottish Biodiversity List;
- Scottish Planning Policy (June 2014); and
- Scottish Government Planning Advice Note 1/2013: Environmental Impact Assessment.

9.4.2 A schedule of relevant Highland Council nature conservation policies and objectives, including relevant local and national Biodiversity Action Plan species and objectives, are provided in Chapter 6: Planning and within the Planning Statement which accompanies this EIA Report.

9.4.3 The approach taken to this assessment draws on a range of guidance from several sources including guidance produced by statutory nature conservation organisations and available published scientific literature. Listed below are the key guidance documents and scientific literature that were considered, in tandem with professional judgement, in determining the detailed and site-specific approach to the baseline surveys and impact assessment.

9.4.4 The field survey, receptor evaluation and assessment methods follow current best practice guidance as detailed in the following documents:

- Recommended Bird Survey Methods to Inform Impact Assessment of Onshore Wind Farms (SNH 2017);
- Assessing the cumulative impacts of onshore wind farms on birds (SNH, August 2018);
- Assessing the Significance of Impacts from Onshore Wind Farms Outwith Designated Areas (SNH, February 2018);
- Significance of impacts on birds within or affecting designated areas (SNH 2013);
- A Review of Disturbance Distances in Selected Bird Species (SNH 2007);
- Environmental Statements and Annexes of Environmentally Sensitive Bird Information (SNH, September 2016);
- Guidance on Assessing Connectivity with Special Protection Areas (SNH, June 2016);
- Calculating a theoretical collision risk assuming no avoiding action (SNH 2000);
- Avoidance Rates for the onshore SNH Wind Farm Collision Risk Model (SNH 2018);
- Environmental Impact Assessment Handbook. Guidance for competent authorities, consulting bodies, and others involved in the Environmental Impact Assessment process in Scotland (SNH 2018);
- Chartered Institute of Ecology and Environmental Management Guidelines for Ecological Impact Assessment in the UK and Ireland (CIEEM 2018, revised September 2019);
- Natural Heritage Zones Bird Population Estimates. SWBSG Commissioned Report Number: 1504 (Wilson *et al*. 2015); and
- Dealing with construction and birds (SNH, March 2016).

9.5 Methodology

Approach to the Desk Study

9.5.1 An initial desk study was completed prior to the start of fieldwork in August 2018. The purpose of this initial study was to ensure that all relevant species that could potentially be present in the study area, based on their known breeding or wintering ranges and the broad habitats present, were taken into consideration in survey planning.

9.5.2 Information on designated sites (local, regional, national and international) that have ornithological interest was also collated during the initial desk study. In addition to this, following SNH guidance on SPA bird populations and potential connectivity to habitats affected by onshore wind farm development, any potentially relevant SPAs up to 20km from the site were also considered (SNH 2016[3]).

9.5.3 Details of international and national designated sites, such as Special Areas of Conservation (SACs) and SSSIs, were obtained through SNH's Natural Spaces website[4] and associated Geographic Information System (GIS) data made publicly available by SNH.

[3] Scottish Natural Heritage (2016). Assessing Connectivity with Special Protection Areas. Version 3, June 2016. Available at: https://www.nature.scot/sites/default/files/2018-08/Assessing%20connectivity%20with%20special%20protection%20areas.pdf
[4] SNH. Natural Spaces. Available at https://gateway.snh.gov.uk/natural-spaces/index.jsp

9.5.4 A review of the extensive information available from various bird surveys completed within the vicinity of the Proposed Development was also completed. These datasets related to the Glendoe Hydroelectric Scheme and the baseline surveys and monitoring carried out for Stronelairg Wind Farm, including the following:

- Data collated for the EIA, pre-construction and post-construction monitoring for the Glendoe Hydroelectric scheme (2002-2003 and 2004, and 2006-2014);
- Results from baseline surveys and assessments completed for the EIA of Stronelairg Wind Farm, including bird flight activity data for golden eagle and other target species collected during: Summer 2009; Winter 2009 / 10; Summer 2010; Winter 2010 / 11; and Winter 2011 / 12;
- Results from pre-construction surveys and Ecological Clerk of Works (ECoW) monitoring completed prior to and during the construction of Stronelairg Wind Farm (2015-2018);
- Data provided to SSE by HRSG in relation to annual monitoring of breeding golden eagle pairs with territories that may overlap with the Stronelairg Wind Farm and the Proposed Development (covering the period 2015-2018); and
- Winter 2017 / 18 bird flight activity data for the Proposed Development collected for SSE. Limited watches were undertaken between October 2017 to March 2018, when weather and access allowed, from five VPs overlooking the Proposed Development. Winter walkovers also were conducted on part of the site between October 2017 and March 2018, when weather and access allowed.

9.5.5 A summary of the key, non-confidential, findings from the baseline surveys is provided in the Section 9.6. of this Chapter. The detailed records are provided in Technical Appendix 9.1 and the Confidential Annex. A map showing the survey areas of these various studies and how they overlap with the Proposed Development is provided in Technical Appendix 9.1.

9.5.6 A further desk study process was completed during the wind farm design phase. This involved contacting a range of organisations that hold bird records and requesting any relevant data they may hold for the study area. Requests for notable records of species of conservation concern for the study area were placed with a range of organisations, including the following:

- British Trust for Ornithology (BTO);
- Royal Society for the Protection of Birds (RSPB); and
- HRSG.

9.5.7 It is important to note that due to the remote nature of the Proposed Development many key species for this assessment, with the exception of golden eagle, have generally not been monitored in detail by any of these groups. Therefore, the absence of records for any species should not be treated as evidence that the species is not present in a particular area. Where there is suitable habitat, and the site is within the distributional range of the species, a precautionary approach is followed in relation to any judgements made on site importance or the need for surveys based on the desk study data alone.

9.5.8 The information from the desk studies and field surveys was used to help inform the wind farm design process as well as the assessment of effects of the proposals. In addition,

outputs from the Golden Eagle Topographic (GET) model (Fielding *et al*. 2019[5]) and the PAT model (McLeod *et al*. 2002[6]) were used to inform the wind farm design, particularly in relation to reducing the potential impact of the proposals on breeding golden eagle, and the impact assessment process.

Baseline Survey Methods

9.5.9 The baseline surveys were carried out between August 2018 and August 2019 in order to assess the use of all habitats within the core / wider survey areas by breeding and non-breeding birds, with a particular focus on the key receptors for this assessment. All surveys were completed by suitably experienced and, where appropriate, licensed surveyors following current best practice methods.

9.5.10 The following is a brief summary of the methods adopted for the baseline ornithological surveys. The extent of the survey areas are shown on Figure 9.2a-b: Ornithological Survey Areas. Details of the survey methods are provided in Technical Appendix 9.1.

9.5.11 The following surveys were completed between August 2018 and August 2019:

- Winter and Summer Flight Activity Survey (August 2018 and August 2019) from strategically located VPs, a minimum of 72 hours of observation per VP in total, to quantify the use of the site by key species (see Table 9.2);
- Breeding Bird Surveys (2019), completed to determine the presence and distribution of breeding territories / sites within the core and wider survey areas (see Figure 9.2a-b: Ornithological Survey Areas) including:
  - Surveys for breeding moorland waders (April to mid-July 2019);
  - breeding moorland raptors (March to July 2019);
  - black grouse (April to mid-May 2019); and
- Wintering Bird Surveys (2018-19), including walkover surveys to assess the use of the site by passage and wintering birds, supplementing observations from the flight activity survey, and regular checks of waterbodies.

Survey Constraints / Data Limitations

9.5.12 The proposed wind turbines are all located within the original western and eastern PDA boundaries, which were used as the basis for defining the various bird survey areas. The following elements of the Proposed Development (all of which are temporary sites that will be reinstated following construction) lie partly within or outside some or all of the 2018-2019 survey areas:

- The proposed construction compound, which is in the same location as the main site compound for Stronelairg Wind Farm);
- The proposed borrow pit (No. 9), which is at the same location as a previously consented borrow pit for Stronelairg Wind Farm; and
- The proposed eastern batching plant, located.

9.5.13 The proposed construction compound location is just outside the western core survey area and within the greenshank and raptor survey areas. Borrow pit 9 is located outside

[5] Fielding, A.H., Haworth, P.F., Anderson, D., Benn, S., Dennis, R., Weston, E. & Whitfield, D.P. (2019). A simple topographical model to predict Golden Eagle Aquila chrysaetos space use during dispersal. Ibis.

[6] McLeod, D.R.A., Whitfield, D.P., Fielding, A.H., Haworth, P.F. & McGrady, M.J. (2002). Predicting home range use by golden eagles Aquila chrysaetos in western Scotland. Avian Science. 2: 183-198.

of the western core survey area and the greenshank survey area but inside the raptor survey area. The eastern batching plan location is outside all of the 2018-19 survey areas. All of these locations were in the process of being reinstated during the 2018-2019 survey period. The assessment of potential effects from these elements has been informed by the available data from the 2018-2019 baseline surveys supplemented by information from the Stronelairg Wind Farm 2015 pre-construction surveys and the 2017-2018 ECoW surveys. The totality of available data is considered to be adequate to inform a reliable assessment of potential effects on the key species of interest for this assessment.

9.5.14 There were some parts of the 2018-2019 survey areas where access was, at least initially, restricted because they fell within adjacent landholdings where the owners had refused access. However, by April 2019 access to the entire survey area (including the 2km buffer zone for raptors, divers etc.) had been agreed with all relevant landowners.

9.5.15 Due to the comparatively high elevation of the site, deep snow and extreme weather conditions (low temperatures and high wind speeds) occurred during the winter months 2018-2019 making it unsafe to access some of the preferred VP locations (particularly VPs 2A, 5B and 6B; see Figure 9.2a-b: Ornithological Survey Areas). To address this, alternative lower-lying VP locations, which were also more accessible from existing wind farm tracks, were used as necessary. These locations provided more restricted views of the Proposed Development than the preferred VPs but allowed data collection to continue.

9.5.16 During the first five months of the survey (August to December 2018) there was on-going construction activity associated with Stronelairg Wind Farm. The last wind turbine to be completed (i.e. the blades fitted) was in August 2018 and the wind farm became fully operational in December 2018. Most of the construction activity during this period was at a relatively low level, in terms of noise and the numbers of plant machinery and operators involved. The work related to the completion of electrical testing of the wind turbines and small work crews, with one or two excavators, completing borrow pit and trackside restoration work.

9.5.17 The presence of site workers and machinery, and the qualitative level of activity, was noted during each survey as was any apparent behavioural reaction of the focal bird species to this activity. There was no apparent influence on bird activity noted during any of the surveys, although it is recognised that species such as golden eagle can be strongly influenced by the presence of people and construction activities and that, consequently, the surveys may underestimate potential longer-term use of parts of the survey area. This limitation has been addressed by drawing on data from other sources, such as previous flight activity surveys and modelling of breeding and non-breeding golden eagle activity to inform the assessment.

9.5.18 The Stronelairg wind turbines, and other associated site infrastructure, are also likely to have had an influence on bird flight activity. Golden eagle, in particular, is known to exhibit strong displacement behaviour near to wind farms in Scotland (e.g. Fielding & Howarth 2010[7], 2015a[8]). This effect is likely to have resulted in a reduced level of golden eagle flight activity within approximately 500m of the existing wind farm, an area which partly overlaps with the core survey area for the Proposed Development. As with the

[7] Fielding, A.H. & Haworth, P.F. (2010). Golden Eagles and Wind Farms. Haworth Conservation, Mull, Scotland.

[8] Fielding, A.H. & Haworth, P.F. (2015a). Edinbane Windfarm: Ornithological Monitoring 2007–2014. A Review of the Spatial Use of the Area by Birds of Prey. Haworth Conservation, Mull, Scotland.

construction disturbance issue discussed above, this limitation has been addressed by modelling of breeding and non-breeding golden eagle activity.

9.5.19 As is the case for all onshore wind farm EIAs, bird flight activity data are collected from VPs that are located to ensure good coverage of the Proposed Development, they do not cover the territories of wider ranging species such as golden eagle. Additionally, surveys over relatively short periods (1-2 years) may not be representative of longer-term patterns of activity and site use (e.g. activity during years of early breeding failure in comparison to years when breeding is successful). To address these constraints, other sources of information have been used to supplement the observational data (such as records from other surveys, information relevant published research, golden eagle territory modelling) and to inform the assessment.

9.5.20 The presence of observers carrying out baseline bird surveys can also influence bird behaviour, again this is a constraint that is not specific to this assessment. Of particular concern is the potential for surveyors located on poorly located VPs to affect golden eagle flight activity. For example, as golden eagles in Scotland tend to avoid people, a VP located between a breeding territory centre and the Proposed Development could cause a reduced level of flight activity within the vicinity of the Proposed Development, resulting in an under-estimate of the use and importance of the area to a breeding pair. In order to try and minimise the influence of 'observer effect', VPs were carefully selected to avoid placing observers between known territory centres and the PDA whilst also ensuring that there was coverage of the VP location from adjacent VPs. This allowed for the location to be monitored when no surveyor was present. Finally, as mentioned above, other sources of information, such as models that predict the use of the area by golden eagle, have been used to supplement observational data and inform this assessment.

9.5.21 There is also evidence from wind farm pre- and post-construction monitoring studies that breeding wader displacement effects may be more apparent, for some species, during construction phase and then gradually reduce with time once site disturbance decreases during the operational phase. It is possible that densities of breeding waders, in the parts of the survey area located near to Stronelairg Wind Farm, were suppressed during 2019 due to construction disturbance. This potential effect has been factored into the evaluation of receptor sensitivity, drawing on data collated from other surveys where applicable.

9.5.22 In conclusion, whilst there were some unavoidable site-specific limitations to some aspects of the field surveys, the baseline data, supplemented with the information derived from the desk study, are considered to be sufficiently extensive and detailed to identify and accurately characterise the use of the site by the key species and to inform a robust assessment of receptor sensitivity and the potential effects of the Proposed Development.

Impact Assessment Process

9.5.23 The methods adopted for this assessment follow current best practice, informed by the best available scientific evidence and experienced professional judgement. Where there are uncertainties, reasonable worst-case assumptions are made to minimise the risk of effects being underestimated. The assessment method takes into account relevant

guidance such as CIEEM's Guidelines for Ecological Impact Assessment in the UK (2018[9]) and SNH's Environmental Impact Assessment Handbook (2018[10]). SNH guidance related to the assessment of the effects of onshore wind farm development on birds is also of relevance and has also been taken into account where appropriate (see list provided in Section 9.4 above).

9.5.24 The EIA process involves the application of specific, standardised criteria to evaluate impacts and receptors. However, due to the complexities of species interactions with their environment and the potential uncertainty of some effects and the efficacy of mitigation measures, experienced professional judgement plays a key role in the evaluation of receptors and in the determination of the significance of residual effects.

9.5.25 The assessment of the potential effects on sensitive bird receptors from development projects is a process that can be summarised as a series of stages, as follows:

- Identifying the ornithological receptors that could be significantly affected by the Proposed Development (effectively part of Scoping);
- Evaluating the importance (i.e. importance at the relevant geographical scale, also referred to as receptor 'sensitivity') of the receptor informed by data from baseline surveys and other appropriate sources;
- Identifying and systematically characterising impacts and their effects (wherever possible based on best available scientific evidence), noting any uncertainties and taking a precautionary approach as appropriate;
- Incorporating measures to avoid and mitigate negative impacts and effects;
- Assessing the significance of any residual effects after the beneficial effects of any proposed mitigation has been taken into account;
- Identifying appropriate compensation measures to offset significant residual effects; and
- Identifying opportunities for ecological enhancement.

9.5.26 In this assessment, the terms 'impact' and 'effect' have the following meanings:

- Impacts - arise from the construction or operation / implementation of the proposals and result in a material change to a receptor; and
- Effects - are the consequences of the impact, which may be varied, for the ornithological receptor under consideration.

Receptor Sensitivity

9.5.27 Assigning a sensitivity value to bird receptors can involve the consideration of a number of factors. In practice, conservation status and relative rarity are often the most important criteria to consider. Ornithological receptor sensitivity is usually defined by consideration of international and / or national conservation status and relative rarity at different geographical scales (e.g. local, regional, national, international) and estimates of population size within the study area (or importance of the habitats within the study

[9] Chartered Institute of Ecology and Environmental Management (2018). Guidelines for Ecological Impact Assessment in the UK and Ireland (September 2018). Available at https://cieem.net/wp-content/uploads/2019/02/Combined-EclA-guidelines-2018-compressed.pdf [Accessed 01/08/2019].

[10] Scottish Natural Heritage (2018). A handbook on environmental impact assessment Guidance for Competent Authorities, Consultees and others involved in the Environmental Impact Assessment Process in Scotland (version 5, April 2018). Available at: https://www.nature.scot/handbook-environmental-impact-assessment-guidance-competent-authorities-consultees-and-others [Accessed 01/08/2019].

area in providing critical supporting habitat to populations present in the wider area). Where there is uncertainty about the accuracy of the available information used to inform judgements on receptor sensitivity a precautionary approach has been adopted to minimise the risk of under-valuing any receptor.

9.5.28 Some explanatory definitions of ornithological receptor sensitivity (populations and supporting habitats) are given in Table 9.3, below.

Table 9.3: Defining ornithological receptor sensitivity

Receptor sensitivity	Example criteria / definitions
Very High (International)	Habitats or species that form part of the cited interest of an internationally protected site or candidate site (for example, SPA, Ramsar site). Bird species listed on Annex I of the EC Birds Directive if present in qualifying numbers / proportions of the national / international population.
High (National)	A nationally designated site (e.g. SSSI, National Nature Reserve (NNR)) and the habitats and species that form its cited interest. Regularly occurring, but rare bird species (for example, less than 300 breeding pairs in the UK). Birds present in nationally important numbers (for example, more than 1% of the UK population). A site that provides critical habitat for any regularly occurring bird population of national importance, which is also considered a rare species in the UK.
Medium (Regional, e.g. NHZ)	A Local Nature Reserve, some local-level designated sites depending on specific site conditions. Any regularly occurring population of a nationally important bird species which is threatened or rare in the region (for example, more than 1% of the regional population or NHZ population where reliable estimates are available). Regularly occurring, regionally important population of bird species listed on the current UK Red list, presence of regionally important habitats critical to such species. Regionally important populations of National and Local Biodiversity Action Plan species.
Low	High Local: Sites with an identified ornithological interest meeting the criteria for Council area designation (such as Site of Importance for Nature Conservation), Local Wildlife Sites, which may include amenity and educational criteria in urban areas. Designated Local Nature Reserves. Any regularly occurring, locally significant population of bird species and their supporting habitats.
	Medium Local: A population of a species or assemblage of species which are not considered to qualify for non-statutory designation, but which are considered locally important (i.e. approx. 10km radius from the Site). Populations and supporting habitats of any bird species conservation importance in the context of the local area (i.e. approx. 10km radius from the Site).
	Low Local: A population of a species or assemblage of species which are not considered to qualify for non-statutory designation, but which are considered locally important in the context of the immediate surrounding area. Populations and supporting habitats of any bird species of conservation importance in the context of the immediate surrounding area.

Receptor sensitivity	Example criteria / definitions
Negligible	A commonplace species / population of little or no conservation importance at a local scale. Habitats of negligible value to any bird population.

9.5.29 Although there are a range of factors to be considered in the evaluation of receptor sensitivity, for the purposes of this assessment, importance in relation to population size is based on the estimated proportion of a population that a site supports in comparison to the wider geographical population. Where 1% of the bird population for a given geographical scale is regularly present within the site, then that site is considered to be important for that species and scale. For example, where more than 1% of the national population of a target species is regularly present within the site, the site would be considered to be of national and thus high importance. The 1% criterion for importance is well established and can be applied at the regional, sub-regional or local scales, providing there is sufficiently accurate information available on population sizes within these geographical units. Where there is uncertainty about the accuracy of the available information, a precautionary approach has been adopted to minimise the risk of under-valuing any receptor.

9.5.30 Current and accurate information on population sizes below the national level is frequently unavailable for many species. The evaluation of regional, sub-regional, and local importance must therefore often be based on the available information and professional judgement. Breeding population estimates, based on NHZ boundaries which divide Scotland into a number of distinct biogeographical areas, have been published and updated for some key species (Wilson *et al.* 2015[11]). The Proposed Development is located within the 'Central Highlands' NHZ.

Effect Characterisation

9.5.31 The overall character of an effect is a function of a wide range of variables, determined through informed professional judgement, including the following considerations:

- Direction of effect: whether the effect benefits (positive) or detracts / harms (adverse) the value of the receptor;
- Extent of the effect: number or area affected or potentially affected (quantified where possible, as the percentage / proportion of the total receptor population lost or affected);
- Complexity of the effect: relating to whether an effect on a receptor is direct or indirect effect, near or far, immediate or delayed;
- Reversibility of the effect: reversible or irreversible (can the effect be reversed, within a reasonable timescale and with reasonable expectation of recovery, or is it permanent and irreversible);
- Frequency of the effect: is the effect acting constantly or intermittently (e.g. occasional noise disturbance in comparison to a longer-term change to the existing baseline levels of disturbance);
- Duration of the effect: is the effect occurring during a more or less sensitive period of the receptor (e.g. relative to the bird breeding season); and

[11] 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.

- Confidence: certain, near-certain, probable, unlikely or extremely unlikely.

9.5.32 The overall effect, considering all of the above factors, for each receptor is categorised for each phase of the Proposed Development (i.e. the construction phase, the operational phase and the decommissioning phase). To help illustrate this, summary descriptions of the various effect levels (primarily considering effect magnitude) are provided in Table 9.4 below. The anticipated duration of the effect may also be summarised as the following categories within the assessment: long-term (15-25 years or longer); medium-term (5-15 years); and short-term (less than 5 years).

Table 9.4: Categorisation of the magnitude of an effect on ornithological receptors

Magnitude	Description
Total / Near Total	Would cause the loss of a major proportion of a regional population (i.e. receptor) or cause sufficient damage to a feature (i.e. receptor) to immediately affect its viability / conservation status.
High	Major effects on the population, which would have a sufficient effect to alter the nature of the population in the short-long term and affect its long-term viability / conservation status (e.g. detectable long-term impacts on the regional population).
Medium	Impacts that are detectable in short and medium-term, but which should not alter the long-term viability of the population (e.g. detectable short to medium-term impacts on the regional population).
Low	Minor impacts, either of sufficiently small-scale or short duration to cause no long-term harm to the population (e.g. no long-term detectable impact on the regional population).
Negligible / Neutral	A potential impact that is not expected to affect the population in any way (or to have no measurable effect); therefore, no effects are predicted.

Vulnerability to Wind Farm Development

9.5.33 Certain species are considered to display greater relative vulnerability to the impacts of wind farm developments than others. Relative vulnerability can be summarised by broad criteria which are assigned to each species based on certain aspects of their ecology, sensitivity to disturbance, biometrics and flight behaviour (see Table 9.5). Species-specific vulnerability to wind farm development is considered within the impact assessment process (i.e. one of the factors considered in determining the level of effect magnitude) and does not form part of the determination of receptor sensitivity which is undertaken without reference to the development type and impact parameters.

9.5.34 For individual receptor species, their relative vulnerability to wind farm development is outlined and discussed within the assessment (see Section 9.8). This is determined from the available published research, monitoring studies and literature reviews that have considered species-specific effects of wind farm development (i.e. displacement, barrier effects, and collision risk). It is important to note that such assessments of vulnerability broadly illustrate differences in potential species-specific responses to wind farm development and are an aid to impact assessment. They do not necessarily reflect variation in vulnerability between individuals, sexes and age groups in the same population, and in the same individual over time (e.g. seasonal changes) or other

influencing factors such as habitat type and condition, wind farm size and layout, and topography.

Table 9.5: Example categorisation of vulnerability to wind farm development

Level	Description
High	Species or populations that are considered to be particularly vulnerable to human-related disturbance generally but to wind farm development specifically, e.g. with a relatively high risk of collision (based on, e.g. behaviour, morphology, typical flight altitude, twilight / nocturnal activity and manoeuvrability) or displacement and that can potentially exhibit behavioural responses to sources of disturbance at greater distances (e.g. more than 300m).
Medium	Species or populations that are considered to be moderately vulnerable to human-related disturbance generally, but to wind farm development specifically, e.g. with a moderate risk of collision (based on behaviour, morphology and manoeuvrability) or displacement and that can potentially exhibit behavioural responses to sources of disturbance at lesser distances (e.g. 100 – 300m).
Low	Species or populations that are relatively invulnerable to human-related disturbance and that are considered to have a low risk of collision or significant long-term disturbance / displacement from operating wind farms.

Effect Significance

9.5.35 Significance is a measure of the importance that should be given to an effect in relation to the consideration of appropriate mitigation and the overall environmental impact of the proposals. Effects can be significant at a wide range of geographical scales (i.e. from the local level to effects that are of international importance for the receptor under consideration), but which result in important consequences for the functioning and / or conservation status of the receptor. In general terms, significance is determined through the interaction between receptor sensitivity and the categorised effect level (i.e. taking into account effect extent, duration, reversibility etc.).

9.5.36 Effect significance is reported in categories, from No effect to Major, through Negligible, Minor and Moderate. A matrix is provided as Table 9.6 to help illustrate how effect level and receptor sensitivity relate to judgements of effect significance. In practice, the determination of significance involves the careful application of informed professional judgement and consideration of a wide range of factors, as outlined above. For the purposes of this assessment, effects are considered significant (i.e. 'significant' in terms of the EIA Regulations if they are reported as Moderate or above).

Table 9.6: Matrix illustrating the relationship between the effect level and receptor sensitivity

Receptor sensitivity		Effect level (significant effects highlighted in bold)			
		High	**Medium**	**Low**	**Negligible**
Very High		**Major**	**Major**	**Major-Moderate**	Negligible
High		**Major**	**Major-Moderate**	**Moderate**	
Medium		**Major-Moderate**	**Moderate**	**Moderate**-Minor	
Low	High	**Moderate**	**Moderate**-Minor	Minor	
	Medium	**Moderate**-Minor	Minor	Minor	
	Low	Minor	Minor	Minor	
Negligible		Negligible			

9.5.37 Where significant adverse effects are predicted then mitigation measures are usually recommended, where feasible, in order to reduce their severity (see below). Mitigation measures are actions that are proposed in order to prevent, reduce or ameliorate any potential changes on ornithological receptors. This might include reconsidering the design of the proposal (e.g. in terms of its size, shape and / or extent) at an early stage as well as the use of best practice construction methods, the timing of works and effective habitat restoration. In some cases, mitigation measures may also be specified, where changes are considered to be non-critical as part of a best practice approach to development. Following consideration of the proposed mitigation the residual effect and significance is reported in the assessment.

9.5.38 In relation to this proposal, appreciable reduction or avoidance in potential effects has been achieved through the wind farm design process. However, as design changes are incorporated into the Proposed Development at an early stage they are therefore not considered as mitigation measures in the context of the assessment of residual effects. How the development design considered ornithological receptors in this process is provided in Chapter 2: Site Selection and Design Evolution.

9.5.39 Consideration has also been given to the potential for other proposals (i.e. cumulative developments) in the wider area to affect the same receptor populations, with the potential to result in additive adverse cumulative effects with the Proposed Development (e.g. wind farm proposals and collision mortality).

Approach to Mitigation

9.5.40 Potentially significant adverse effects on sensitive ornithological receptors have been addressed by following the mitigation hierarchy principles:

- Avoidance: Seek options / alternative location(s) or layouts that avoid / reduce risk of harm (e.g. locating wind turbines away from regularly used flight areas);
- Mitigation: Potentially significant adverse effects avoided or minimised through mitigation measures (e.g. timing of works to avoid / reduce disturbance to breeding birds);
- Compensation: Where there are significant residual negative ecological effects despite the mitigation proposed, these should be offset by appropriate compensatory measures (e.g. habitat improvement or creation outside the zone of effect of the wind farm); and

- Enhancement: Seek to provide net benefits for biodiversity over and above requirements for avoidance, mitigation or compensation. Identify opportunities for ecological enhancement and net-gain of biodiversity.

Collision Risk Modelling

9.5.41 Annual collision rates for key species have been estimated following a method developed by Band *et al.* (2007[12]). The calculations and parameters involved in the collision risk assessment are detailed in Technical Appendix 9.3: Details of the Collision Risk Modelling. In summary, the process involves three stages:

- Stage one is the estimation of the number of transits through the proposed rotor swept volume per year, based on observed flight activity data and parameters of the wind farm and wind turbine design;
- Stage two involves the estimation of the predicted proportion of transits through the rotor swept volume that would result in a collision between the bird and a wind turbine blade. All predicted collisions are assumed to be fatal. This provides an estimate of the number of fatalities per year for the wind farm but assumes that no bird takes avoiding action to prevent a collision; and
- Finally, an assumed rate for collision avoidance is applied to the estimate.

9.5.42 This method is more suitable for some species than others (Madders and Whitfield 2006). For example, small, cryptic and fast-flying birds, such as merlin, are difficult to detect beyond a distance of a few hundred metres and this results in under-estimates of flight activity based on observational data alone. For these species collision risk is best assessed through other means, for example territory modelling and assumptions about flight activity, rather than collision risk modelling alone.

9.5.43 In order to provide a biologically realistic estimate of collision risk it is necessary to assume that birds take action to avoid collision (Band *et al.* 2007). Birds may display avoidance at several spatial scales: e.g. avoiding a wind farm as a whole; altering flight direction to avoid turbines within the wind farm (e.g. flying between turbine rows); or taking action very close to an individual turbine to avoid a collision.

9.5.44 Reliable empirical data on which to base estimates for different types of avoidance are lacking for many species. Additionally, there are many other factors associated with wind farm location, habitats types and landform, which may also influence collision risk on a site-specific basis. Therefore estimates of collision rates derived from assumed avoidance values, in the absence of suitable empirical data, should be treated with caution. SNH initially recommend a default avoidance rate of 95% but have in recent years, following various literature reviews of bird collision monitoring studies, increased these rates for some species. For example, current guidance is to assume a 99% avoidance rate for golden eagle (Whitfield 2009[13], SNH 2018[14]), 99.5% for red-throated diver (Furness 2015[15], SNH 2018) and whooper swan (Whitfield & Urquhart 2015, SNH 2018).

9.5.45 In this assessment, estimates of collision risk / mortality have been calculated for the receptor species where there was sufficient data to carry out the analyses. Further details

[12] Band, W., Madders, M. and Whitfield, D.P. (2007). Developing field and analytical methods to assess avian collision risk at Wind Farms. In de Lucas, M., Janss, G. and Ferrer, M. (eds.) Birds and Wind Power. Quercus.
[13] Whitfield, D.P. (2009). Collision avoidance of golden eagles at wind farms under the 'Band' collision risk model. Report to SNH.
[14] Scottish Natural Heritage (2018). Avoidance Rates for the onshore SNH Wind Farm Collision Risk Model, September 2018.
[15] Furness, R.W. (2015). A review of red-throated diver and great skua avoidance rates at onshore wind farms in Scotland. SNH Commissioned Report No. 885.

and discussion of various generic and assessment-specific assumptions, limitations and biases applicable to collision risk modelling are provided in Technical Appendix 9.3: Collision Risk Model Report.

Cumulative Assessment

9.5.46 The potential for cumulative impacts with other proposals has been assessed following current CIEEM and SNH guidance (SNH 2018[16], CIEEM 2018[17]). This part of the assessment focuses on those receptors where there is considered to be a realistic potential for cumulative effects to occur. The assessment includes consideration of operational projects; projects under construction; consented projects which are not yet under construction; and projects for which planning applications have been submitted and for which sufficient information is publicly available (as of November 2019).

9.5.47 Cumulative effects, from two or more development proposals, can be additive (i.e. the effect of each of the proposals can be summed), antagonistic (i.e. the combined effects are less than if they were summed) or synergistic (i.e. the combined effects are greater than if they were summed). In relation to combined collision mortality estimates the approach has been to assume, on a precautionary basis, that the effect on key receptor populations would be additive. However, combining collision mortality estimates from a number of different projects is likely to lead to over-estimates, as individual birds taken from a population, as a result of collision mortality, can be removed only once and this then reduces the number of birds subject to collision risk from other sources. Also, birds that are lost to the population as a result of wind turbine collision may have died anyway from other causes (i.e. compensatory mortality).

9.5.48 Broadly, there are three main sources for cumulative effects:

- Type 1 – those arising from the Proposed Development being assessed;
- Type 2 – those arising from the Proposed Development being assessed in combination with those arising from other proposed projects; and
- Type 3 – those arising from the Proposed Development in combination with those that are predicted to arise from completed development projects.

9.5.49 Type 1 cumulative effects are associated with the Proposed Development (e.g. the cumulative result of wind farm operational displacement and collision risk needs to be considered as they are antagonistic effects) and are considered within Section 9.8 of this Chapter.

9.5.50 Type 2 and 3 effects are potential 'in combination' effects associated with other existing and proposed developments and are considered in Section 9.11 of this Chapter. The cumulative assessment focuses on wind farm development and the potential for significant cumulative effects on breeding waders (golden plover and dunlin) and golden eagle (breeding and non-breeding population) within the context of the Central Highlands NHZ.

9.5.51 In relation to Type 2 effects, priority is given in this assessment to consideration of proposals which have consent, or for which an application for consent has been

[16] Scottish Natural Heritage (2012). Assessing the Cumulative Impact of Onshore Wind Energy Developments [online]. Available at: https://www.nature.scot/guidance-assessing-cumulative-impact-onshore-wind-energy-developments [Accessed 01/08/2019].
[17] Chartered Institute of Ecology and Environmental Management (2018). Guidelines for Ecological Impact Assessment in the UK and Ireland (September 2018). Available at https://cieem.net/wp-content/uploads/2019/02/Combined-EclA-guidelines-2018-compressed.pdf [Accessed 01/08/2019].

submitted. There is clearly greater uncertainty about projects which are at the EIA Scoping stage. Additionally, projects at this stage rarely have any detailed baseline survey information or assessments available for review. Therefore, the assessment of potential cumulative effects is inevitably more speculative for such proposals.

9.5.52 The relevant spatial scale is also an important consideration in determining the scope of the cumulative assessment. The assessment of potential cumulative effects has been restricted to those projects that have the potential to interact with the same key receptor populations at a similar scale or influence as the Proposed Development, at the regional or NHZ scale.

9.5.53 Further details on the approach to the cumulative effects assessment are provided in Section 9.11 of this Chapter.

Assessment Limitations

9.5.54 The methods adopted for this assessment follow current best practice and have been agreed in consultation with SNH. There are considered to be no methodological limitations, specific to this assessment, that appreciably affect the reliability or robustness of its conclusions.

9.5.55 Generally, all impact assessments are subject to some degree of uncertainty as to the potential scope, scale, duration and magnitude of effects and the range and sensitivity of receptors affected. Also, well recognised in wind farm EIA, there can be a relatively weak relationship between levels of bird flight activity recorded during monitoring prior to EIA (or construction), and the resulting predicted collision rates, and the actual levels of collision mortality during wind farm operation (Ferrer 2012[18]), which can be much lower than predicted. This is particularly evident in species that typically exhibit a strong avoidance of wind farms as a whole, such as golden eagle in Scotland.

9.5.56 Limitations in respect of bird collision risk modelling are well known (Band *et al.* 2007[19]). As discussed above, the method is limited by the current understanding of how bird flight activity and behaviour is affected by wind farms in the long-term and in proximity to individual wind turbines. However, this method includes parameters that can be adjusted to some extent to account for species-specific differences in morphology and flight behaviour and incorporates variables for individual turbine design, wind farm layout and operational regime. A further advantage of the Band Model, which has become widely adopted in wind farm EIA, is that it enables comparisons of collision risk between proposals, which also helps to inform cumulative assessment.

9.5.57 General and project-specific uncertainties have been accounted for in this impact assessment, where appropriate, by assuming reasonable 'worst cases' where relevant in the evaluation of receptor sensitivity and the assessment of the potential effects of the Proposed Development. These are highlighted and discussed, where relevant, within the assessment sections of this Chapter.

[18] Ferrer, M., de Lucas, M., Guyonne F.E.J., Casado, E., Muñoz, A.R., Bechard, M.J., Calabuig, C.P. (2012). Weak relationship between risk assessment studies and recorded mortality in wind farms. Journal of Applied Ecology, 49, pp 38–46.

[19] Band, W., Madders, M. and Whitfield, D.P. (2007). Developing field and analytical methods to assess avian collision risk at Wind Farms. In de Lucas, M., Janss, G. and Ferrer, M. (eds.) Birds and Wind Power. Quercus.

9.6 Baseline Description

Designated Sites

9.6.1 There are a number of nationally and internationally important natural heritage designations within approximately 10km of the Proposed Development (see Figure 9.1: Sites Designated for Nature Conservation), as listed in Table 9.7. Other SPAs, up to 20km from the Proposed Development, have been considered during the EIA Scoping process. It was confirmed, based on SNH guidance that the Proposed Development would not affect any populations associated with SPAs not listed in Table 9.7.

Table 9.7: Natural Heritage Designated Sites with Ornithological Interest.

Site Name	Designation	Size (ha)	Location*	Summary of Species Interest / Condition
Monadhliath	SSSI	10,671	0.1km south-east	Aggregations of upland breeding birds including, dotterel, golden plover, dunlin, ring ouzel, wheatear, stonechat, red grouse, meadow pipit and dipper. The breeding population of dotterel is of national importance. • Dotterel, Unfavourable No Change (July 2011) • Breeding bird assemblage, Favourable Maintained (June 2008)
Glendoe Lochans	SSSI	255	2.2km west	• Slavonian grebe (1.25 pairs, average), Favourable Maintained (March 2005) • Common scoter (2 pairs), Favourable Maintained (August 2002)
Loch Knockie and Nearby Lochs	SPA	397	2.2km west	Breeding Slavonian grebe (up to 6 pairs, 1992-1995), Unfavourable No Change (July 2002).
Creag Meagaidh	SSSI	7,032	6.5km south	Supports a varied breeding bird assemblage including: golden eagle, black grouse, golden plover, dotterel, ring ouzel and twite. • Breeding bird assemblage, Favourable Maintained (June 2013).
Creag Meagaidh	SPA	2,856	7.7km south	Breeding dotterel (1987 to 1994, an average of 23 pairs). Unfavourable Declining (July 2011).

**Distance from the nearest permanent infrastructure of the Proposed Development.*

9.6.2 The boundary of the Monadhliath SSSI is located adjacent to the Proposed Development, approximately 0.1km to the south-east of the nearest proposed wind turbines. The Monadhliath SSSI is a very extensive area of high moorland plateau comprising a range of dwarf-shrub heath and blanket bog habitats. These habitats support an assemblage of breeding upland waders, including a breeding dotterel (*Charadrius morinellus*) population that is of national importance.

9.6.3 The Monadhliath Special Area of Conservation (SAC) has the same boundary as the SSSI and is designated due to the international importance of the blanket bog habitats the site supports (blanket bog is a priority habitat in Annex I of the EC Habitats Directive (Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora).

9.6.4 Approximately 2km to the west of the Proposed Development is the eastern boundary of the Glendoe Lochans SSSI, which forms part of the Loch Knockie and Nearby Lochs SPA. The sole qualifying species for the SPA is Slavonian grebe; a very rare breeding species in the UK with the national population most recently estimated at only 29 pairs (Holling & RBBP 2018). The SPA also supports a number of other breeding waterbirds, including a nationally important population of common scoter. The conservation objectives for the Loch Knockie and Nearby Lochs SPA are as follows:

- To avoid deterioration of the habitats of the qualifying species (i.e. Slavonian grebe) or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained; and
- To ensure for the qualifying species that the following are maintained in the long term:
  - Population of the species as a viable component of the site;
  - Distribution of the species within the site;
  - Distribution and extent of habitats supporting the species;
  - Structure, function and supporting processes of habitats supporting the species; and
  - No significant disturbance of the species.

Summary of Baseline Data

9.6.5 This section of the Chapter provides a summary of the ornithological data collated to inform this assessment.

9.6.6 Relevant records from the various desk study sources are summarised within the individual species accounts below. The full details are provided in Technical Appendix 9.1 or the Confidential Annex for sensitive records relating to Schedule 1 species.

9.6.7 The following is a summary of the baseline surveys completed between August 2018 and August 2019, focusing on potential receptor species for this assessment (see Table 9.2).

Summary of Breeding Bird Surveys

9.6.8 The following is a summary of the key findings from the baseline breeding bird surveys completed in 2019. Further detail is provided in the key species accounts later in this section of the Chapter and also within Technical Appendix 9.1. The non-confidential mapped results from the various surveys are provided as:

- Figure 9.9a Breeding Bird Survey Results 2019 - Waders (Western Cluster);
- Figure 9.9b Breeding Bird Survey Results 2019 - Waders (Eastern Cluster);
- Figure 9.10a Breeding Bird Survey Results 2019 - Other species (Western Cluster); and
- Figure 9.10b Breeding Bird Survey Results 2019 - Other species (Eastern Cluster).

9.6.9 Sensitive breeding records related to Schedule 1 species (e.g. golden eagle) are provided in the separate Confidential Annex.

9.6.10 Table 9.8 below summarises the results of the breeding bird surveys in 2019 for species of national conservation concern and / or that receive special statutory protection. Further details of all species recorded during the surveys are provided in Technical Appendix 9.1.

Table 9.8: Apparent breeding territories of species of conservation concern from the 2019 surveys (golden plover and dunlin density, i.e. territories per km^2, given in parentheses)

Common Name	Western Core Survey Area	Western Cluster (500m buffer)	Eastern Core Survey Area	Eastern Cluster (500m buffer)	**Total (Core Survey Areas)**	**Total (500m turbine buffer)**
Golden Plover	20 (0.91)	14 (1.03)	12 (1.12)	5 (1.06)	**32 (0.98)**	**19 (1.03)**
Ringed Plover	1	1	0	0	**1**	**1**
Dunlin	16 (0.73)	11 (0.81)	6 (0.55)	2 (0.42)	**22 (0.67)**	**13 (0.71)**
Common Sandpiper	2	2	3	1	**5**	**3**
Common Snipe	1	1	0	0	**1**	**1**
Greenshank	2	1	0	0	**2**	**1**
Teal	3	2	0	0	**3**	**2**
Mallard	2	2	0	0	**2**	**2**
Red Grouse	22	17	18	9	**40**	**26**

9.6.1 Evidence of breeding greenshank was recorded within the survey area, with one confirmed mating territory located within 500m of the nearest proposed wind turbines (see the Confidential Annex for further details). In Scotland, breeding is typically associated with flat, or gently undulating, topography with blanket bog, bog pool complexes, rivers, lochs and lochans. Waterbodies used for courtship and foraging and drier areas for nesting can lie several kilometres apart (Nethersole-Thompson 1979[20], Snow & Perrins 1998[21]). Unlike other moorland waders (such as golden plover) greenshank may also breed close to, or within, areas of open woodland, although this is more typical of the species in northern continental Europe and Asia. Breeding greenshank will display and defend several areas within their breeding grounds, and not just their nest sites (i.e. mating territories in April, nesting territories in May and chick-rearing areas in June). Parts of the survey areas (west and east) and adjacent areas, including within Stronelairg Wind Farm, provide suitable courtship, nesting and chick-rearing habitats.

9.6.2 Golden plover, ringed plover, dunlin, common sandpiper and common snipe were all recorded breeding within the core survey area in 2019 (see Figures 9.9a-b: Breeding Bird Survey Results 2019 – Waders). The most abundant wader species was golden plover, with 20 apparent breeding territories recorded in the western core survey area and 12 within the eastern core survey area (an approximate density of 0.91 and 1.12 per km^2 respectively). Followed by dunlin, with 16 territories recorded in the western survey area and 6 on the eastern survey area (an approximate density of 0.73 and 0.55 per km^2 respectively). Of these, a total of 19 golden plover and 13 dunlin territories were located within 500m of the nearest proposed wind turbines. The general pattern of recorded presence and abundance of breeding waders broadly reflected habitat quality for the individual species. For example, dunlin breeding territories were often associated with areas of blanket bog with small bog pools, a habitat matrix which is often a good predictor

[20] Nethersole-Thompson, D. & Nethersole-Thompson, M. (1979). Greenshanks. T & AD Poyser, Berkhamsted.
[21] Snow, D.W. & Perrins, C.M. (1998). The Birds of the Western Palearctic, Volume 1: Non-Passerines. Oxford University Press, Oxford.

of dunlin breeding density (Lavers & Haines-Young 1996[22]). Golden plover territories were broadly distributed across both survey areas, with similar densities in the west and east, typically associated with flatter areas such as hill tops and plateaux ground, particularly where there was suitable shorter vegetation (nesting golden plover show a preference for vegetation less than 15 cm tall, Ratcliffe 1977[23]). Common sandpiper were closely associated with the shorelines of the larger waterbodies and with the main watercourses. The general distribution of breeding locations and the recorded territory density was broadly consistent with previous surveys of breeding waders within / near to the Proposed Development.

9.6.3 The most notable difference to previous surveys in the area (i.e. related to Glendoe Hydroelectric Scheme monitoring surveys and Stronelairg Wind Farm EIA) was the presence of breeding greenshank. It is possible that this difference is due to wider trends in the breeding population since the previous surveys were completed. But this may also be related to an increase in habitat availability (or 'attractiveness' for this species) within the area due to the creation of small artificial waterbodies, associated with the Hydroelectric Scheme intake lagoons.

9.6.4 A small number of teal and mallard breeding locations were recorded within the western survey area, associated with the eastern end of the main Glendoe Hydroelectric Scheme reservoir and nearby smaller waterbodies.

9.6.5 The moorland breeding songbird assemblage is considered to be relatively species-poor, although this is likely to be due to the relatively high altitude of the site. The vast majority of the species recorded are widespread and common within the habitats present in the survey areas, although some species are of conservation concern at a national level (e.g. meadow pipit).

9.6.6 There was no evidence during the 2019 surveys to indicate breeding activity by hen harrier, merlin or peregrine within the core or wider raptor survey areas.

Summary of Flight Activity Survey Results

9.6.7 This section summarises the results of the flight activity surveys completed for the Proposed Development between August 2018 and August 2019. The detailed findings are provided in Technical Appendix 9.1. The locations of the vantage points and viewsheds, relative to the Proposed Development, as used for these flight activity surveys are shown on Figure 9.3a-b: Vantage Point Locations and Viewsheds. The mapped results for target and secondary species are shown on Figures 9.5-9.8. Golden eagle flight activity has also been summarised as an activity index, based on observation effort and seconds of flight time within a 250 x 250m grid overlaying the combined extended viewsheds of the flight activity survey VPs (see Figures 9.4a-b).

9.6.8 Table 9.9 below provides a summary of completed hours of observation from the flight activity survey. Hours of observation from the overlapping viewsheds of alternative VPs (e.g. 2a and 2b) have been summed in this table. Further detail is provided in Appendix 9.1.

[22] Lavers, C. P., & Haines-Young, R. H. (1996). The pattern of Dunlin Calidris alpina distribution and abundance in relation to habitat variation in the Flow Country of northern Scotland. Bird Study, 43(2), 231–239.
[23] Ratcliffe, D. A. (1977). Observations on the breeding of the Golden Plover in Great Britain. Bird Study 23(2): 63-116.

Table 9.9: Hours of observation completed at each vantage point (August 2018 - August 2019)

Year	Season	Month	VP1	VP2	VP3	VP4	VP5	VP6	Total
2018	Summer	August	6	6	6	6	6	6	36.00
	Winter	September	6	6	6	6	6	6	36.00
		October	6	6	5.5	6	6	6	35.50
		November	6	6	3	5.75	6	6	32.75
		December	6	6	5.5	3	6	6	32.50
2019		January	6	9	8	9.75	6	3	41.75
		February	9	3	9.5	6	9	10.5	47.00
		March	3	6	4.5	5.5	3	5.5	27.50
	Summer	April	6	6	6	6	6	6	36.00
		May	9	6	7.5	9	6	6	43.50
		June	9	9	8.5	9	12	12	59.50
		July	6	9	8	6	6	6	41.00
		August	12	0	0	0	0	0	12.00
Totals			**90**	**78**	**78**	**78**	**78**	**79**	**481.00**

9.6.9 A summary of the observed 2018-2019 flight activity survey results by target and secondary species is provided in Table 9.10, which shows the number of flights (and also the number of birds where flights represented more than one bird) recorded between August 2018 and August 2019 within the 'light risk area' (FRA) for the western and eastern turbine clusters. The FRA refers to a bounding line around the outermost proposed wind turbines plus a 500m wide buffer zone.

Table 9.10: Summary of recorded flight activity by target and secondary species within the flight risk area for the western and eastern clusters (2018-2019).

Species	Survey Area	Number of flightlines in the FRA (total number of birds)	Number of flightlines at or partially at risk height within FRA (total number of birds)
Osprey	Eastern	1 (1)	1 (1)
	Western	2 (2)	2 (2)
Golden Eagle (Juv.)	Eastern	6 (6)	3 (3)
	Western	7 (7)	7 (7)
Golden Eagle (Sub-ad, Ad.)	Eastern	13 (15)	8 (8)
	Western	9 (11)	7 (8)
Red Kite	Eastern	11 (13)	11 (13)
	Western	1 (1)	1 (1)
White-tailed Eagle	Eastern	1 (1)	1 (1)
	Western	5 (5)	3 (3)

Species	Survey Area	Number of flightlines in the FRA (total number of birds)	Number of flightlines at or partially at risk height within FRA (total number of birds)
Greylag Goose	Eastern	8 (452)	0 (0)
	Western	11 (590)	4 (161)
Golden Plover	Eastern	0 (0)	0 (0)
	Western	7 (11)	2 (3)
Common Kestrel	Eastern	2 (2)	2 (2)
	Western	0 (0)	0 (0)
Merlin	Eastern	0 (0)	0 (0)
	Western	4 (4)	4 (4)
Peregrine	Eastern	2 (2)	2 (2)
	Western	1 (1)	1 (1)

9.6.10 The most frequently observed target species during the flight activity survey was golden eagle, corresponding to approximately 46% of the total flightlines recorded. There was also a comparatively high record of flight activity of greylag goose (c. 12% of all flights), red kite (c. 10%) and white-tailed eagle (c. 9%). Summarised below are descriptions of flight activity for target species.

9.6.11 A total of 19 greylag goose flights (comprising 1042 birds in total) were recorded overall, primarily during September 2018, and assumed to be birds on passage. Similar numbers of flights were recorded in the western and eastern survey areas (10 and 8 respectively). All of the observations were of birds flying partially within the flight risk area. However, only 15.5% of all of the birds recorded were flying wholly or partially at collision risk height. The majority of the geese flights were within the 'very high' height band (i.e. >250m).

9.6.12 A total of 16 red kite flights were recorded overall (i.e. all records not just those within the FRA) during the survey period, 14 of which were within the summer / early autumn and two during the winter. The majority (12, 75%) of the flights were recorded in the eastern survey area, with activity focused to the north of this area (see Figure 9.8b). A total of 12 of the flight observations were of birds flying partially within the flight risk area. All but two of the flight records were of single birds, with two adults observed together on two occasions (in April and June 2019). A total of 15 (94%) flights were of birds flying wholly or partially at collision risk height.

9.6.13 A total of 14 white-tailed eagle flights were recorded overall, mostly adult birds, during the summer and early autumn months. Similar levels of activity were recorded in the western and eastern survey areas (8 and 6 flights respectively). Six of the flights were within the flight risk area. In the western survey area, flight activity was concentrated towards Carn Easgann Bàna, and between the reservoir, Meall Caca and the bowl to the south of this peak. In the eastern survey area, flight activity was recorded over the peaks / ridges of Carn Fraoich and Creag an Dearg Lochain. A total of 5 (c. 36%) flights were partially or wholly within collision risk height.

9.6.14 A total of 71 flights of golden eagle were recorded overall during the survey of which 25 were recorded as birds with juvenile plumage. During August 2018 to January 2019 a total

of 28 flights were recorded (see Figures 9.5a-9.5b), of which 19 (c. 68%) were in the eastern survey area. A total of 43 flights were recorded during the February to August 2019 period (see Figures 9.6a-9.6b), of which 25 (c. 58%) were in the western survey area. Most records were of single birds. An adult pair and juvenile were recorded on 24 September 2018, circling to the southwest over ridges of Geal Charn to the northeast of the eastern survey area. Across the whole survey period, a total of 54 flights (c. 63%) were of birds flying wholly or partially at collision risk height. Observations within the western survey area recorded juvenile birds flying between the ridges (e.g. to the south of Carn na Cloiche) and troughs (e.g. at A' Chraidhleag). In the eastern survey area, flight activity was mainly concentrated over the higher slopes to the east, over Carn Fraoich, the ridges of Càrn na Crìche and Carn Donnachaidh. One exception was of a juvenile flying partly with an adult bird in the relatively lower ground partially at risk height through the existing Stronelairg wind farm on 5 October 2018.

9.6.15 Three osprey flights were recorded during the survey period, all within the early summer period. Two flight records in the western survey area, at the eastern end of the reservoir, and one in the eastern survey area, flying over the summit of Carn Fraoich. All were of single adult birds, flying partially or wholly at collision risk height.

9.6.16 Golden plover was recorded on nine occasions during the flight activity surveys, three flights during the summer and six during the autumn / late winter. The majority of the flights were recorded in the western survey area. Most flights were of one or two birds, with the exception of a flock of seven birds on 24 September 2018 in the eastern survey area (see Figure 9.7b).

9.6.17 Merlin was recorded on five occasions during the flight activity survey period. All of these observations were of birds in the late summer / autumn period in the western survey area. Four of the flight records were of birds flying partially through the flight risk area, and mainly between the higher summits, with the exception of observations of flights over Meall Caca and around the summit of Sìdhean Dubh na Cloiche Bàine. All flights were of single birds and were of birds flying wholly or partially at collision risk height.

9.6.18 A total of seven peregrine flights were recorded overall during the survey, four records in the winter and three in the summer. Three flights were recorded in the western survey area and four in the eastern survey area. A total of three flights were of birds flying wholly or partially within the flight risk area. All flights were of single birds and five flights were wholly or partially at collision risk height.

Species Accounts

9.6.19 The following sections provide a summary of the international, national and regional status (where data is available) of the species which have been considered in detail as potential receptors for this assessment, along with a summary of the desk study and baseline survey findings. Also included is the assessment of the sensitivity of the Proposed Development site (including appropriate buffer zones) for each receptor based on the available data. For each species, justification for exclusion from further consideration in the assessment, or part of the assessment, is also provided where appropriate.

9.6.20 Certain relatively common species, which are present within the study area and potentially vulnerable to wind farm development (e.g. may have a comparatively high collision risk), have been excluded from detailed consideration in this assessment as their populations (other than at a local level) are not considered to be at any risk of significant

effects from the Proposed Development. This is consistent with current SNH guidance for onshore wind farm EIA studies (SNH 2017). The species excluded from detailed consideration in the assessment include: greylag goose, pink-footed goose, red grouse, mallard, teal, common snipe, common sandpiper, grey heron and common buzzard. Desk study and survey findings related to these species are provided in the technical appendices to this Chapter.

Whooper Swan

National & Regional Status

9.6.21 Whooper swan is a very rare breeding species in the UK (26 pairs, Holling & RBBP 2018[24]) but a relatively common winter migrant. It is listed on Schedule 1 to the WCA and Annex I of the EC Birds Directive and is currently on the UK Amber list due to its rarity as a breeding species and the wintering population being restricted to a small number of sites (Eaton *et al*. 2015).

9.6.22 The UK peak abundance was estimated at 11,000 wintering birds between winter 2004-2005 and winter 2009-2010 (Musgrove *et al*. 2013[25]) of which there were estimated to be a peak of 9,283 present in Scotland. The most recent national census, in 2015, resulted in estimates of 16,100 for the Great Britain (GB) wintering population (Hall *et al*. 2016[26]). The population estimate for the Central Highlands NHZ is 28 birds, ranging from four to 62 (Wilson *et al*. 2015). However, this is likely to be a significant underestimate of the actual population that pass through the region during spring and autumn passage.

Summary of Desk Study Information

9.6.23 Whooper swans were occasionally recorded flying over the development area during the winter flight activity surveys for Stronelairg wind farm. One flightline was recorded across the development area in winter 2010 and seven in winter 2011, only two of which were in the 'at risk' height band. The species was not considered in detail in the Stronelairg Wind Farm impact assessment.

9.6.24 During pre-construction surveys for Stronelairg Wind Farm a single adult whooper swan was seen on three occasions at the western end of the site during winter 2014-2015.

9.6.25 During the construction phase of the Stronelairg Wind Farm the ECoW reported small family groups of whooper swan appearing from late autumn 2016 through to spring 2017. They would use Glendoe reservoir and other smaller waterbodies for a few days before continuing their migration. Of note were comparatively large groups of 22 on Glendoe reservoir in March 2017, during a period of bad weather, and 14 on Lochan na Stairne in early March 2018 (waterbody 2, see Figure 9.2a: Ornithology Survey Areas).

Summary of Baseline Surveys

9.6.26 Small family groups of wintering / passage whooper swan were recorded in three locations within the core survey area during the 2018-2019 survey period. Two adults and one juvenile were seen on Lochan Iain in November 2018 (waterbody 11, see Figure 9.2: Ornithology Survey Areas). A pair of adults were seen on Dearg Lochan (waterbody 15,

[24] Holling, M. & the Rare Breeding Birds Panel (2018). Rare breeding birds in the UK in 2016. British Birds 111: 644 – 694.
[25] Musgrove, A., Aebischer, N., Eaton, M., Hearn, R., Newson, S., Noble, D., Parsons, M., Risely, K., & Stroud, D. (2013). Population estimates of birds in Great Britain and the United Kingdom. British Birds 106, 64 –100.
[26] Hall, C., Crowe, O., McElwaine, G., Einarsson, Ó., Calbrade, N., & Rees, E. C. (2016). Population size and breeding success of Icelandic Whooper Swans Cygnus cygnus: results of the 2015 international census. Wildfowl 66: 75–97.

see Figure 9.2b: Ornithology Survey Areas (Eastern Cluster)) in January 2019 and a pair were on the Glendoe lagoons (waterbody 10, see Figure 9.2a: Ornithology Survey Areas (Western Cluster)) in February 2019. There were three birds, two adults and a juvenile, seen on Dearg Lochan in April 2019. During the April 2019 breeding bird survey, a whooper swan carcass was found in a marshy area to south of Loch na Larige (waterbody 17, see Figure 9.2b: Ornithology Survey Areas (Eastern Cluster)).

9.6.27 This species was not recorded in flight within the survey area during August 2018 to August 2019.

Sensitivity Evaluation

9.6.28 The survey area supports small family groups of wintering / passage whooper swan, which use a range of waterbodies, typically resting for a few days before moving on. Comparatively large groups of whooper swan have also been noted on Glendoe reservoir (up to 22 have been recorded) for short periods, particularly during periods of bad weather. Whooper swans may also pass over the site during migration periods although there was no evidence of this occurring during the 2018-2019 flight activity surveys. The survey area is considered to be important in a local context only for this species. The sensitivity of the western and eastern survey areas for wintering / passage whooper swan is evaluated as Low (Local High). No appreciable effects from the Proposed Development on whooper swan populations at the regional or local level are predicted and therefore there is no further consideration of this species within this assessment.

Common Scoter

National & Regional Status

9.6.29 In Scotland common scoter is a rare breeding bird (approximately 52 pairs, Holling & RBBP 2018) close to the southern edge of its range, which extends across Iceland, eastern Greenland, Fenno-Scandinavia and central Russia. Common scoter is on Schedule 1 to the WCA and is on the UK Red list due to severe breeding population and breeding range declines (Eaton *et al*. 2015).

9.6.30 In the North and West Scottish Highlands common scoter breeding habitat is typically associated with nutrient-poor lochs in areas of open blanket bog, with shallow areas where they can feed on benthic invertebrates and macrophytes. Nest sites are typically in dense vegetation, e.g. heather (*Calluna vulgaris*) or bilberry (*Vaccinium myrtillis*), within 20m of the loch shore. During the winter common scoter is associated with coastal habitats, with concentrations in the Moray and Dornoch Firths, off the Welsh coast and along the North Norfolk coast. The GB wintering population has been estimated at 130,000 birds (Frost *et al.* 2019[27]). There are no regional population estimates available for this species. Analysis of aerial counts of wintering common scoter within the Moray Firth between 2000 and 2007 gave a peak estimate of 5,479 individuals (Lawson *et al.* 2015[28]).

[27] Frost, T., Austin, G.E., Hearn, R.D., McAvoy, S., Robinson, A., Stroud, D.A., Woodward, I., & Wotton, S.R. (2019). Population estimates of wintering waterbirds in Great Britain. British Birds 112: 130-145.

[28] Lawson, J., Kober, K., Win, I., Bingham, C., Buxton, N.E., Mudge, G., Webb, A., Reid, J.B., Black, J., Way, L. & O'Brien, S. (2015). An assessment of numbers of wintering divers, seaduck and grebes in inshore marine areas of Scotland (Revised May 2018). JNCC Report 567.

Summary of Desk Study Information

9.6.31 Glendoe Lochans SSSI is located approximately 2.2km to the west of the Proposed Development. This site also forms part of the Loch Knockie and Nearby Lochs SPA. Common scoter is one of the notified features of the SSSI. These lochans support two to three breeding pairs, which is a nationally important number.

9.6.32 The Stronelairg Wind Farm ES reported that no pairs of common scoter nested within the development area, but up to two pairs were recorded in 2009 nesting in the wider study area (refer to the Confidential Annex for further details). These breeding locations are more than 3km from the Proposed Development.

9.6.33 Post-construction monitoring surveys for the Glendoe Hydroelectric Scheme confirmed successful breeding by a pair of common scoter in 2011 at a location which lies outside of the 2km buffer around the Proposed Development (refer to the Confidential Annex for further details). During detailed breeding productivity surveys of common scoter in 2014, associated with post-construction monitoring for Glendoe Hydroelectric Scheme, two breeding females were present within the Glendoe Lochans SSSI area and two breeding females with young at three other waterbodies nearby (refer to the Confidential Annex for further details). The 2014 season appeared to be an exceptionally productive year for breeding common scoter within this area.

9.6.34 During Spring 2017 the Stronelairg Wind Farm ECoW recorded a pre-breeding group of eight common scoter, four males and four females, on Lochan a Choire Ghlais (waterbody 3, see Figure 9.2a: Ornithological Survey Areas (Western Cluster)) on 2 May 2017. They had moved on by the following morning.

9.6.35 A maximum of five males and five females were seen in one pre-breeding group on Glendoe Reservoir during Spring 2018, but there were also several groupings on different waterbodies for up to two weeks in the Spring. One pair were confirmed to have attempted to breed in the area during 2018 at a loch which is more than 2km from the Proposed Development (refer to the Confidential Annex for further details).

Summary of Baseline Surveys

9.6.36 Previous breeding locations, within the wider area, were surveyed during 2019 but no confirmed breeding attempts by this species were recorded. A pair were seen on Glendoe Reservoir on 9 May and there were two pairs present on 10 May 2019. A single male was on the Reservoir on 13 June 2019 and a pair together on 21 June 2019.

9.6.37 This species was not recorded during any of the flight activity surveys between August 2018 and August 2019.

Sensitivity Evaluation

9.6.38 The Proposed Development is located more than 2km from the nearest regularly occupied breeding sites for common scoter. Glendoe Reservoir appears to be used primarily as a site for foraging and possibly for courtship and mating rather than breeding. The reservoir may be an important food source for females prior to incubation. However, occasional use of the reservoir by adult females with large young, later in the breeding season, has been reported on one occasion (2014). The western survey area, due to its proximity to the Glendoe Lochans SSSI and Glendoe Reservoir is considered to be of Medium sensitivity for this species. The eastern survey area is considered to be of Low (Local High) sensitivity for common scoter.

Black Grouse

National & Regional Status

9.6.39 Black grouse is a native, resident breeding species, associated with areas of upland moorland, often close to native woodland or suitable plantation, at an altitude between 200 to 500m AOD.

9.6.40 The UK population was estimated at 5,100 displaying males in 2005 with the Scottish population estimated at 3,344 males (Sim *et al*. 2008). The 2005 survey resulted in an estimate of 770 (423-1423) displaying males for the North Scotland region. The population estimate for the Central Highlands NHZ is 114 displaying males (Wilson *et al*. 2015).

9.6.41 Black grouse is a species of high conservation concern in the UK due to significant historical and ongoing population declines resulting from a combination of factors including habitat degradation and climate change. It is on the UK Red List of Birds of Conservation Concern (Eaton *et al*. 2015) and the Scottish Biodiversity List (as a former UK BAP Priority Species). The Inverness & Nairn area (as defined in the LBAP) remains an important region for the species in Scotland.

Summary of Desk Study Information

9.6.42 There were no desk study records of black grouse associated with the eastern or western survey areas.

9.6.43 There are several traditional lek sites near to the proposed main site access route (i.e. the existing Glendoe Reservoir and Stronelairg Wind Farm access track) approximately 7km north-west of the Proposed Development.

9.6.44 A black grouse lek near to the proposed main access route (i.e. the existing Glendoe Reservoir and Stronelairg Wind Farm access track) was surveyed in 2017 and 2018 as part of the construction monitoring programme for Stronelairg Wind Farm. In 2017 there was a peak spring count of four males and no females recorded. During 2018 there was a peak spring count of four males and one female (possibly two). There are other traditional lek sites in the wider area (further from the site and proposed access route) that typically attract much larger numbers of displaying males.

Summary of Baseline Surveys

9.6.45 Due to the elevation and poor quality of habitat within the vicinity of the Proposed Development a formal survey for black grouse was not carried out. A single adult male was flushed from a heather bank close to the southern shore of Glendoe Reservoir during breeding bird surveys in April 2019. This location is approximately 1km from the nearest proposed wind turbine. There were no other observations of this species during the baseline survey period.

Sensitivity Evaluation

9.6.46 Habitat quality within the vicinity of the Proposed Development is relatively poor for black grouse due to the high altitude and absence of the mosaic of moorland / woodland fringe habitats that this species typically requires.

9.6.47 Although there may be occasional use of the area by low numbers of black grouse during the summer months, the relatively poor quality of habitats within the vicinity of the

Proposed Development, coupled with the absence of any evidence of breeding activity, indicates that the site is of low importance to the species in a regional context. The western survey area has been conservatively assessed to be of Low (Local Medium) sensitivity for black grouse. The eastern survey area is of Negligible sensitivity.

9.6.48 This species not considered in detail within the impact assessment as it is not at appreciable risk from the construction or operation of the Proposed Development. However, as black grouse are known to be present and to lek near to the main access route this species is considered within the mitigation section of this chapter (and in Technical Appendix 9.4: Outline Bird Protection Plan) to address the risk of disturbance, and collisions by vehicle movements, during the construction and operational phases of the Proposed Development.

Red-throated Diver

National & Regional Status

9.6.49 Red-throated diver is listed on Schedule 1 to the WCA, Annex I of the EC Birds Directive and is currently on the UK Green list (Eaton *et al*. 2015). The UK breeding population is restricted to Scotland, with the majority of the population in the Western seaboard, Western and Northern Isles. From a national survey in 2006 the UK population was estimated as 1,255 pairs (Dillon *et al.* 2009[29]). The Scottish population has been estimated as 1,268 pairs (Wilson *et al*. 2015) with the population present in the Central Highlands NHZ at 6 pairs (1-11, 95% confidence limits).

9.6.50 Breeding red-throated divers are typically associated with small freshwater lochs in open, treeless areas of blanket bog, nesting on well-vegetated promontories or on small islets close to the water's edge. At the end of the breeding season they move to the coast and can form large flocks, on sheltered inshore waters. The GB wintering population has been estimated at 21,000 individuals (Frost *et al*. 2019). Analysis of aerial counts of wintering red-throated diver within the Moray Firth between 2000 and 2007 gave a peak estimate of 366 individuals (Lawson *et al.* 2015[30]).

Summary of Desk Study Information

9.6.51 The Stronelairg Wind Farm ES reported no pairs of red-throated divers breeding within the development area in 2009-2011 or in the 8km wide survey buffer during 2009 and 2010. Red-throated divers were not recorded flying in the development area during flight activity surveys. The species was not considered as a receptor for that assessment.

9.6.52 Post-construction monitoring surveys for the Glendoe Hydroelectric Scheme in in 2011, 2012, and 2014 confirmed successful breeding by one red-throated diver pair at a location which lies outside of the 2km buffer around the Proposed Development (refer to the Confidential Annex for further details). A pair of red-throated divers were also seen fishing on the main Glendoe Reservoir in 2014.

[29] Dillon, I.A., Smith, T.D., Williams, S.J., Haysom, S. & Eaton, M.A. (2009). Status of Red-throated Divers Gavia stellata in Britain in 2006. Bird Study, 56, 147–157.

[30] Lawson, J., Kober, K., Win, I., Bingham, C., Buxton, N.E., Mudge, G., Webb, A., Reid, J.B., Black, J., Way, L. & O'Brien, S. (2015). An assessment of numbers of wintering divers, seaduck and grebes in inshore marine areas of Scotland (Revised May 2018). JNCC Report 567.

9.6.53 During the pre-construction surveys for Stronelairg Wind Farm a single red-throated diver was seen fishing on Glendoe Reservoir on 3 July 2015. No evidence was found of any breeding attempts on waterbodies within the survey area in 2015.

9.6.54 Monitoring by the ECoW during the Stronelairg Wind Farm construction period confirmed attempted breeding by a pair of red-throated divers at a site which is outside of the 2km buffer of the Proposed Development. Breeding was attempted in 2017 but was unsuccessful. A single chick was successfully fledged in 2018 from the same breeding loch.

Summary of Baseline Surveys

9.6.55 There was no evidence of any red-throated diver breeding attempts at any waterbodies within 2km of the Proposed Development during 2019. A pair of red-throated divers were seen on several occasions at a regularly occupied breeding loch just outside of the survey area. There was no evidence of successful breeding at this site during 2019.

9.6.56 An adult red-throated diver was seen loafing and fishing at the southwestern end of Glendoe Reservoir on 16 May 2019.

9.6.57 No red-throated diver observations were made during the August 2018 to August 2019 flight activity surveys.

Sensitivity Evaluation

9.6.58 Although there are several potentially suitable breeding lochs within the survey area there was no evidence of red-throated diver breeding activity at any waterbody within 2km of the Proposed Development during 2019. Previous surveys for the Glendoe Hydroelectric Scheme and Stronelairg Wind Farm provide a detailed history of breeding attempts by this species over the past ten years, covering a large proportion of the Proposed Development survey area. There is one favoured location where breeding has regularly occurred in the wider area (i.e. more than 2km from the Proposed Development) and another location (also more than 2km from the Proposed Development) where breeding attempts have been more sporadic during this period.

9.6.59 The Glendoe Reservoir is used by a small number of red-throated divers, mostly as a loafing and fishing site prior to and following the main breeding period. The rapid fluctuations in water levels within the hydro reservoir makes this artificial waterbody unsuitable as a breeding loch. There is no evidence to suggest the breeding red-throated divers, commuting to feed on larger waterbodies in the surrounding area (e.g. Loch Ness), would pass through the Proposed Development.

9.6.60 The western survey area is considered to be of Medium sensitivity for this species due to the importance of Glendoe Reservoir as an assembly loch for up to two pairs (more than 1% of the Central Highlands NHZ population). The eastern survey area is considered to be of Negligible sensitivity for the species.

<u>Slavonian Grebe</u>

National & Regional Status

9.6.61 Slavonian grebe is a very rare breeding waterbird in the UK with the entire population now restricted to a small number of freshwater lochs in the eastern Highlands and Moray, which are at the southern limit of the species global range. Since the early 1990s the breeding population has been in decline (falling by approximately 60%) and estimated to be 29 pairs (mean 2012-2016, Holling & RBBP 2018).

9.6.62 Slavonian grebes typically breed on shallow, mesotrophic waterbodies with floating, submerged and marginal vegetation (Snow & Perrins 1998[31]). Nests are often located in dense sedge beds on the fringes of the breeding loch. During the winter Slavonian grebes move to sheltered inshore waters, at various locations along the coast of Scotland including the Moray Firth. The GB winter population has been estimated at 920 individuals (Frost *et al*. 2019). A mean peak of 43 individuals were reported for the Moray Firth, based on counts from aerial surveys completed between 2000 and 2007 (Lawson *et al*. 2015).

Summary of Desk Study Information

9.6.63 The few remaining breeding sites of this rare species are generally known and monitored annually. The Glendoe Lochans SSSI, also part of the Loch Knockie and Nearby Lochs SPA, is a regular site for this species and of national importance. Breeding was first reported at this location in 1989 and an annual maximum of three pairs have been present subsequently. This is the highest altitude breeding site for the species in Scotland.

9.6.64 Due to concerns about potential impacts from construction disturbance Slavonian grebe was a focal species for the assessment and monitoring of the Glendoe Hydroelectric Scheme. Baseline surveys in 2002 recorded two pairs within the SPA / SSSI. During the monitoring period for the construction of the scheme (2006-2011), breeding productivity was found to be relatively high, in comparison to the rest of the Scottish population, with between two and three young fledged each year (one to three young per pair). However, surveys in 2014 (final year of post-construction monitoring) recorded only one adult and no evidence of breeding.

9.6.65 The ES for Stronelairg Wind Farm reported that no pairs of Slavonian grebe nested within the development area, but up to two pairs were recorded nesting in the wider study area. The development area was evaluated to be of 'No Importance' and wider study area of 'National Importance' for the species.

9.6.66 During the pre-construction surveys for Stronelairg Wind Farm, visits to the Glendoe Lochans SPA / SSSI recorded a single adult and no evidence of breeding occurring. Monitoring data for the site provided by RSPB Scotland show an individual present in 2016.

9.6.67 Slavonian grebe was not recorded by the ECoW during the main construction period for Stronelairg Wind Farm (2017-2018). The Glendoe Loachns SSSI were far enough from the works that there was considered to be no risk of disturbance at the traditional breeding site.

Summary of Baseline Surveys

9.6.68 The traditional breeding loch is located more than 4 km from the Proposed Development and is monitored annually by RSPB. This location was not included as part of the baseline surveys for this EIA.

9.6.69 Slavonian grebe was not recorded during any of the baseline surveys between August 2018 and August 2019.

[31] Snow, D., & Perrins, C.M. (1998). The Birds of the Western Palearctic. Concise Edition. Oxford University Press.

Sensitivity Evaluation

9.6.70 There is no evidence that the eastern or western survey areas provide any supporting habitat for this species or are likely to be overflown by Slavonian grebe when moving from wintering / pre-breeding sites to the Glendoe Lochans SPA / SSSI. The traditional breeding site is more than 4 km from the Proposed Development.

9.6.71 The western and eastern survey areas are considered to be of Negligible sensitivity for this species. The wider area, i.e. the Glendoe Lochans SPA / SSSI, supports one to two breeding pairs and is of High sensitivity (i.e. National importance).

9.6.72 Slavonian grebe is a species that is particularly vulnerable to disturbance at its breeding sites and the status of the Scottish population is highly precarious. However, even assuming a precautionary approach, there is considered to be no potential for any adverse effects on Slavonian grebe arising from the construction of the Proposed Development. The main access to the Proposed Development site is already constructed and was used for the construction of Glendoe Hydroelectric Scheme and Stronelairg Wind Farm. The use of this route by construction traffic for the Proposed Development would not present any risk of disturbance to the known breeding sites or adjacent lochs used by this species.

9.6.73 Potential operational effects, i.e. collision risk, were considered in detail in the Stronelairg Wind Farm ES, including consultation with SNH and RSPB on this issue. It was recognised that standard VP flight activity surveys would not be effective for determining flight routes for this species. Movements to and from wintering, pre-breeding and breeding sites are likely to occur once at the beginning and end of the breeding season and may be at night. Such activity, given the time of day and low size of the population, would be so infrequent that it would be impossible to monitor through visual means.

9.6.74 Consequently, a desk study approach was adopted for the assessment of collision risk for Stronelairg Wind Farm, which involved reviewing all available records of Slavonian breeding locations in the region. That assessment concluded that flights to and from the current breeding sites and historical sites (i.e. used within the last 30 years) would not place birds at risk of collision with the proposed (at that time) Stronelairg Wind Farm. Consequently, no significant effects from collision risk on Slavonian grebe were reported.

9.6.75 In terms of the factors that were considered at the time of the Stronelairg Wind Warm ES and information that has become available since then, there is considered to be no justification for a different conclusion for this assessment. Whilst potential impacts can never be entirely excluded, it is considered highly unlikely that the Proposed Development would result in any material adverse effect on the species. Given the low number of potential collision risk flights by this species and the location of the proposed wind turbines, the potential exposure to collision risk is considered to be very low.

9.6.76 The potential effects on Slavonian grebe are not considered further and no material effect on the Loch Knockie and Nearby Lochs SPA, in view of that site's conservation objectives, is predicted.

<u>Osprey</u>

National & Regional Status

9.6.77 Osprey is a rare migratory breeding raptor in the UK, listed on Schedule 1 to the WCA and Annex I of the EC Birds Directive. It is on the Amber list of Birds of Conservation Concern

due to historical declines and low population size (Eaton *et al.* 2015). Following near extinction towards the beginning of the 20th century the Scottish population has made a dramatic re-colonisation and recovery. Osprey breeding resumed in England in 2001 following a re-introduction programme.

9.6.78 The UK population is currently estimated at between 218 and 250 pairs. Approximately 200 pairs breed in Scotland, 56 estimated for Highland (Holling & RBBP 2018). Based on 2013 breeding records, the population within the Central Highland NHZ was estimated at eight pairs (4-12, 95% confidence limits, Wilson *et al*. 2015).

Summary of Desk Study Information

9.6.79 There are no records of any osprey breeding sites within or near to the Proposed Development. Osprey are known to breed in the surrounding area (more than 5km from the Proposed Development).

9.6.80 The Glendoe Hydroelectric Scheme ES mentioned osprey as being recorded during baseline surveys (as a non-breeding Annex I species) but that the activity levels suggested that the development area was not critical to the requirements of the species. The creation of the reservoir as foraging habitat was noted a potential benefit to osprey.

9.6.81 No osprey activity was reported in the Stronelairg Wind Farm ES.

9.6.82 During the construction of Stronelairg wind farm the ECoW noted that a foraging osprey was seen occasionally during the 2017 breeding season, around the hydro infrastructure and lochans. It appeared to be coming into the wind farm from the east, although this was unconfirmed. During summer 2018 two foraging birds (assumed males) were seen frequently hunting around the main reservoir and associated lochans. One appeared to be entering the site from the south-east and the other was witnessed several times flying in from the direction of Loch Ness, the north-west.

Summary of Baseline Surveys

9.6.83 An adult osprey was recorded during a flight activity survey from VP2a (western survey area) on 29 May 2019, fishing at the eastern edge of the main reservoir. An adult osprey was seen the following day, from VP1 (western survey area), hunting for fish over the reservoir and also mobbing a passing white-tailed eagle. On 27 June 2019 an adult osprey was recorded briefly from VP5a (eastern survey area), alarm calling and mobbing a white-tailed eagle that was on the ground.

Sensitivity Evaluation

9.6.84 The main reservoir, within the western survey area, is used occasionally as a hunting site by osprey that may be breeding in the surrounding area. There are also occasional flights by osprey passing through the western and eastern survey areas.

9.6.85 The western and eastern survey areas are considered to be of Low (Local High) sensitivity for osprey.

Golden Eagle

National & Regional Status

9.6.86 Golden eagle is a scarce, resident breeding raptor, listed on Annex I of the EC Birds Directive and currently on the UK Green list of Birds of Conservation Concern (Eaton *et*

al. 2015). Breeding pairs of golden eagle are resident year-round within their home ranges. However, before successfully settling within a breeding territory young eagles can range widely across suitable upland habitats, sometimes moving several hundred kilometres from their natal area, and can appear at any time of year.

9.6.87 The UK breeding population is currently restricted to Scotland. Successful breeding last occurred in England in 2001. Based on the results of a national survey completed in 2015, the Scottish population was estimated at 508 pairs (Hayhow *et al*. 2017[32]). Although the breeding population has experienced increases in recent years, in regions such as the Western Isles and the west Highlands, this masks long-term declines and failure to reoccupy former breeding territories in other regions such as the central and eastern Highlands. The primary reason for this is the impact of illegal persecution of golden eagles (Whitfield *et al*. 2008[33]).

9.6.88 Based on the results of the 2003 national golden eagle survey the Central Highlands NHZ population was estimated at 12 breeding pairs (Walker *et al*. 2015). The 2008 Conservation Framework for Golden Eagles determined that the Central Highlands NHZ population was in 'unfavourable' condition due to the comparatively high proportion of unoccupied territories (i.e. falling below the 66% occupation threshold, Whitfield *et al*. 2008[33]). The factors adversely affecting the population were considered to be mortality from human persecution, the primary concern, as well as the long-term effects of over-grazing and trampling by red deer (*Cervus elaphus*) and sheep on habitat quality for important prey populations during the golden eagle breeding season.

9.6.89 However, since 2003 many of these unoccupied territories have been successfully recolonised by breeding pairs, including two located near to the Proposed Development. The NHZ population has more recently been estimated at 21 pairs (based on HRSG data from 2018) and the number of available ranges within the NHZ has increased to 28. Consequently, the conservation status of the NHZ 10 population is currently considered to be Favourable.

9.6.90 SSE funded the development of a Regional Eagle Conservation Management Plan (RECMP[34]) for the NHZ 10 area as part of the Nature Conservation Management Plan for Dunmaglass Wind Farm (also located within the Monadhliath). The RECMP is a 25-year plan that includes objectives to monitor breeding golden eagles in the NHZ 10, determine the key factors influencing the conservation status of the population and to implement measures (e.g. improving habitats and prey availability) to increase breeding productivity and the size of the population. The benefits of the RECMP should accrue over time and help to ensure that the conservation status of the NHZ 10 population continues to improve.

Summary of Desk Study Information

9.6.91 Annual surveys for golden eagle at three breeding territories were completed as part of the pre-construction, construction and post-construction monitoring for the Glendoe Hydroelectric Scheme. One of the breeding territories closest to the project was a particular focus of the surveys. Following a couple of years of breeding failure, the pair

[32] Hayhow, D. B., Benn, S., Stevenson, A., Stirling-Aird, P. K., & Eaton, M. A. (2017). Status of Golden Eagle Aquila chrysaetos in Britain in 2015. Bird Study 64: 281–294.
[33] 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).
[34] Haworth, P. (2014). The Dunmaglass Wind Farm Regional Eagle Conservation Management Plan. Report by Haworth Conservation Ltd.

occupying this territory in 2014 successfully raised two chicks to fledging (the last year of post-construction monitoring). Further details are provided in the Confidential Annex.

9.6.92 The Stronelairg Wind Farm ES reported that no golden eagles nested within the development area, but that they did nest within the 6km wider study area in 2009-2011. Golden eagles were occasionally recorded in the development area during the flight activity surveys, most regularly in the northwest.

9.6.93 Golden eagles were frequently observed during the first year of construction for Stronelairg Wind Farm. The ECoW reported seeing adult golden eagles regularly around the upper access track and various juveniles and surrounding resident adults fairly regularly hunting on the wind farm site and its margins. However, there were less sightings of golden eagle within the site in 2018 as more turbines were built and became operational.

9.6.94 Prior to the start of the baseline surveys it was agreed, in consultation with HRSG, that information from approximately the past ten years on territory occupancy, breeding attempts and breeding success by golden eagles present within approximately 6km of the Proposed Development would be provided. A summary of information on occupancy and breeding success for each territory is provided in Table 9.11 below. Further details are provided in the Confidential Annex.

Table 9.11: Summary information on the golden eagle breeding territories present in the wider study area, for the five-year period 2015-2019 (source: Stuart Benn, HRSG).

Territory	2015	2016	2017	2018	2019
EA1	Adult pair. No active nest found, thought to have failed early or not laid.	Fledged one young.	Adult pair - no active nest found, thought to have failed early or not laid.	Fledged two young.	No evidence of nesting. Suspected that pair did not lay.
EA2	Adult pair. No active nest found, thought to have failed early or not laid.	Fledged two young.	Fledged one young.	Adult pair. No active nest found, thought to have failed early or not laid.	One chick fledged.
EA3	Fledged two young.	Adult pair. No active nest found, thought to have failed early or not laid.	Fledged one young.	Laid two eggs but deserted.	Two chicks, one chick fledged and One taken for South Scotland Golden Eagle Project.
EA4	Fledged two young.	Fledged one young.	Fledged one young.	Fledged one young.	Failed on eggs.
EA5	Sub-adult pair didn't nest.	Adult / sub-adult pair. Nest not found.	Birds not seen but nest with undersized egg. Failed.	Two young in nest.	No evidence of nesting. Suspected that pair did not lay.

9.6.95 The territory centres are the following approximate distances from the nearest proposed wind turbines EA1 3.3km; EA2 2.0km; EA3 5.3km; EA4 4.0km; and EA5 6.7km.

9.6.96 As can been seen from the information in Table 9.11, most of these territories have shown a high level of occupancy during the past five years. The five-year mean

productivity (fledged young per occupied territory per year) for these territories is EA1 0.6; EA2 0.8; EA3 1.0; EA4 1.0 and EA5 0.4. Mean productivity for the golden eagle population in Scotland as a whole has been estimated at 0.46 young per occupied territory per year (Whitfield *et al*. 2008[33]).

9.6.97 EA1 is a long-established territory that has been occupied almost continuously since at least 2006. Between 2009 and 2014 the resident breeding pair were more successful than in the 5 years from 2015 to 2019, fledging 5 young in total (an annual productivity rate of 0.83). EA2 is an old territory which appeared to be abandoned in the early 2000s and probably recolonised in 2010 or very shortly before then. EA3 was recolonised in 2010 after having been vacant since the 1970's. EA4 is a long-established territory. EA5 is an old territory which appeared to be abandoned in the early 2000s, this territory was also probably recolonised in 2010 or very shortly before.

9.6.98 The western survey area overlaps partially with three golden eagle breeding territories (i.e. as defined by nominal home ranges of 6km radius from the territory centres). These territories are referred to in this Chapter as EA1, EA2 and EA3. The nominal home range of a fourth breeding territory (EA5) is just outside of the location of the western cluster. The western cluster is closest to territories EA1 and EA2, the potential effects arising from range loss and disturbance on these territories has been a key focus for this assessment.

9.6.99 The eastern cluster overlaps with the nominal home range of two golden eagle breeding territories (EA3 and EA4). The eastern cluster is located in a peripheral area relative to these territories.

Summary of Baseline Surveys

9.6.100 As mentioned above, there are four golden eagle pairs (as of 2019) occupying breeding territories that overlap with the Proposed Development. The favoured nesting locations associated with these territories are all more than 2km from the nearest proposed wind turbine. The western and eastern survey areas are located within an area of comparatively lower value habitat for golden eagle. There appears to be abundant suitable prey available within both the western and eastern survey areas (e.g. populations of mountain hare, red grouse and red deer). However, the existing Stronelairg Wind Farm and the Proposed Development are situated in a high elevation, relatively open and gently undulating plateau, which is topographically unfavourable for golden eagle due to the lack of suitable slopes to aid efficient hunting.

9.6.101 Golden eagle was one of the most frequently recorded target species during the flight activity surveys. Flight activity was primarily associated with the few prominent ridges and slopes on the fringes of the eastern and western survey areas, with activity generally much lower during the winter months.

Sensitivity Evaluation

9.6.102 The western core survey area includes habitats that support two pairs of breeding golden eagle, which is a regionally significant number (i.e. in the context of the Central Highlands NHZ). This area is considered to be of Medium sensitivity for golden eagle. The eastern core survey area also includes habitats that support two pairs of breeding golden eagles, this area is also considered to be of Medium sensitivity.

Hen Harrier

National & Regional Status

9.6.103 Hen harrier is a widespread but scarce breeding species in the Scottish uplands, a partial migrant and winter visitor. It is listed on Schedule 1 to the WCA, and on Annex I of the EC Birds Directive. It is also on the Red List of UK Birds of Conservation Concern (Eaton *et al*. 2015), due to historical and ongoing population declines resulting primarily from the effects of human persecution.

9.6.104 The most recent national survey, in 2016, recorded 575 territorial pairs for the UK and Isle of Man (Wotton *et al*. 2016). The latest breeding population estimate, from 2011, for the Central Highlands NHZ is 18 (15-20, 95% confidence limits), and the total Scottish population (total of NHZ) is 501 pairs (Wilson *et al.* 2015). The latest estimate of Wintering hen harriers in Scotland is approximately 1,534-1,832 (Dobson *et al*. 2012).

Summary of Desk Study Information

9.6.105 The Stronelairg Wind Farm ES reported that no pairs of hen harriers were recorded nesting within the study area in 2009-2011. Hen harriers were seldom seen from VPs and were only recorded flying across the development area twice in 2009-2012. Hen harrier was not treated as a receptor in the assessment of that project.

9.6.106 A single female hen Harrier was seen hunting across the western end of the site in winter 2014 during the pre-construction surveys for Stronelairg Wind Farm.

9.6.107 The Stronelairg Wind Farm ECoW recorded a ringtail hen harrier in autumn 2016 passing through the area. No hen harriers were seen during the whole of 2017. An adult male was seen on one occasion passing through the site in May 2018.

Summary of Baseline Surveys

9.6.108 There was no evidence of the presence of breeding hen harrier in the raptor survey area during 2019. There were no observations of this species during any of the baseline surveys.

Sensitivity Evaluation

9.6.109 There is no evidence to indicate that either the western or eastern survey areas provide important supporting habitat for hen harrier during the breeding season or at other times of year. The western and eastern survey areas are considered to be of Negligible sensitivity for this species. No appreciable effects from the Proposed Development on hen harrier populations at the regional or local level are predicted, consequently there is no further consideration of this species within this assessment.

Red Kite

National & Regional Status

9.6.110 The red kite is a resident breeding species in Scotland, following a successful re-introduction programme (it was made extinct as a Scottish breeding bird in the late nineteenth century) carried out between 1989 and 2009 at four sites in Scotland, including the Black Isle (in Ross-shire). The red kite is listed on Schedule 1 to the WCA and Annex I of the EC Birds Directive. It is now on the UK Green list (Eaton *et al*. 2015) due to the recovery of the national population, although there remain concerns about high

mortality rates, primarily caused by human persecution / poisoning, slowing the speed of expansion from some of the re-introduced areas, particularly the Black Isle (Smart et al. 2010[35]) despite a relatively high nesting success rate (Sansom *et al*. 2016[36]).

9.6.111 Sansom *et al.* (2016) reported a population of 266 pairs for Scotland in 2014 of which 64 were breeding in North Scotland. During January 2019 a Europe-wide red kite winter roost count was completed. Scottish Raptor Study Group volunteers counted all known winter roost sites, with a total of 940 red kites recorded across 29 roost sites (Scottish Raptor, May 2019).

9.6.112 No red kites were assigned to the Central Highlands NHZ area in the analysis carried out by Walker *et al.* (2015).

Summary of Desk Study Information

9.6.113 Red kite was not mentioned in the Stronelairg Wind Farm ES.

9.6.114 Red kite was not recorded during the 2015 pre-construction surveys for Stronelairg Wind Farm.

9.6.115 During the construction period for Stronelairg Wind Farm the ECoW noted the regular presence of one to two adults, mainly in the south and south-east of the wind farm area during 2017 and 2018.

Summary of Baseline Surveys

9.6.116 Red kite was recorded fairly frequently during the spring and summer periods, mostly hunting within and near to the eastern survey area. After golden eagle, red kite was the most frequently recorded target raptor species during the flight activity surveys.

9.6.117 There was no evidence to indicate that this species bred within the raptor survey area during 2018.

Conclusions & Sensitivity Evaluation

9.6.118 The nearest known core breeding areas are some distance away from the Proposed Development, although regular monitoring of this population ceased in 2016. It is assumed that the activity recorded during 2018 was associated with non-breeding birds but potential breeding occurring at a suitable location at lower elevation in the wider area cannot be excluded. The western survey area is considered to be of Negligible sensitivity for red kite and the eastern survey area is of Low (Local High) sensitivity.

White-tailed Eagle

National & Regional Status

9.6.119 White-tailed eagle is a rare breeding raptor, which is currently expanding its breeding range in Scotland after successful re-introductions, following extinction in the early 20th Century, initially centred on Mull and more recently on the east coast. White-tailed eagle is listed on Schedule 1, 1A and A1 to the WCA and Annex I of the EC Birds Directive. It is

[35] Smart, J., Amar, A., Sim, I. M. W., Etheridge, B., Cameron, D., Christie, G. & Wilson, J. D. (2010). Illegal killing slows population recovery of a re-introduced raptor of high conservation concern - The red kite Milvus milvus. Biological Conservation, 143, 1278-1286.
[36] Sansom, A., Etheridge, B., Smart, J. & Roos, S. (2016). Population modelling of North Scotland red kites in relation to the cumulative impacts of wildlife crime and wind farm mortality. Scottish Natural Heritage Commissioned Report No. 904.

on the UK Red list of birds of Conservation Concern due to historical population declines (Eaton *et al*. 2015).

9.6.120 The UK population is restricted to Scotland (efforts to establish a breeding population in southern England are ongoing) and most recently estimated at 102 pairs (Holling & RBBP 2018). The species has expanded its range from the west coast and Outer Hebrides to the Central Highlands, with a pair breeding successfully in Badenoch & Strathspey in 2016. The Scottish population includes a large number of immature birds that range well outside of the current distribution of the breeding population (Whitfield *et al*. 2009[37]).

9.6.121 No breeding white-tailed eagles were assigned to the Central Highlands NHZ area in the analysis carried out by Walker *et al.* (2015). However, it was recognised that as the population is currently expanding that situation could change in the short-term.

9.6.122 There is at least one recently established white-tailed eagle breeding pair present in the wider surrounding area (i.e. outside of the western and eastern raptor survey areas).

Summary of Desk Study Information

9.6.123 During the pre-construction surveys for Stronelairg Wind Farm a white-tailed Eagle was recorded once on site, as an incidental sighting during October 2014.

9.6.124 White-tailed eagle was observed regularly (at least three different individuals: an adult male, adult female and older juvenile) by the ECoW within the Stronelairg Wind Farm construction area during 2017 and the area of the upper access track. During 2018 there were at least 4 different individuals present on the wind farm area and upper access track area: an adult male, adult female and two different sub-adults.

Summary of Baseline Surveys

9.6.125 White-tailed eagle was recorded occasionally in flight and hunting within or near to the western and eastern survey areas during the spring and summer months. There was no evidence of any breeding behaviour by this species within the raptor survey area during 2018.

Conclusions & Sensitivity Evaluation

9.6.126 The general area appears to be used occasionally by hunting adult and immature white-tailed eagles, also as a movement route when crossing between the various main glens that radiate down from the central plateau that Stronelairg Wind Farm and the western and eastern survey areas located on. There is no evidence to indicate that either of these areas provide important supporting habitat for any breeding white-tailed eagles that may be present in the wider area, however some use by breeding pairs cannot be ruled out given the current breeding range expansion of the species into the Central Highlands. The eastern and western areas are considered to be of Low (Local High) sensitivity for this species.

[37] Whitfield, D.P., Douse, A., Evans, R.J., Grant, J., Love. J., McLeod, D.R.A, Reid, R. & Wilson, J.D. (2009). Natal and breeding dispersal in a reintroduced population of White-tailed Eagles Haliaeetus albicilla. Bird Study, 56, 177–186

Golden Plover

National & Regional Status

9.6.127 Golden plover is relatively common wintering and migrant wader throughout much of the UK lowlands. In Scotland it is widespread as a breeding upland wader present in the Northern Isles, Western isles, north-west mainland and southern Scotland. Golden plover is listed on Annex I of the EC Birds Directive and currently on the UK Green list (Eaton *et al.* 2015).

9.6.128 The Scottish breeding population has been estimated at 37,480 pairs and the population estimate for the Central Highlands NHZ, based on an analysis of 2009 breeding distribution data, is 2,702 pairs (Wilson *et al*. 2015). The GB population size for wintering golden plover is 400,000 birds (Gillings & Fuller 2009[38]). The latest Scottish wintering population estimate for golden plover is approximately 25,000-35,000 birds (Humphreys *et al*. 2015).

Summary of Desk Study Information

9.6.129 The Stronelairg Wind Farm ES reported approximately 34-41 pairs of golden plover breeding in the wider study area, of which 14-15 territories were recorded within the development area. Golden plover were rarely recorded during the baseline flight activity surveys for the Stronelairg Wind Farm EIA. There was some evidence of limited late winter use of the area by early returning birds. During the 2015 pre-construction surveys for Stronelairg wind farm a total of 26 golden plover breeding territories were recorded within that survey area.

Summary of Baseline Surveys

9.6.130 Golden plover was the most frequently recorded species during the breeding moorland wader survey in 2019, with 20 apparent breeding territories recorded in the western core survey area and 12 within the eastern survey area. Of these a total of 19 territories were located within 500m of the nearest proposed wind turbines, 14 associated with the western cluster and 5 for the eastern cluster. This species was also recorded relatively frequently during the flight activity survey of the western area. There was some evidence of the presence of occasional small flocks during the post-breeding / passage period, however there was no evidence of regular use of the survey area (e.g. for roosting or foraging) and these were likely to be birds passing through the region.

Sensitivity Evaluation

9.6.131 The western cluster (including a 500m wide buffer zone around the proposed wind turbines) supports an assumed population of 14 pairs, this equates to 0.5% of the NHZ population estimate (Walker *et al*. 2015). The eastern cluster (including the 500m buffer zone) supports 5 territories, which is 0.2% of the NHZ population. The combined total for the number of breeding territories within the two areas is therefore less than 1% of the assumed NHZ population. Both the eastern and western areas are considered to be of Low (Local High) sensitivity for the species.

[38] Gillings, S. & Fuller, R.J. (2009). How many Eurasian Golden Plovers Pluvialis apricaria and Northern Lapwings Vanellus vanellus winter in Great Britain? Results from a large-scale survey in 2006/07. Wader Study Group Bulletin 116: 21-28.

Dotterel

National & Regional Status

9.6.132 Dotterel is a scarce breeding and migrant wader in Scotland, and breeding in the Central Highlands is associated with montane alpine habitats above approximately 700m AOD. Dotterel is listed on Schedule 1 to the WCA, Annex I of the EC Birds Directive and is on the UK Red list of Birds of Conservation Concern due to recent breeding population and range declines (Eaton *et al.* 2015). The breeding range includes the east / central and north-west Highlands although the majority of the population is now restricted to the East Highlands. In 2011, the number of Dotterel in the UK was estimated to be 423 breeding males (279–644, 95% confidence limits), a decline of 57% since 1987/88 and 43% since 1999 (Holling & RBBP 2018).

9.6.133 NHZ population estimates are unavailable for this species.

Summary of Desk Study Information

9.6.134 Dotterel was not mentioned in the ornithological baseline descriptions for the Glendoe Hydroelectric or Stronelairg Wind Farm ESs.

9.6.135 The pre-construction surveys for Stronelairg Wind Farm recorded dotterel on suitable breeding habitat to the south of the site in 2015, but this was assumed to be birds temporarily displaced by heavy snowfall from their breeding grounds on Creag Meagaidh National Nature Reserve and not treated as a breeding record.

9.6.136 During the construction period for Stronelairg Wind Farm the ECoW noted the presence of a single dotterel on the wind farm site in late September 2018, for less than one day.

Summary of Baseline Surveys

9.6.137 Dotterel were not recorded during any of the baseline surveys for the Proposed Development completed between August 2018 and August 2019.

Sensitivity Evaluation

9.6.138 Due to the absence of records of any breeding records for the species within the study area, and as the Proposed Development is located in unsuitable breeding habitat below the typical altitude where this species breeds in this part of the Monadhliath, the western and eastern survey areas are considered to be of Negligible sensitivity for this species. No appreciable effects on dotterel populations at the regional or local level are predicted and therefore there is no further consideration of this species within this assessment.

Dunlin

National & Regional Status

9.6.139 Dunlin is a small breeding and migrant wader. Breeding in Scotland is primarily associated with machair and blanket bog habitats in the Central Highlands, north-west Mainland, Western and Northern Isles. There are three races of dunlin in the UK, race *schinzii* breed here and winter in West Africa and this race is listed on Annex I of the EC Birds Directive. Race *alpina* birds breed in western Siberia and winter around the UK coast. Some of the Greenland race (*arctica*) also pass through in the UK during autumn migration.

9.6.140 The dunlin is on the UK Amber list of Birds of Conservation Concern (Eaton *et al*. 2015) due to severe declines in the wintering population and the restricted range of the UK breeding population (*schinzii*) and the importance of the UK wintering population (*alpina*).

9.6.141 The UK breeding population was estimated at 8,600–10,600 pairs by Musgrove *et al*. (2013). The Scottish breeding population has been estimated at 13,313 pairs (Wilson *et al*. 2015) but this is based on a wide range 5,904–28,939 (95% confidence limits). The NHZ 10 population was estimated by Wilson *et al*. (2015) to be 105 (range 33-266) pairs, which was considered likely to be in unfavourable conservation status due to declines in the national population.

Summary of Desk Study Information

9.6.142 The Stronelairg Wind Farm ES reported 16 dunlin territories present in the wider study area in 2009 and 2010, of which 9 were located within the development area in 2009 and 11 in 2010. Dunlin were very rarely recorded flying across the development area during the flight activity surveys. During the 2015 pre-construction surveys for Stronelairg wind farm a total of 24 dunlin breeding territories were recorded within that survey area.

9.6.143 Within the survey area for the Glendoe Hydroelectric Scheme a total of five dunlin territories were recorded in 2014, the highest number across all survey years (i.e. 2007-2009, 2011 & 2014).

Summary of Baseline Surveys

9.6.144 During the 2019 breeding wader surveys 16 apparent dunlin breeding territories were recorded in the western survey area and 6 in the eastern survey area. Of these, a total of 13 dunlin territories were located within 500m of the nearest proposed wind turbines, 11 in the western area and two in the eastern area. Dunlin was not recorded during the flight activity surveys.

Sensitivity Evaluation

9.6.145 The western area (cluster and 500m wide buffer zone), assuming a population of 11 pairs, equates to 10.5% of the NHZ population (Walker *et al*. 2015). The eastern area (cluster and 500m wide buffer zone), supports 1.9% of the NHZ population. The combined total breeding territories across the western and eastern areas is therefore more than 10% of the assumed NHZ population. Both the western and eastern areas are considered to be of Medium sensitivity for the species.

Greenshank

National & Regional Status

9.6.146 Greenshank is a scarce breeding wader in the UK with its range restricted to the north-western Scottish Highlands the Western Isles and Shetland. It breeds on remote open, treeless moorland and in Scotland is at the westernmost limit of its large range, which extends from Fennoscandia across Russia to Kamchatka (Hancock *et al*. 1997[39]). The greenshank is listed on Schedule 1 to the WCA and is currently on the UK Amber list of

[39] Hancock, M. H., Gibbons, D. W., & Thompson, P. S. (1997). The status of breeding Greenshank (Tringa nebularia) in the United Kingdom in 1995. Bird Study 44: 290–302.

Birds of Conservation Concern due in part to breeding population and breeding range declines (Eaton *et al.* 2015).

9.6.147 The UK breeding population has been estimated at 1,080 pairs (Holling & RBBP 2018). The Scottish breeding population was estimated by Wilson *et al*. (2015) at 1,297 pairs (851-1,792, 95% confidence limits), although this was considered to be a possible underestimate. The Central Highlands NHZ population was estimated at 10 pairs (3-17 range), this is also likely to be an underestimate of the true population size.

Summary of Desk Study Information

9.6.148 Greenshank was not noted as a breeding species within the survey area for the Stronelairg Wind Farm EIA.

9.6.149 Four breeding greenshank territories, associated with the Glendoe Lochans SSSI area, were recorded as part of the 2014 post-construction monitoring surveys for Glendoe Hydroelectric Scheme. A probable breeding territory to the north of the reservoir (previously the location of Loch Seileach) was also reported, although breeding was not confirmed (see the Confidential Annex for further details).

9.6.150 Greenshank was recorded in one location during the 2015 pre-construction breeding bird surveys for Stronelairg Wind Farm, c. 500m from the Proposed Development (see the Confidential Annex).

9.6.151 As part of the Glenshero Wind Farm 2013 baseline surveys, greenshank breeding registrations were recorded at three locations (four observations) in the eastern survey area (all are > 500m from the Proposed Development). During surveys completed in 2017 there were two locations (three observations) where breeding behaviour was recorded in the western survey area, all of which are > 500m from the Proposed Development. There was one location (3 observations) of breeding greenshank within the eastern survey area in 2017, also > 500m from the Proposed Development (further details are provided in the Confidential Annex).

9.6.152 During pre-works surveys for nesting birds, carried out by the Stronelairg Wind Farm ECoW, greenshank was confirmed to have bred in 2017 and 2018. Well-grown chicks were seen at three locations in 2018, one of which was within the western survey area (further details are provided in the Confidential Annex).

Summary of Baseline Surveys

9.6.153 During the 2019 surveys there was one confirmed greenshank mating territory recorded in May within the western core survey area and a second just outside of the core survey area and one adult bird was noted calling in the same general area in early July (see the Confidential Annex for further details). Greenshank may nest several kilometres away from their mating and feeding territories. There was no evidence of nesting within the survey area in 2019 or of the presence of any broods (including at locations within the western survey area where chicks had been observed during the Stronelairg Wind Farm works during 2018).

Conclusions & Sensitivity Evaluation

9.6.154 The western survey area supports at least one, and possibly two, breeding pairs, including confirmed courtship / mating areas, possible nesting and brood-rearing areas. There is evidence from previous surveys within and near to the eastern survey are that this

location also supports breeding greenshank in some years, at least one pair. The western and eastern areas are considered to be of Medium sensitivity for this species (i.e. supporting a population of regional importance).

Merlin

National & Regional Status

9.6.155 Merlin is a small falcon that breeds across the Scottish uplands, particularly associated with heather moorland habitats moving to suitable lower lying-areas during the winter. It is listed on Schedule 1 to the WCA and Annex I of the EC Birds Directive. The merlin is currently on the UK Red list of Birds of Conservation Concern due in part to historical and recent breeding population declines (Eaton *et al.* 2015).

9.6.156 The 2008 national survey resulted in an estimated breeding population for GB of approximately 1,159 pairs with the Scottish population estimated at 733 pairs (Ewing *et al*. 2011[40]). However, there was some doubt cast over the accuracy of these figures. Walker *et al.* (2015) did not use the national survey results in their estimates of the NHZ populations. They used merlin counts from NHZs where this species was intensively studied and a high proportion of merlin pairs were likely to have been found, arriving at an estimate of 434 pairs for Scotland. The Central Highlands NHZ was estimated to hold 13 pairs (ranging from 7-21).

Summary of Desk Study Information

9.6.157 The Glendoe Hydroelectric Scheme monitoring reported one merlin breeding territory which is approximately 4.5km from the western cluster.

9.6.158 The Stronelairg Wind Farm ES reported that no pairs of merlin were recorded nesting within the development area or the 2km buffer in 2009-2011. Merlin was recorded from VPs flying across the development area very occasionally during three years of flight activity surveys.

9.6.159 The Stronelairg Wind Farm ECoW reported that merlin were only very occasionally seen within the wind farm site but more regularly on the lower to mid-level main access track where breeding near-by was suspected but unconfirmed.

Summary of Baseline Surveys

9.6.160 There was no evidence of breeding activity by merlin occurring within the raptor survey area during 2019.

9.6.161 Several flights by adult merlin (male and female) were observed in the western survey area during late summer and early autumn 2018. All appears to be birds passing through the area rather than hunting.

Conclusions & Sensitivity Evaluation

9.6.162 There is no evidence to indicate that either the western or eastern survey areas provide important supporting habitat for any pairs of breeding merlin. This species was not recorded in the eastern survey area and this area is considered to be of Negligible sensitivity for the species. There are occasional, non-breeding, records associated with

[40] Ewing, S. R., Rebecca, G. W., Heavisides, A., Court, I. R., Lindley, P., Ruddock, M., Cohen, S., & Eaton, M. A. (2011). Breeding status of the Merlin Falco columbarius in the UK in 2008. Bird Study 58: 379–389.

parts of the western survey area and this area is considered to be of Low (Local High) sensitivity for merlin.

Peregrine

National & Regional Status

9.6.163 Peregrine is listed on Schedule 1 to the WCA, and it is currently on the UK Green List, having been moved from the Amber List following recent status reviews (Eaton *et al.* 2009 and Eaton *et al*. 2015).

9.6.164 The UK peregrine population was the subject of national surveys in 2002 and 2014. The population in the in the UK, Isle of Man and Channel Islands was estimated at 1769 pairs in 2014, a 22% increase on the 2002 estimate (Wilson *et al*. 2018[41]). However, most of this increase was associated with populations in lowland England, with some upland populations declining during that period. The Scottish breeding population was estimated at 523 occupied territories which was a decrease on the 2002 estimate. The decrease in the population estimates for Scotland between 2002 and 2014 appears to be largely due to losses from upland and inland sites. Based on the 2014 national survey data the NHZs populations have been estimated (Wilson *et al*. 2015). The most recent estimated number of breeding pairs was seven (3-14 range) for the Central Highlands NHZ.

Summary of Desk Study Information

9.6.165 The Stronelairg Wind Farm ES reported that there were no pairs of peregrine recorded nesting within the study area in 2009-2011. Peregrine was seldom seen from VPs and were only occasionally recorded flying across the development area, with on average less than six flightlines a year.

9.6.166 A pair were seen mating in March 2015, during the pre-construction breeding bird surveys for Stronelairg Wind Farm, at a location that is approximately 5km from the western cluster. There is also a known peregrine breeding territory located outside of the western raptor survey area.

9.6.167 During the construction phase of Stronelairg Wind Farm the ECoW reported that a male peregrine was regularly seen hunting around the wind farm site during the summer. There were adult females seen in the autumn and early winter 2017. During 2018 male(s) and female(s) were regularly seen hunting around the wind farm site and passing through. In the summer, there were thought to be two breeding pairs in wider surrounding area, well outside of the wind farm site.

Summary of Baseline Surveys

9.6.168 There was no evidence of the presence of peregrine breeding within the raptor survey area during 2019. Peregrine were occasionally recorded during flight activity surveys in autumn 2018 and spring / summer 2019. There was a total of three flights within the survey area (one west, two east).

[41] Wilson, M. W., Balmer, D. E. Jones, K., King, V. A., Raw, D., Rollie, C. J., Rooney, E., Ruddock, M., Smith, G. D., Stevenson, A., Stirling-Aird, P. K., Wernham, C. V. Weston, J. M. & Noble, D. G. (2018). The breeding population of Peregrine Falcon Falco peregrinus in the United Kingdom, Isle of Man and Channel Islands in 2014. Bird Study 65: 1–19.

Conclusions & Sensitivity Evaluation

9.6.169 The western and eastern survey areas do not appear to provide important supporting habitat for peregrine breeding in the surrounding area (estimated at two territories). However, the area is occasionally visited by hunting adults during the breeding season. The western and eastern survey areas are both considered to be of Low (Local High) sensitivity for this species.

Other Species of Note

9.6.170 Ptarmigan (*Lagopus muta*) breed within the montane heath and grassland areas on the elevated ridges to the east of the eastern cluster.

9.6.171 The Stronelairg Wind Farm ECoW reported a single adult black-throated diver (*Gavia arctica*) loafing and feeding on the west end of Glendoe Reservoir on 28 April 2017.

9.6.172 A short-eared owl (*Asio flammeus*) was seen in April 2017 and also hunting on the eastern side of the wind farm site, over a three-week period, in early autumn 2017.

9.6.173 Ring ouzel (*Turdus torquatus*, a UK Red listed species (Eaton *et al*. 2015) was recorded breeding (several territories) near to the main access track (well to the west of the western survey area for the Proposed Development) during monitoring of the area in 2017-2018 by the ECoW for Stronelairg Wind Farm.

9.6.174 Large flocks of thrushes were recorded by the Stronelairg Wind Farm ECoW in late autumn 2017 generally travelling from east to west. There were two days in early November, in particular, where thousands to tens of thousands passed through the upper access track and west end of the wind farm site. These mixed flocks were largely fieldfare (*Turdus pilarus*) but there were also occasional redwing (*Turdus iliacus*) and mistle thrush (*Turdus viscivorus*).

9.6.175 Small parties of Snow bunting (*Plectrophenax nivalis*) were seen occasionally around the upper access track and the wind farm site in the winter of 2016 / 2017 and late in 2017.

Summary of Receptor Sensitivity Evaluations

9.6.176 The sensitivity of the populations of key bird species supported by study area has been systematically evaluated based on information drawn from desk study and field surveys. The sensitivity values for the various receptors ranges from 'Medium' (i.e. population / feature important Regional-scale) to 'Low' (i.e. population / feature important at a Local-scale). Table 9.12 provides a summary of the sensitivity assessment for all ornithological receptors. The features / species highlighted in bold are considered as key sensitive receptors for the assessment.

Table 9.12: Sensitivity of the Evaluated Ornithological Receptors

Receptor	Western Area*	Eastern Area*	Whole Area*
Monadhliath SSSI	**n/a**	**High**	**High**
Whooper swan	Low (LH)	Low (LH)	Low (LH)
Common scoter	**Medium**	**Low (LH)**	**Medium**
Black grouse	Low (LM)	Negligible	Low (LM)
Red-throated diver	**Medium**	**Negligible**	**Medium**
Slavonian grebe	Negligible	Negligible	Negligible

Receptor	Western Area*	Eastern Area*	Whole Area*
Osprey	**Low (LH)**	**Low (LH)**	**Low (LH)**
Golden eagle	**Medium**	**Medium**	**Medium**
Hen harrier	Negligible	Negligible	Negligible
Red kite	**Negligible**	**Low (LH)**	**Low (LH)**
White-tailed eagle	**Low (LH)**	**Low (LH)**	**Low (LH)**
Golden plover	**Low (LH)**	**Low (LH)**	**Low (LH)**
Dotterel	Negligible	Negligible	Negligible
Dunlin	**Medium**	**Medium**	**Medium**
Greenshank	**Medium**	**Medium**	**Medium**
Merlin	**Low (LH)**	**Negligible**	**Low (LH)**
Peregrine	**Low (LH)**	**Low (LH)**	**Low (LH)**

** LH = Local High, LM = Local Medium, LL = Local Low.*

9.6.177 Some of the species listed in Table 9.12 which have been scoped out of detailed consideration in this assessment would be covered by best practice measures to avoid or reduce potential impacts during the breeding season. For example, black grouse that lek near to the main access track (i.e. well outside of the Proposed Development) are at risk of significant disturbance and vehicle collision from construction traffic during the spring. Measures are outlined in Technical Appendix 9.4 to address this.

9.7 Changes in the absence of the Proposed Development

9.7.1 Due to the complex range of potential influencing factors it is difficult to predict with any certainty what would occur to the status of key bird populations and supporting habitats in the study area should the Proposed Development not go ahead.

9.7.2 However, it is anticipated that should the Proposed Development not be constructed, the management of the area would continue in a broadly similar manner to current practice, with the primary land-uses continuing to be management for red grouse shooting, red deer stalking, low-intensity sheep grazing and renewable (wind and hydro) electricity generation.

9.7.3 There is some uncertainly about the potential long-term effects of wind farms on breeding wader abundance, predicting future trends related to this impact with any reliability is difficult (see discussion within the main operational impact assessment section below). Using golden plover as an example: evidence from some studies, where the various confounding variables have been controlled for, is that large (i.e. >50%) reductions in abundance during the operational phase are possible within c. 400m of a wind farm. As Stronelairg Wind farm has only been operational since December 2018 such effects, should they occur and persist, may not have been fully realised at the time of the 2019 surveys for the Proposed Development. It is therefore possible that the density of breeding golden plover adjacent to Stronelairg Wind Farm could decrease from the current baseline. If, as has been shown in some studies, disturbance during construction results in a larger effect on breeding abundance than the operational phase, it is possible that the density of golden plover was supressed near to Stronelairg Wind Farm during the 2019 survey (i.e. within 12 months of construction) and that there may be some level of recovery and increase in the future. If there is localised displacement

from the wind farm area, and numbers do not reach a level where density-dependent processes are important, the abundance of breeding golden plover could potentially increase within suitable habitats >400m from Stronelairg Wind Farm and therefore apparent breeding densities may have been elevated in parts of the survey area during 2019 or may increase in the future.

9.7.4 National population trends from the UK Breeding Bird Survey (covering most widespread breeding species in Scotland) were most recently published in 2018[42]. Golden plover has shown a recent increasing trend, with an 18% increase for the period 2012 to 2017. Conversely, breeding dotterel have shown large declines, potentially due to the effects of climate change and other factors such as grazing pressure, and have been placed on the UK Red lists (Eaton *et al.* 2015).

9.7.5 Management for red grouse encourages the growth of heather, whilst deer and sheep grazing tends to reduce heather cover, leading to the heather-grassland mosaic, typical of much of the uplands in Scotland. The long-term effects of over-grazing by red deer would continue to act as a pressure on sensitive habitats such as blanket bog and montane heath and grassland habitats. The two Estates that the Proposed Development is located within are part of the Monadhliath Deer Management Group. The Strategic Deer Management Plan (2015-2024[43]) reports that estimated red deer numbers within the area remained relatively stable during the period 2004 to 2013. There are aims within the plan for reductions in the number of hinds within the area so impacts related to grazing and trampling pressure are likely to ease in the future if this objective is achieved. There are also proposals for the restoration of blanket bog habitats within the Monadhliath SSSI/SAC, which could improve habitat quality for breeding waders if carried forward.

9.7.6 Whilst deer can provide a good source of carrion for eagles during the winter, overgrazing may adversely influence prey availability during the breeding season (Whitfield *et al*. 2008[44]). However, given the successful re-occupation of near-by golden eagle breeding territories in recent years, there does not appear to be a clear influence on breeding success, in the medium-term at least, in relation to the intensity of deer grazing / trampling and live prey availability. It is also assumed that management measures to reduce the risk to golden eagle collisions with Stronelairg Wind Farm, such as removal of deer carcases and gralloch to suitable winter larder sites outside of the wind farm, would continue.

9.7.7 It appears that the occupation of available golden eagle territories is at or very close to the maximum that the area could support. Therefore, no additional breeding pairs, from the current baseline, are considered likely to settle in the area. The local increase in territory occupation, since 2010, reflects a wider recovery trend for breeding golden eagle in the region.

9.7.8 Various changes in average temperatures and seasonal rainfall are predicted as a result of global climate change, which are likely to affect the breeding bird assemblage in the medium to long-term. Across the UK during the period 2008-2017 temperature was on average 0.3 °C warmer than the 1981-2010 average and 0.8 °C warmer than 1961-1990

[42] See: https://www.bto.org/our-science/projects/bbs/latest-results/population-trends

[43] Monadhliath Deer Management Group: Strategic Deer Management Plan for 2015-2024. Prepared by: Strath Caulaidh Ltd. Version 2.5. 15th April 2015.

[44] Whitfield, D.P., Fielding, A.H., McLeod, D.R.A., & 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.

(UKCP18[45]). In the past few decades there has been an increase in annual average rainfall, particularly over Scotland for which the period 2008–2017 saw an average 11% increase on the 1961–1990 period. Over land the projected general trends of climate change are towards warmer, wetter winters and hotter, drier summers. By 2070 the UK prediction is for a 0.7°C to 4.2°C temperature increase in winter and 0.9°C to 5.4°C in summer with the largest changes likely to occur in the south. For precipitation, corresponding ranges of UK average changes are -1% to +35% for winter, and -47% to +2% for summer. The continuing broad trends, predicted for Scotland, are for increasing precipitation in the west in the spring and decreases in the east during summer.

9.7.9 Variability in seasonal rainfall can affect breeding success in moorland wader species. For example, unusually hot and dry conditions during the summer can result in a significant reduction in insect prey availability in the following years for golden plover. This is likely result in reduced breeding success with consequent population declines in long-term if these conditions become more frequent (Pearce-Higgins 2011[46]).

9.7.10 Several other species of conservation concern present in the general area are close to the southern edge of their global breeding range (e.g. red-throated diver, common scoter, Slavonian grebe, dotterel and greenshank). Such species, particularly those dependent on upland / montane habitats, are considered to be particularly vulnerable to the effects of climate change. The climatic conditions that sustain these habitats may gradually move to higher elevations and further to the north. Therefore these species may be subject to altitudinal / latitudinal range shifts (i.e. resulting in further decreases in abundance within the region, if not complete loss in some cases).

9.8 Potential Effects

9.8.1 The following section considers the potential effects of the construction, operation and decommissioning of the Proposed Development on sensitive ornithological receptors as identified in Table 9.12. The mitigation measures proposed, and the likely residual effects are discussed in Sections 9.9 and 9.10.

9.8.2 A summary impact assessment table is provided at the end of the Chapter which includes the conclusion of the pre-mitigation and post-mitigation (i.e. residual) assessment of effects for individual species where appropriate and a summary of the proposed mitigation measures.

9.8.3 Chapter 3: Description of Development provides the details of the various elements of the Proposed Development, including an outline construction process and programme.

Construction Disturbance and Displacement

9.8.4 Construction effects include the potential disturbance to breeding / foraging birds (including dependent young) or sensitive sites, such as nests or roost sites, and the direct / indirect and temporary / permanent loss of habitat as a result of construction activities.

9.8.5 The anticipated duration for the construction of the Proposed Development is 24 to 36 months (see Chapter 3: Description of Development).

[45] UKCP18 Science Overview Report November 2018 (Updated March 2019), available from: https://www.metoffice.gov.uk/pub/data/weather/uk/ukcp18/science-reports/UKCP18-Overview-report.pdf

[46] Pearce-Higgins, J.W. (2011), Modelling conservation management options for a southern range-margin population of Golden Plover Pluvialis apricaria vulnerable to climate change. Ibis, 153: 345-356.

9.8.6 Assuming the least favourable timing of works in relation to the bird breeding season, disturbance to breeding birds arising from ground clearance, general construction noise, vehicles, vibration, lighting, presence of construction workers, etc., would have an effect on breeding success and potentially cause displacement of birds from the affected areas. It is assumed that birds could be subject to disturbance from construction works during all / part of the breeding season for up to three breeding seasons in total, assuming the least favourable commencement date (e.g. mid-summer).

9.8.7 It is assumed that no nesting Schedule 1 species or their dependent young would be disturbed by the works in compliance with the WCA. In addition, the active nest sites of all wild birds are protected so it is also assumed that the construction works would be carried out in a manner that avoids damaging nest sites of all wild birds. Measures to help achieve this are outlined in Section 9.9, and also refer to the Technical Appendix 9.4: Outline Bird Protection Plan.

9.8.8 Noise from construction works may affect birds in a number of ways including the ability of a bird to select, establish and defend a territory, its foraging and breeding success and song learning. The degree of disturbance impact would be dependent on a range of variables, including the time of year, as the potential scale of effect may vary depending on the stage of the breeding season, the species affected, the duration and magnitude of the source of the disturbance, the nature of the surrounding habitats and topography and the availability of suitable alternative habitats for birds to move into.

9.8.9 Breeding raptors are particularly vulnerable to disturbance at the nest site where repeated disturbance can cause adults to cease egg incubation; even temporary cooling or overheating of eggs can result in failure to hatch. In extreme cases, for cliff nesting species (e.g. peregrine, golden eagle), adults may knock chicks out of the nest if the disturbance is sudden and intense. Flushing of the adult birds from the nest site is also likely to increase the risk of predation of chicks or eggs abandoned at the nest.

9.8.10 It is also important to consider that construction works would likely move progressively across the site, and would not occur simultaneously across the entire area, affecting all habitats continuously throughout the construction period.

Monadhliath SSSI

9.8.11 There is no potential for any direct disturbance to habitats within the Monadhliath SSSI. However, there is the potential for temporary disturbance to a small number of breeding wader territories that form part of the breeding bird assemblage which is one of the notified natural features of the SSSI (i.e. golden plover, approximately one territory, and dunlin approximately two territories, based on the 2019 survey results).

9.8.12 The potential effect of pre-mitigation construction disturbance to the Monadhliath SSSI breeding bird assemblage is Negligible which is **not significant**.

Common scoter

9.8.13 Breeding common scoters are considered to be vulnerable to human disturbance and predation, however there is little published research on this issue. Ruddock & Whitfield (2007[47]) reported an upper limit of active response to disturbance, from people

[47] Ruddock, M. & Whitfield, D.P. (2007). A Review of Disturbance Distances in Selected Bird Species. A report from Natural Research (Projects) Ltd to Scottish Natural Heritage.

approaching on foot, at 300m during the chick-rearing period and a much lower active response distance during incubation (<10m).

9.8.14 At the distances over which disturbance is considered possible for this species, the construction of the Proposed Development would not have any appreciable direct effect on the known, regularly occupied breeding sites for common scoter present in the wider area. This is also no line of sight to these waterbodies from the construction areas. However, there is some potential for disturbance to pre-breeding / post-nesting birds that may occasionally use the main Glendoe Reservoir.

9.8.15 The potential effect of pre-mitigation construction disturbance to common scoter is Negligible-Low / short-term resulting in an effect significance of Minor which is **not significant**.

Red-throated diver

9.8.16 Breeding red-throated divers are potentially vulnerable to construction disturbance at their nesting lochs and at comparatively large distances. However, the distance at which behavioural responses are elicited can vary considerably according to loch size, stage in the breeding season, screening and between individual birds (e.g. their prior experience of human disturbance). Based on expert option, red-throated divers may show behavioural responses to a person on foot at a distance of between 500 to 750m from their nesting loch (Ruddock & Whitfield 2007[43]).

9.8.17 At the distances over which disturbance is considered possible for this species, the construction of the Proposed Development would not have any appreciable direct effect on known breeding sites for red-throated diver. However, there is the potential for disturbance to pre-breeding / post-nesting birds using the main Glendoe Reservoir. There is also the potential for disturbance to breeding divers using lochs near to the main access track. However, as a Schedule 1 species protected from disturbance when breeding, this risk was effectively managed during the construction of Stronelairg Wind Farm and there is no reason to assume that significant disturbance could also be avoided during the construction of the Proposed Development.

9.8.18 The potential effect of pre-mitigation construction disturbance to red-throated diver is Negligible-Low / short-term resulting in an effect significance of Minor which is **not significant**.

Osprey

9.8.19 Osprey are at risk of disturbance near to their nest sites and, to a lesser degree, at favoured hunting sites during the breeding season. Ruddock & Whitfield (2007[43]) reported a wide range of expert opinion on disturbance to nesting osprey from a person on foot. Distances of 100-150m to 500-750m for static responses to sources of disturbance and an upper limit of 500-750m for active responses to disturbance. As is the case for many raptor species, there is likely to be large variation in response in relation to the stage in the nesting season and the individual bird's prior exposure to such sources of disturbance.

9.8.20 At the distances over which disturbance is considered possible for this species, the construction of the Proposed Development would not have any effect on known breeding sites for osprey. However, there is the potential for some limited disturbance to hunting birds that occasionally use the main Glendoe Reservoir.

9.8.21 The potential effect of pre-mitigation construction disturbance to osprey is considered to be Negligible, which is **not significant**.

Golden eagle

9.8.22 Breeding golden eagles are highly sensitive to the presence of people visible at relatively large distances from their nest sites. Such disturbance may cause breeding failure or reduced breeding success. For example, flushing the parent birds from the nest for extended periods could cause loss of eggs or young chicks through predation or chilling / overheating, depending on the weather conditions. Disturbance from the nest area, and important hunting grounds during chick-rearing, could result in reduced provisioning rates, reduced productivity or breeding failure. In a review of expert option, Ruddock & Whitfield (2007[43]) reported an upper limit for active responses of breeding golden eagles to disturbance from a person on foot at 750-1000m from the nest. As with other raptor species, there was reported variation between individual birds in their typical response distance. It was recommended that different safe working distances may be necessary depending on the specific circumstances (i.e. nature of the works, line of sight to the nest, extent of topographic screening). Cliff-nesting golden eagles may be particularly sensitive because their nest sites allow greater visibility of their surroundings.

9.8.23 At the distances over which disturbance is considered possible for this species, the construction of the Proposed Development would not have any direct effect on any known nest sites for golden eagle. However, there is the potential for some temporary disturbance and displacement of hunting birds that use parts of the site and nest in the wider area (up to four breeding pairs).

9.8.24 The potential effect of pre-mitigation construction disturbance to golden eagle is Negligible-Low / short-term resulting in an effect significance of Minor which is **not significant**.

Red kite

9.8.25 As a species that often occupies agricultural landscapes, red kites can be fairly tolerant of human presence near to their nest sites, often using suitable trees near to farm buildings. However, nest failure due to human disturbance can occur and pairs not exposed to much human activity are likely to be less tolerant of such disturbance. A disturbance free zone around active nests of 400-600m was recommended by Petty (1998[48]). Ruddock & Whitfield (2007[43]) reported that that breeding red kites were unlikely to be disturbed from a human on foot >300m from a nest. From the expert opinion survey, median static response disturbance distances were 125m and between 30m (incubation) and 75m (chick-rearing) for active responses to disturbance.

9.8.26 At the distances over which disturbance is considered possible for this species, the construction of the Proposed Development would not have any effect on red kite breeding sites. However, there is the potential for some temporary disturbance and displacement of hunting birds that use the site, particularly the eastern survey area.

9.8.27 The potential effect of pre-mitigation construction disturbance to red kite is Negligible-Low / short-term resulting in an effect significance of Minor which is **not significant**.

[48] Petty, S.J. (1998). Ecology and Conservation of Raptors in Forests. Forestry Commission Bulletin 118. The Stationery Office, London.

White-tailed eagle

9.8.28 The expert survey results reported in Ruddock & Whitfield (2007[43]) indicated that white-tailed eagles display a static response to disturbance from a person on foot at up to 1000m from the nest and active responses at up to 500m. The results for active disturbance were broadly consistent with protective buffers for the species in continental Europe. As with golden eagle, applying generic protection zones without regard to the site-specific circumstances should be avoided. There is likely to be variation in response between different pairs, due to their previous exposure to human presence. Also responses may vary at different stages of the breeding season and in relation to the type of works, their duration and location relative to the nest and any intervening topographic / vegetation screening.

9.8.29 At the distances over which disturbance is considered possible for this species, the construction of the Proposed Development would not affect any white-tailed eagle breeding sites. However, there is the potential for some temporary disturbance and displacement of hunting birds that occasionally use the site (and which may breed in the wider surrounding area) particularly the western survey area.

9.8.30 The potential effect of pre-mitigation construction disturbance to white-tailed eagle is considered to be Negligible, which is **not significant**.

Golden plover

9.8.31 Disturbance to breeding golden plover territories, resulting in the parent birds being flushed or increasing vigilance, and therefore spending less time brooding, increases the risk of egg or chick predation and lethal exposure during adverse weather conditions. Repeated disturbance also places increased energetic costs on the adult birds. Evidence from monitoring of wind farm construction sites in Scotland indicates that golden plover are sensitive to disturbance during construction. Prolonged, high levels of disturbance are likely to cause birds to vacate breeding territories.

9.8.32 The distances at which golden plovers show behavioural reactions to a person on foot ranges from 50m to 400m (references quoted in Bright *et al*. 2006[49]) and varies in relation to a number of factors including stage of the breeding season. Yalden & Yalden (1990[50]) reported that adults with chicks alarm-called when approached within c. 200m. However, despite high levels of human disturbance (walkers close to the Pennine Way) over many years there was no evidence of a significant effect on golden plover breeding distribution or breeding success (Pearce-Higgins *et al*. 2007[51]).

9.8.33 At the maximum distances over which disturbance is considered possible for this species, there is the potential for temporary disturbance / displacement to affect approximately 21 golden plover breeding territories (accounting for potential disturbance at temporary works locations outside of the 2019 survey area by using data from the 2015 pre-construction survey for Stronelairg wind farm). This represents c. 0.8% of the NHZ 10 population (this is clearly a 'worst case' as not all territories would be equally effected or affected at the same time). Golden plover (pre-mitigation) construction disturbance is

[49] Bright, J. A., Langston, R. H. W., Bullman, R., Evans, R. J., Gardner, S., Pearce-Higgins, J.W. & Wilson, E. (2006). Bird Sensitivity Map to provide locational guidance for onshore wind farms in Scotland. RSPB Research Report No 20. RSPB, The Lodge, Sandy.
[50] Yalden, P.E. & Yalden, D.W. (1990). Recreational disturbance of breeding Golden Plovers Pluvialis apricaria. Biological Conservation. 51: 243– 262.
[51] Pearce-Higgins, J.W., Finney, S.K., Yalden, D.W. & Langston, R.H.W. (2007). Testing the effects of recreational disturbance on two upland breeding waders. Ibis, 149(suppl. 1), 45–55.

assessed to be no greater than a Low effect, resulting in a significance level of Minor in the short-term (i.e. **not significant**).

Dunlin

9.8.34 Dunlin appear to be less behaviourally responsive to human sources of disturbance than some other moorland waders (e.g. golden plover). Yalden & Yalden (1989[52]) found that breeding dunlin, near a section of the Pennine Way, reacted to a human presence by alarm calling within about 35m. Incubating birds will often sit very tightly and will not be flushed from the nest site until a very close approach is made. Another study in the Peak District found evidence that this species is sensitive to human disturbance as there was a marked increase in breeding dunlin within c. 200m of the footpath once the number of walkers had declined (Finney *et al.* 2004[53]).

9.8.35 At the distances over which disturbance is considered possible for this species, there is the potential for temporary disturbance to approximately 15 dunlin breeding territories (accounting for potential disturbance at temporary works locations outside of the 2019 survey area by using data from the 2015 pre-construction survey for Stronelairg wind farm). This represents c. 14.3% of the NHZ 10 population (this is clearly 'worst case' as not all territories would be equally effected and affected at the same time, additionally the NHZ 10 population is likely to be severely underestimated). Dunlin (pre-mitigation) construction disturbance is assessed to be no greater than a Low effect, resulting in a significance level of **Moderate** in the short-term (i.e. **significant**).

Greenshank

9.8.36 Greenshank are considered to be vulnerable to human disturbance during the breeding season but, in comparison to other moorland waders such as golden plover and dunlin, there has been very little research into this issue. A 27-year study of a breeding greenshank population in Sutherland (NW Scotland) reported a decline in breeding pairs and found that territories that had been subject to the most disturbance (primarily people on ATVs) were occupied by breeding pairs less regularly than areas with less disturbance (Thompson & Thompson 1991[54]). A breeding territory size of 800m radius (centred on breeding registrations) was assumed for the national survey methodology (Hancock *et al*. 1997[55]). In the absence of published research on responses to disturbance sources by this species, 800m has been treated as the potential zone of disturbance during construction. However, during the Public Inquiries for the Achany and Strathy South wind farm developments a 200m zone of potential displacement was proposed, based on evidence provided by Professor Des Thompson[56]. Additionally, there is anecdotal evidence during the construction of Stronelairg Wind Farm which indicated that several greenshank pairs managed to successfully raise broods near to construction works, with measures in the place to protect nest locations, during 2017 and 2018.

[52] Yalden, D.W. & Yalden, P.E. (1989). The sensitivity of breeding golden plovers Pluvialis apricaria to human intruders. Bird Study 36: 49-55.

[53] Finney, S.K., Pearce-Higgins, J.W. & Yalden, D.W. (2004) The effect of recreational disturbance on two upland breeding birds the golden plover Pluvialis apricaria and the dunlin Calidris alpina. English Nature Research Report: Project Reference FST20-11-011.

[54] Thompson, P.S. & Thompson, D.B.A. (1991). Greenshanks Tringa nebularia and Long-term Studies of Breeding Waders. Ibis, 133 (suppl. 1), 99-112.

[55] Hancock, M.H., Gibbons, D.W. & Thompson, P.S. (1997). The status of breeding Greenshank Tringa nebularia in the United Kingdom in 1995. Bird Study, 44:3, 290-302.

[56] Thompson, D. (2009). Proposed wind farm development at Achany Estate, Lairg, Sutherland. Expert Opinion provided to the Achany Wind Farm Public Inquiry.

9.8.37 At the maximum distances over which disturbance is considered possible for this species, there is the potential for temporary disturbance to a maximum of two greenshank breeding pairs. This represents 20% of the NHZ 10 population (which a clear 'worst case' outcome as the NHZ 10 population is likely to be severely underestimated). Greenshank (pre-mitigation) construction disturbance is assessed to be no greater than a Low effect, resulting in a significance level of **Moderate** in the short-term (i.e. **significant**).

Merlin

9.8.38 Breeding merlin are sensitive to disturbance from human activity, potentially over large distances. Flushing of birds from nest sites exposes the eggs / chicks to the risk of predation and also increases the potential for breeding failure due to the chilling of eggs and young if disturbance occurs during inclement weather. Behavioural responses to sources of disturbance are likely to vary according to stage in the breeding season and the prior exposure of individuals which may increase tolerance. Ruddock & Whitfield (2007[43]) reported an upper limit to static responses to disturbance (person on foot) at 300-500m.

9.8.39 At the distances over which disturbance is considered possible for this species, there is considered to be negligible risk of disturbance to breeding merlin during construction. There is the potential for some short-term displacement of birds passing through the area, potentially hunting, during and outside of the breeding season.

9.8.40 Merlin (pre-mitigation) construction disturbance is assessed to be Negligible, which is **not significant**.

Peregrine

9.8.41 Ruddock & Whitfield (2007[43]), based on data from an expert questionnaire on the upper limit of static or passive disturbance, recommended a disturbance management zone of 500-750 m from the nest. They recommended that peregrine protection zones should be flexible to reflect the range of tolerance likely to be exhibited at different sites with differing existing background levels of disturbance.

9.8.42 At the distances over which disturbance is considered possible for this species, the construction of the Proposed Development would not have any direct effect on known peregrine breeding sites. However, there is the potential for some temporary disturbance and displacement of hunting birds that use the site.

9.8.43 The potential effect of pre-mitigation construction disturbance to peregrine is considered to be Negligible, which is **not significant**.

Summary of pre-mitigation assessment

9.8.44 A summary of the assessment of potential construction phase disturbance and displacement effects for each receptor, prior to mitigation and management, is given in Table 9.13, below.

Table 9.13: Construction phase – pre-mitigation assessment of construction disturbance / displacement (potentially significant effects highlighted in bold)

Receptor	Sensitivity	Effect	Significance level	Duration	Confidence
Monadhliath SSSI	High	Negligible	Minor	Short-term	Near-certain
Common scoter	Medium	Negligible-Low	Minor	Short-term	Near-certain
Red-throated diver	Medium	Negligible-Low	Minor	Short-term	Near-certain
Osprey	Low (Local High)	Negligible	Negligible	Short-term	Near-certain
Golden eagle	Medium	Negligible-Low	Minor	Short-term	Near-certain
Red kite	Low (Local High)	Negligible	Negligible	Short-term	Near-certain
White-tailed eagle	Low (Local High)	Negligible	Negligible	Short-term	Near-certain
Golden plover	Low (Local High)	Low	Minor	Short-term	Probable
Dunlin	Medium	Low	**Moderate**	Short-term	Probable
Greenshank	Medium	Low	**Moderate**	Short-term	Probable
Merlin	Low (Local High)	Negligible	Negligible	Short-term	Near-certain
Peregrine	Low (Local High)	Negligible	Negligible	Short-term	Near-certain

Direct Habitat Loss / Degradation

9.8.45 Details and discussion of habitat losses resulting from the construction phase are provided in Chapter 8: Ecology.

9.8.46 The total area of moorland habitats (i.e. primarily modified and unmodified blanket bog) directly affected by wind farm infrastructure has been estimated at 20.28ha of blanket bog, 66.7ha of wet modified bog, 0.33ha of dry modified bog, 7.18ha of wet heath, 10.24ha of wet heath/acid grassland mosaic and 1.04ha of dry heath (see Chapter 8: Ecology for further details). These are relatively small areas in comparison of the extent of these habitat types present within the survey area and wider surrounding area. For example, the estimated loss of blanket bog is approximately 4.37% of the total extent of this habitat type within the habitat survey area.

9.8.47 Consideration has been given during the design of the Proposed Development to avoid or minimise effects where practicable, areas of particularly sensitive habitat such as lochans, watercourses, flushes and areas of unmodified blanket bog on deeper peat. No significant loss (other than at a localised level) of any habitats is predicted from the construction and upgrade of the access tracks which would service the Proposed Development.

9.8.48 The scale of the direct moorland habitat loss would not give rise to a significant effect upon any bird receptor due to the relatively small total area, distributed over the development area, and the small extent of the habitat types affected in comparison to similar available habitat in the immediate surrounding area. This assessment takes into consideration the potential for wind turbine bases and access tracks to result in indirect effects over a wider area than the construction footprint because of changes to local hydrology.

9.8.49 There is the potential for pollution to occur to surface waters during the construction phase, through siltation and oil, fuel, chemical spills. This has the potential to adversely affect species that depend on waterbodies for food during the breeding season (e.g. greenshank).

9.8.50 A summary of the assessment of potential pre-mitigation habitat loss / degradation effects for each relevant receptor is given in Table 9.14.

Table 9.14: Construction phase – pre-mitigation assessment of direct habitat loss / degradation (potentially significant effects highlighted in bold)

Receptor	Sensitivity	Effect	Significance level	Duration	Confidence
Monadhliath SSSI	High	None	n/a	n/a	Certain
Common scoter	Medium	Negligible-Low	Minor	Medium-term	Near-certain
Red-throated diver	Medium	Negligible-Low	Minor	Medium-term	Near-certain
Osprey	Low (Local High)	Negligible-Low	Minor	Medium-term	Near-certain
Golden eagle	Medium	Negligible	Negligible	Long-term	Certain
Red kite	Low (Local High)	Negligible	Negligible	Long-term	Certain
White-tailed eagle	Low (Local High)	Negligible	Negligible	Long-term	Certain
Golden plover	Low (Local High)	Negligible	Negligible	Long-term	Near-certain
Dunlin	Medium	Negligible	Negligible	Long-term	Near-certain
Greenshank	Medium	Negligible-Low	Minor	Medium-term	Near-certain
Merlin	Low (Local High)	Negligible	Negligible	Long-term	Certain
Peregrine	Low (Local High)	Negligible	Negligible	Long-term	Certain

Operational Displacement & Barrier Effects

9.8.51 Turbine-related displacement, assuming no habituation over time, has the potential to affect breeding success and reduce individual fitness as it results in the effective loss of habitat for nesting, foraging and roosting. The scale of the effects would be likely to vary considerably between species and could be dependent on factors such as the number of turbines affecting the same habitat / population of birds and the zone of displacement relative to territory size etc.

9.8.52 Displacement of birds from suitable habitat by operating wind turbines has been observed in a number of studies of onshore wind farms (e.g. Larsen & Madsen 2000[57]; Devereux, Denny & Whittingham 2008[58]; Pearce-Higgins *et al.* 2008[59] and 2009[60]). From various published field studies and literature reviews (e.g. Winkelman 1995[61], Green 1995[62], Leddy *et al*. 1999[63], Larsen and Madsen 2000[64], de Lucas *et al.* 2004[65], Hötker *et al.* 2006[66], Zwart *et al.* 2015, Hötker 2017[67]) it is apparent that displacement effects can vary between locations and species, with some species showing remarkable tolerance of

[57] Larsen, J. K.; Madsen, J. (2000). Effects of wind turbines and other physical elements on field utilization by pink-footed geese (*Anser brachyrhynchus*): A landscape perspective. Landscape Ecology 15: 755-764.

[58] Devereux, C,L., Denny, M,J,H. and Whittingham, M,J. (2008) Minimal effects of wind turbines on the distribution of wintering farmland birds. Journal of Applied Ecology. 45: 1689-1694.

[59] Pearce-Higgins, J.W., Stephen, L., Langston, R.H.W., and Bright, J.A. (2008). Assessing the cumulative impacts of wind farms on peatland birds: a case study of golden plover *Pluvialis apricaria* in Scotland. Mires and Peat Volume 4, pp 1-13.

[60] Pearce-Higgins, J.W., Stephen, L., Langston, R.H.W., Bainbridge, I.P., and Bullman, R. (2009). The distribution of breeding birds around upland wind farms. Journal of Applied Ecology Volume 46 Issue 6, Pages 1323 - 1331.

[61] Winkelman, J. E. (1995). Bird / wind turbine investigations in Europe. Pages 43-47 and 110-120 in LGL Ltd., environmental research associates, Ed. Proceedings of the National Avian-Wind Power Planning Meeting, Lakewood, Colorado. National Renewable Energy Laboratory, Golden, Colorado.

[62] Green, M. (1995) Effects of Windfarm operation on the winter bird community of the Byrn Titli Uplands: 1994 / 1995. Report to National Wind Power Ltd.

[63] Leddy, K. L.,Higgins, K. F. and Naugle D. E. (1999). Effects of wind turbines on upland nesting birds in Conservation Reserve Program grasslands. Wilson Bulletin 111: 100-104.

[64] Larsen, J. K.; Madsen, J. (2000). Effects of wind turbines and other physical elements on field utilization by pink-footed geese (*Anser brachyrhynchus*): A landscape perspective. Landscape Ecology 15: 755-764.

[65] de Lucas, M., Janss, G.F.E. and Ferrer, M. (2004). The effects of a wind farm on birds in a migration point: the Strait of Gibraltar. Biodiversity and Conservation 13:395-407.

[66] Hötker, H., Thomsen, K.-M. & Jeromin, H. (2006). Impacts on biodiversity of exploitation of renewable energy sources: the example of birds and bats - facts, gaps in knowledge, demands for further research, and ornithological guidelines for the development of renewable energy exploitation. Michael-Otto-Institut im NABU, Bergenhusen.

[67] Hötker, H., Krone, O., & Nehls, G. (2017). Birds of Prey and Wind Farms: Analysis of Problems and Possible Solutions. Springer International Publishing.

wind turbines and others being partially or entirely displaced from a wind farm area (i.e. show strong macro-avoidance).

9.8.53 The results of wind farm monitoring studies in the Scottish uplands have shown variable results with respect to breeding wader displacement effect. However, with studies of operational wind farms it is often difficult to account for concurrent changes to habitat condition within and outside of the wind farm area, either as a result of construction or from deliberate habitat enhancement, influencing habitat use within the wind farm area.

9.8.54 There is also the potential for the presence of the wind farm to affect flight behaviour and force birds to make deviations which are more costly in terms of energy expenditure or in extreme cases prevent access to important habitats.

Monadhliath SSSI

9.8.55 There is the potential for the operational disturbance / displacement of a small number of golden plover and dunlin territories located within the SSSI, of which there are one and two, respectively (see below for species-specific discussion of this issue).

9.8.56 Pre-mitigation operational displacement / barrier effects on the Monadhliath SSSI breeding bird assemblage, given the low number of wader territories potentially affected is considered to be Negligible which is **not significant**.

Common scoter

9.8.57 There is very little Information amiable on common scoter responses to operational onshore wind farms. Offshore wind farm monitoring studies have reported macro-avoidance by wintering common scoter (Furness *et al*. 2013[68]) with some evidence of habituation (Hötker *et al*. 2006[61]), although responses are likely to be different at breeding sites. As a relatively long-lived species, with low annual productivity and small population size, this increases the risk of displacement resulting in population level effects. Particularly in relation to potential cumulative effects. This species is also at risk from offshore wind farm barrier effects, but evidence from onshore wind farm studies is lacking. Bright *et al*. (2008[69]) applied a 1km wide 'high sensitivity' buffer to common scoter breeding sites.

9.8.58 The operation of the Proposed Development would not have any appreciable direct effect on known breeding sites for common scoter, at the distances were displacement effects could operate for this species. However, there is the potential for long-term disturbance / displacement to pre-breeding / post-nesting birds occasionally using the main Glendoe Reservoir.

9.8.59 Pre-mitigation operational displacement / barrier effects on common scoter are considered to be Negligible-Low / long-term resulting in an effect significance of Minor, which is **not significant**.

Red-throated diver

9.8.60 Red-throated divers appear to display a strong macro-avoidance of offshore wind farms (Furness *et al*. 2013[6]). There is also some evidence for flight displacement from onshore

[68] Furness, R. W., Wade, H. M., & Masden, E. A. (2013). Assessing vulnerability of marine bird populations to offshore wind farms. Journal of Environmental Management, 119, 56–66.
[69] Bright, J., Langston, R., Bullman, R., Evans, R., Gardner, S., & Pearce-Higgins, J. (2008). Map of bird sensitivities to wind farms in Scotland: a tool to aid planning and conservation. Biological Conservation 141 (9), 2342–2356.

wind turbines near to breeding sites (Furness 2015[70]). The abandonment of some breeding sites following wind farm construction has also been reported (Humphreys *et al*. 2017[71]). Evidence of wind farm barrier effects for breeding sites is lacking in the scientific literature, but red-throated divers are considered to be potentially vulnerable to such effects. Bright *et al*. (2008[9]) applied a 1km wide 'high sensitivity' buffer to red-throated diver breeding lochs.

9.8.61 The operation of the Proposed Development would not have any appreciable direct effect on known breeding sites for red-throated diver, at the distances were displacement effects could operate for this species. There is the potential for long-term disturbance / displacement to pre-breeding / post-nesting birds occasionally using the main Glendoe Reservoir.

9.8.62 Pre-mitigation operational displacement / barrier effects on red-throated diver are considered to be Negligible-Low / long-term resulting in an effect significance of Minor, which is **not significant**.

Osprey

9.8.63 In relation to avoidance of offshore wind farms, on migration osprey have been observed to show a comparatively high degree of macro-avoidance (c. 80%, Jacobsen *et al*. 2019[72]). This indicates that collision risk on migration may be relatively low but that there is the potential for barrier effects to occur at poorly sited wind farms (e.g. within important migratory corridors). There is very little information available in the scientific literature on the vulnerability of this species to displacement effects from onshore wind farms.

9.8.64 The operation of the Proposed Development would not have any appreciable direct effect on known breeding sites, at the distances were displacement effects could operate for this species. However, there is the potential for long-term displacement / disturbance to hunting birds that occasionally use the main Glendoe Reservoir.

9.8.65 Pre-mitigation operational displacement / barrier effects on osprey are considered to be Negligible-Low / long-term resulting in an effect significance of Minor, which is **not significant**.

Golden eagle

9.8.66 Resident breeding golden eagles in Scotland appear to show a strong displacement behaviour in relation to operational wind farms (Walker *et al*. 2005[73], Fielding &Haworth 2010[74], 2015[75]). Data emerging from the expansion in satellite tracking of young golden eagles in Scotland has also shown relatively consistent displacement response (i.e. macro-avoidance) around operational wind farms (Whitfield & Fielding 2017[76]). Golden eagles do still occasionally pass through wind farms, but they tend to fly above turbine

[70] Furness, R.W. (2015). A review of red-throated diver and great skua avoidance rates at onshore wind farms in Scotland. Scottish Natural Heritage Commissioned Report No. 885.
[71] Humphreys, E.M., Marchant, J.H., Wilson, M.W. & Wernham, C.V. (2015). Red-throated Diver (Gavia stellata): SWBSG Species Dossier 4. Report by BTO Scotland to SWBSG as part of Project 1403. Updated by SWBSG March 2017.
[72] Jacobsen, E. M., Jensen, F. P., & Blew, J. (2019). Avoidance Behaviour of Migrating Raptors Approaching an Offshore Wind Farm. Wind Energy and Wildlife Impacts, 43–50.
[73] Walker, D., McGrady, M., McCluskie, A., Madders, M., McLeod, D. (2005). Resident Golden Eagle Ranging Behaviour Before and After Construction of a Windfarm in Argyll. Scottish Birds, 25, 24-40.
[74] Fielding, A.H. & Haworth, P.F. (2010). Golden Eagles and Wind Farms. Haworth Conservation, Mull, Scotland.
[75] Fielding, A.H. & Haworth, P.F. (2015). Edinbane Windfarm: Ornithological Monitoring 2007–2014. A Review of the Spatial Use of the Area by Birds of Prey. Haworth Conservation, Mull, Scotland.
[76] Whitfield, D.P. & Fielding, A.H. (2017). Analyses of the Fates of Satellite Tracked Golden Eagles in Scotland. Scottish Natural Heritage Commissioned Report No. 982.

height or appear to deliberately fly through gaps between the turbine arrays. Whitfield & Fielding (2017) analysed GPS location data from over 100 young (dispersal phase) satellite tagged golden eagles relative to 39 wind farm sites. Only 0.03% of the records (totalling 360,711 location fixes) were within 500m of an operational wind turbine.

9.8.67 The assumed displacement zone affecting territory-holding golden eagles (typically quantified using the PAT model, McLeod *et al*. 2002[77]) is 500m from the outermost turbines. The displacement of golden eagles from important parts of their breeding territory could result in reduced breeding success or, in extreme cases, range abandonment. Barrier effects are also possible, particularly for territory-holding birds, depending on wind farm placement relative to nesting areas and productive hunting habitats within the home range.

9.8.68 The operation of the Proposed Development would not have any appreciable direct effect on known breeding sites for golden eagle (i.e. there is no direct line of sight to any eyrie sites used in the past five years and the proposed wind turbines are located more than 2km from all of the eyries / territory centres).

9.8.69 There is the potential for displacement of hunting birds that use the site and breed in the wider area (up to four breeding territories) as well as non-breeding birds that range over a larger area and occasionally use the site. The potential magnitude of this effect has been lessened though the wind farm design process (i.e. design mitigation). The initial the wind turbine layout, informed by flight activity results and territory modelling, has been altered to minimise encroachment into areas of better quality habitat closest to near-by territory centres for golden eagle. The overall objective was to ensure that the predicted loss (i.e. range use overlap) to any of the territories affected would not exceed 5% (i.e. predicted range use overlap by the wind farm a +500m wide buffer around the outermost turbines). SNH advise that a predicted loss of >5% of breeding range use is a potentially significant impact. The actual impact on individual breeding pairs is dependent on a range of factors. For example, the productivity of the pair is an indicator of territory habitat quality, with more productive pairs assumed to be more resilient to small habitat losses. Also, the amount of suitable habitat that the pair have potential access to, which can be used to compensate for losses. Access to such habitat can be constrained by the presence of adjacent breeding pairs. This is particularly important given that one of the main territories that could be affected is believed to be constrained in terms of the potential for the pair to exploit alternative, suitable hunting grounds due to the proximity of adjacent occupied golden eagle territories and the extent of existing unsuitable habitats within their home range.

9.8.70 PAT (Mcleod *et al*. 2002) and GET modelling (Fielding *et al*. 2019) has been used to inform this assessment (see Appendix 9.2 and the Confidential Annex for further details). The PAT model is used to predict range use probability for breeding golden eagles (i.e. time spent in different parts of the territory based on habitat quality and distance from the nest site). It also determines the likely range boundaries based on the proximity of the territory centre to other occupied territories in the surrounding area. The GET model is used to predict habitat use by eagles generally, based on the presence of suitable habitat, slope, aspect and distance to a ridge. The preference index that underlies the GET model is based on an extensive dataset of GPS positions of young satellite tagged golden eagles in Scotland.

[77] McLeod, D.R.A., Whitfield, D.P., Fielding, A.H., Haworth, P.F. & McGrady, M.J. (2002). Predicting home range use by golden eagles Aquila chrysaetos in western Scotland. Avian Sci. 2: 183-198.

9.8.71 Considering the Proposed Development in isolation, the PAT model analyses has shown that range use overlap could vary from 0.8 to 2.7% of the affected territories. For the closest territory centre to the Proposed Development (EA2, see Table 9.11) the PAT model predicts a 2.7% overlap. Using a different method of predicting golden eagle habitat use or preference, the GET model predicted a 2.4% overlap of areas likely to be used, or used more than, expected according to their availability in the landscape (i.e. predicted use rating of six and above in the preference scale used in the GET model) within that pair's assumed territory boundary (as defined by the PAT model). Whilst this is clearly a reduction in the extent of available suitable habitat it is considered unlikely that, at this relatively small scale of assumed loss, this pair (or any of the other territories potentially affected) would suffer significant reduction in breeding productivity as a result. Given the locational and topographical context of the Proposed Development, relative to the exiting Stronelairg Wind Farm and that the proposed wind turbines would be located at territory edges (i.e. there would be no appreciable 'fragmentation / barrier effect' within any territory), this is not considered to be a significant effect for any golden eagle territory.

9.8.72 There is also the potential for habitat loss effects on non-breeding, young golden eagle as a result of wind farm displacement. Using the GET model, the Proposed Development is predicted to result in the loss of 3.6 km^2 of potentially suitable golden eagle habitat with a preference index of six and above. In the context of the extent of potentially suitable habitats within the wider NHZ, and given that young eagles can range much more widely than the Central Highlands NHZ area, this is not considered to be a significant amount of potential habitat loss for that population.

9.8.73 Pre-mitigation operational displacement / barrier effects on golden eagle are considered to be Negligible-Low / long-term resulting in an effect significance of Minor, which is **not significant**.

Red kite

9.8.74 There is currently insufficient evidence to be certain whether red kites in Scotland exhibit wind turbine or wind farm displacement behaviour (Humphreys *et al.* 2015[78]). However, research on red kite wind farm displacement effects in Germany has shown little evidence of macro-avoidance by this species. In a literature review, Hötker (2017[79]) reported only 1 of 7 studies indicating a negative (i.e. displacement) response of breeding red kites to operational wind farms. Hötker *et al.* (2017[80]) found that breeding red kites spent most of their time within a radius of c. 1000m around their nests. They frequently visited wind farms for foraging and spent about 25% of their flight time within the blade swept height band of the most common wind turbines present in the study area. A study in Scotland reported reduced use of part of a wind farm by red kite during the operational period (Duffy & Urquhart 2014[81]). However, this was not attributed to wind turbine avoidance due to concurrent changes in a communal roost location, moving further away from the wind farm during the study period. There appears to be a lack of evidence of any wind farm barrier effect on this species but this is consistent with the general finding that red

[78] Humphreys, E.M., Marchant, J.H., Wilson, M.W. & Wernham, C.V. (2015). Red Kite (Milvus milvus): SWBSG Species Dossier 6. Report by BTO Scotland to SWBSG as part of Project 1403. Updated by SWBSG March 2017

[79] Hötker, H. (2017) Chapter 7, Birds: displacement. In: Perrow, M.R. (ed.) Wildlife and Wind Farms, Conflicts and Solutions. Volume 1, Onshore: Potential Effects, Pelagic Publishing, Exeter, UK.

[80] Hötker, H., Mammen, K., Mammen, U., Rasran, L. (2017). Red Kites and Wind Farms — Telemetry Data from the Core Breeding Range. In: Köppel J. (eds) Wind Energy and Wildlife Interactions. Springer, Cham.

[81] Duffy, K. & Urquhart, B. (2014). Braes of Doune Windfarm – Report on Red Kite Studies (2004-2012). Natural Research Projects Ltd. On behalf of the Braes of Doune Ornithology Steering Group.

kites tend not to avoid wind farms, which also partly explains their comparatively high collision risk (see below).

9.8.75 The operation of the Proposed Development would not have any effect on red kite breeding sites at the distances where such effects are likely. There is the potential for some displacement of hunting birds that use the site, particularly the eastern area. However, there was no obvious evidence of displacement effects occurring during the baseline flight activity surveys for the Proposed Development (i.e. during which time the Stronelairg Wind Farm was operational, see Figure 9.8b).

9.8.76 Based on the available evidence, pre-mitigation operational displacement / barrier effects on red kite are considered to be Negligible, which is **not significant**.

White-tailed eagle

9.8.77 In a literature review on this issue, Humphreys *et al*. (2015[82]) concluded that the available evidence from wind farm monitoring studies in Scotland, Norway, Finland and Germany indicates that white-tailed eagles abandon or breed less successfully at nesting sites that are close to wind turbine locations (breeding displacement), but that they do not consistently show strong avoidance / displacement in terms of flight behaviour. This is reflected in the comparatively high vulnerability of this species to wind farm collision (see below). A long-running study at two wind farms on the Isle of Skye (Haworth 2015[83]) found no evidence for the macro-avoidance of the wind farms by white-tailed eagle. This is broadly consistent with the findings from long-term monitoring studies on the Smøla archipelago in Norway (Dahl *et al.* 2012[84], May *et al.* 2013[85]) and in Germany, with respect to territory-holding birds nesting near to a wind farm (Krone & Treu 2018[86]). There appears to be a lack of research on the issue of wind farm barrier effects but the white-tailed eagle's low macro-avoidance of wind farms indicates that this potential effect from wind farm development is a lower concern for this species in comparison to breeding territory displacement and collision mortality.

9.8.78 The operation of the Proposed Development would not directly affect any white-tailed eagle breeding sites. However, there is the potential for some displacement of hunting birds that occasionally use the site (and which may breed in the wider surrounding area), particularly the western area.

9.8.79 Based on the available evidence, the pre-mitigation operational displacement / barrier effects on white-tailed eagle are considered to be Negligible, which is **not significant**.

Golden plover

9.8.80 The effects of wind farm operation on the distribution of breeding golden plover has been studied at a number of locations in Scotland. A wide variation in results has been reported, with some studies finding no evidence for significant operational displacement, following a short period when construction disturbance displacement effects are

[82] Humphreys, E.M., Marchant, J.H., Wilson, M.W. & Wernham, C.V. (2015). White-tailed Eagle (Haliaeetus albicilla): SWBSG Species Dossier 7. Report by BTO Scotland to SWBSG as part of Project 1403. Updated by SWBSG March 2017.
[83] Haworth, P (2015). Edinbane Windfarm: Ornithological Monitoring. A review of the spatial use of the area by birds of prey 2007–2015. Haworth Conservation Ltd.
[84] Dahl, E. L., Bevanger, K., Nygård, T., Røskaft, E. & Stokke, B. (2012). Reduced breeding success in white-tailed eagles at Smøla windfarm, western Norway, is caused by mortality and displacement. Biological Conservation 145:79–85.
[85] May, R., Nygård, T., Dahl, E. L. & Bevanger, K. (2013). Habitat utilization in white-tailed eagles (Haliaeetus albicilla) and the displacement impact of the Smøla wind-power plant. Wildlife Society Bulletin 37:75–83.
[86] Krone, O. & Treu, G. (2018). Movement Patterns of White-Tailed Sea Eagles Near Wind Turbines. The Journal of Wildlife Management, 82: 1367-1375.

apparent (e.g. Pearce-Higgins *et al*. 2012[87]), showing no apparent displacement effect at all (e.g. Douglas *et al*. 2011[88], Fielding & Haworth 2013[89]) or clear reductions in breeding density following wind farm operation (e.g. Pearce-Higgins *et al*. 2009[90], Sansom & Douglas 2014[91], Sansom 2016[92]). Pearce-Higgins *et al*. (2009)[49] analysed post-construction data from twelve wind farms and associated control sites in Scotland for a single year. Breeding golden plover density was found to decrease by 39% within 500m of wind turbines. Sansom 2016[51] found the abundance of breeding golden plover pairs was 79% lower within the wind farm area (c. 400m from the wind turbines) during post-construction compared to the pre-construction period.

9.8.81 The available evidence on the issue of breeding golden plover wind farm displacement is conflicting. However, as there are some scientifically rigorous studies (i.e. 'before-after control-intervention' designs, which attempts to control for the various confounding variables) that have shown significant operational displacement effects at some sites. Consequently, a precautionary approach to assessment is considered to appropriate, particularly given the potential for significant cumulative wind farm effects on the breeding population in Scotland (Pearce-Higgins *et al*. 2008[93], Dobson *et al*. 2015[94]).

9.8.82 On the precautionary, i.e. worst case, assumption that there is the potential for long-term displacement to affect 80% of the 19 golden plover breeding territories located within 500m of the operational Proposed Development, this would represent a loss of c. 0.6% of the NHZ 10 population.

9.8.83 Pre-mitigation operational displacement / barrier effects on golden plover are assessed to be no greater than a Low effect, resulting in a significance level of Minor in the long-term, which is **not significant**.

Dunlin

9.8.84 The available evidence indicates that this species is less vulnerable to displacement effects than golden plover. In a 14-year study of the Farr Wind Farm site in Scotland (also located within NHZ 10) there was no evidence for biologically significant declines in the distribution or number of dunlin breeding territories comparing pre-construction data to over eight years of monitoring of the operational wind farm (Fielding & Haworth 2015b[95]).

9.8.85 A multi-site comparison of the density of breeding waders at different stages of wind farm development did not find any evidence that dunlin were displaced by operational wind farms (Pearce-Higgins *et al.* 2012[47]).

[87] Pearce-Higgins, J. W., Stephen, L., Douse, A., & Langston, R. H. W. (2012). Greater impacts of wind farms on bird populations during construction than subsequent operation: results of a multi-site and multi-species analysis. Journal of Applied Ecology, 49(2), 386–394.
[88] 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.
[89] 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.
[90] Pearce-Higgins, J.W., Stephen, L., Langston, R.H.W., Bainbridge, I.P. & Bullman, R. (2009). The distribution of breeding birds around upland wind farms. Journal of Applied Ecology, 46, 1323–1331.
[91] Sansom, A. & Douglas, D. (2014). Gordonbush wind farm golden plover research project. RSPB report.
[92] Sansom, A., Pearce-Higgins, J.W., & Douglas, D. (2016). Negative impact of wind energy development on a breeding shorebird assessed with a BACI study design. Ibis, 158, 541–555.
[93] Pearce-Higgins, J.W., Stephen, L., Langston, R.H.W. & Bright, J.A. (2008). Assessing the cumulative impacts of wind farms on peatland birds: a case study of golden plover Pluvialis apricaria in Scotland. Mires and Peat, 4, 1–13.
[94] Dobson, A.D.M., Massimino, D. & Pearce-Higgins, J.W. (2015). Modelling cumulative impacts of wind farms on birds – Developing approaches and testing assumptions – Phase 1: a pilot study. SWBSG Commissioned Report no. 1500.
[95] Fielding, A.H. & Haworth, P.F. (2015b). Farr wind farm: A review of displacement disturbance on dunlin arising from operational turbines 2002-2015. Haworth Conservation Ltd., Bunessan, Isle of Mull.

9.8.86 During the 2019 breeding wader surveys for the Proposed Development, several male dunlin were recorded holding territories near to wind turbines within Stronelairg Wind Farm (which was operational at that time).

9.8.87 Based on the available evidence, the pre-mitigation operational displacement / barrier effects on breeding dunlin are assessed to be no greater than a Negligible-Low effect, resulting in a significance level of Minor in the long-term, which is **not significant**.

Greenshank

9.8.88 There appears to be a lack of published peer-reviewed studies examining the issue of operational wind farm displacement effects on greenshank. Humphreys *et al.* (2015[96]) reported that several unpublished studies at wind farms in Scotland have failed to find any evidence of a high level of behavioural displacement around wind turbines by this species. For example, pre- and post-construction monitoring data from Achany and Rosehall wind farms in Sutherland (located near to an SPA for greenshank) have failed to show any clear evidence of displacement (or collision mortality) effects on the local greenshank population (RPS 2015[97], NES 2019[98]). There are considered to be some important limitations to the available data, which need to be carefully considered in drawing wider conclusions on the assessment of potential displacement effects for other wind farm developments. However, in the absence of further and more detailed studies, it is considered appropriate to draw inferences from such monitoring data for this assessment. Anecdotally, from the observations during the construction of Stronelairg Wind Farm when several greenshank broods were observed at various locations within the construction area in 2018, also provides some indication that the population present near the Proposed Development is not particularly prone to displacement, at least during the early stages of wind farm operation. In conclusion, based on the available evidence on this issue, it is considered reasonable to assume that greenshank have a low vulnerability to operational wind farm displacement.

9.8.89 The pre-mitigation operational displacement / barrier effects on breeding greenshank are assessed to be no greater than a Negligible-Low effect, resulting in a significance level of Minor in the long-term, which is **not significant**.

Merlin

9.8.90 There appears to have been very little research on the potential displacement effects of wind farms on merlin. Jacobsen *et al*. (2019) report that about 50% of merlins approaching an offshore wind farm in the Baltic sea displayed avoidance behaviour (macro and meso-avoidance). This is based on a sample of only 14 flights. However, in comparison to other raptor species recorded during this study, this is a relatively low rate of avoidance (i.e. the lowest of all species that showed any avoidance response at all). This may be indicative of a comparatively low vulnerability to displacement, possibly reflecting the high manoeuvrability and agility that this species displays on the wing. However, it is difficult to draw any firm conclusions based on one study of an offshore

[96] Humphreys, E.M., Marchant, J.H., Wilson, M.W. & Wernham, C.V. (2015). Greenshank (Tringa nebularia): SWBSG Species Dossier 17. Report by BTO Scotland to SWBSG as part of Project 1403. Updated by SWBSG March 2017.
[97] RPS (2015). A Review of the Combined Findings of Achany and Rosehall Wind Farms Bird Monitoring 2003-2014. Greenshank: from Baseline Surveys to Post-construction Monitoring. Confidential Report to SSER.
[98] Northern Ecological Services (2019). Achany windfarm Post-construction bird monitoring - spring and summer 2019. Confidential Report to SSER.

wind farm. These results may have no relevance to the potential effects of onshore wind farms displacement effects within merlin breeding habitat.

9.8.91 Due to the absence of any breeding records within 2 km of the Proposed Development there would not be any direct displacement effect on any merlin breeding sites or core hunting ranges. There is the potential for displacement of hunting birds that occasionally use the site and may nest in the wider area. Pre-mitigation operational displacement / barrier effects on breeding merlin are assessed to be Negligible-Low, resulting in a significance level of Minor in the long-term, which is **not significant**.

Peregrine

9.8.92 There is little evidence in the scientific literature to indicate that peregrine are significantly affected by the presence of wind farms, e.g. displaced by the wind farm as a whole (macro-avoidance) or that wind farms within breeding ranges present a significant barrier to movement. However, this issue has not received much attention, in comparison to displacement effects on other raptor species of conservation concern such as golden eagle. It is therefore difficult to draw firm conclusions about the potential magnitude of this effect. Humphreys *et al.* (2015[99]), reported on a study from Colorado where the abundance of bird counts within the wind farm area was not significantly different from the abundance at reference sites, indicating a lack of evidence to support displacement of peregrine (Schmidt *et al*. 2003[100]). The Proposed Development would not have any direct displacement effect on any peregrine breeding sites and is located outside of the likely core hunting range of any pairs that breed in the wider area. There is the potential for some displacement of hunting birds that occasionally use the site and nest in the wider area.

9.8.93 Based on the available evidence, pre-mitigation operational displacement / barrier effects on peregrine are considered to be Negligible, which is **not significant**.

Summary of Pre-Mitigation Assessment

9.8.94 Table 9.15 provides a summary of the assessed pre-mitigation effect of operational displacement and barrier effects for each of the potentially affected receptors.

Table 9.15: Operational phase – pre-mitigation assessment of displacement and barrier effects (potentially significant effects highlighted in bold)

Receptor	Sensitivity	Effect	Significance level	Duration	Confidence
Monadhliath SSSI	High	Negligible	Minor	Long-term	Near-certain
Common scoter	Medium	Negligible-Low	Minor	Long-term	Near-certain
Red-throated diver	Medium	Negligible-Low	Minor	Long-term	Near-certain
Osprey	Low (Local High)	Negligible-Low	Minor	Long-term	Near-certain
Golden eagle	Medium	Negligible-Low	Minor	Long-term	Near-certain
Red kite	Low (Local High)	Negligible	Negligible	Long-term	Near-certain
White-tailed eagle	Low (Local High)	Negligible	Negligible	Long-term	Near-certain
Golden plover	Low (Local High)	Low	Minor	Long-term	Probable
Dunlin	Medium	Negligible-Low	Minor	Long-term	Probable
Greenshank	Medium	Negligible-Low	Minor	Long-term	Probable
Merlin	Low (Local High)	Negligible	Negligible	Long-term	Near-certain
Peregrine	Low (Local High)	Negligible	Negligible	Long-term	Near-certain

[99] Humphreys, E.M., Marchant, J.H., Wilson, M.W. and Wernham, C. V. (2015). Peregrine (Falco peregrinus): SWBSG Species Dossier 12. Report by BTO Scotland to SWBSG as part of Project 1403. Updated by SWBSG March 2017.

[100] Schmidt, E. Piaggio, A.J. Bock, C.E. and Armstrong, D.M. (2003). National Wind Technology Center Site Environmental Assessment: Bird and Bat Use and Fatalities - Final Report; Period of Performance: April 23, 2001 -- December 31, 2002. Work performed by University of Colorado, Boulder, Colorado. NREL/SR-500-32981.

Operational Collison Risk

9.8.95 Bird fatalities due to collisions with wind turbines has been identified as one of the key adverse impacts on wildlife from wind farm development (e.g. Drewitt and Langston 2006[101] 2008[102], Marques *et al*. 2014[103]). However, most reviews of available data from studies of wind farms in the UK and the rest of Europe have found that collisions are generally rare in wind farms that have been well-sited, and do not reach a level that is likely to result in important demographic effects, other than at the scale of local populations (e.g. Crockford 1992[104], Benner *et al.* 1993[105], Winkelman 1995[106], Erickson *et al.* 2001[107] and Hötker *et al.* 2006[108], Zwart *et al.* 2015[109], Hötker *et al.* 2017[110]).

9.8.96 The risk of collision is dependent on a wide range of factors including time of year, bird age, size and flight behaviour, degree of displacement (i.e. behavioural avoidance of the wind farm area or individual turbines), nature of the surrounding topography, habitat quality, weather, wind speed and direction, wind turbine design, layout and spacing. Some of these factors may act in combination to increase collision risk (e.g. soaring species may use topographic features to help generate lift, whilst turbines placed close to these features may increase collision risk for those species) others may interact to decrease risk (e.g. birds may avoid the wind farm as a whole resulting in a reduced potential for collisions to occur). Certain taxonomic groups are considered to be at greater risk of collision. In particular, larger, less manoeuvrable species and / or species (families, groups of species) which spend a considerable proportion of their life on the wing, for example divers, grebes, herons, wildfowl, waders, raptors, owls and grouse.

9.8.97 Other groups of birds such as passerines are also at risk of collision with wind turbine blades, however they are often present in high enough densities and have relatively high reproductive rates such that the effect of the additional mortality from turbine collision is less likely to be significant to the local population.

9.8.98 Larger birds such as raptors tend to have a lower reproductive rate than smaller species, such as passerines and waders, a longer period before first breeding and a much lower population density. Consequently, although there may not be significant differences in the susceptibility to collision with wind turbines, differences in life history, reproductive

[101] Drewitt, A.L. & Langston, R.H.W. (2006). Assessing the Impacts of Wind Farms on Birds. Ibis. 148. 29-42.
[102] Drewitt, A. L. & Langston, R.H.W. (2008). Collision effects of wind-power generators and other obstacles on birds. Annals of the New York Academy of Sciences, 1134(1): 233-266.
[103] Marques, A.T., Batalha, H., Rodrigues, S., Costa, H., Ramos Pereira, M.J., Fonseca, C., Mascarenhas, M., Bernardino, J. (2014). Understanding bird collisions at wind farms: An updated review on the causes and possible mitigation strategies, Biological Conservation, Volume 179, Pages 40-52.
[104] Crockford, N.J. (1992). A review of the possible impacts of windfarms on birds and other wildlife. JNCC Report No. 27. pp. 60, JNCC, Peterborough.
[105] Benner, J.H.B., Berkhuizen, J.C., de Graaf, R.J. and Postma, A.D. (1993). Impact of wind turbines on birdlife. Report no. 9247. Consultants on Energy and the Environment, Rotterdam, The Netherlands.
[106] Winkelman, J. E. (1995). Bird / wind turbine investigations in Europe. Pages 43-47 and 110-120 in LGL Ltd., environmental research associates, Ed. Proceedings of the National Avian-Wind Power Planning Meeting, Lakewood, Colorado. National Renewable Energy Laboratory, Golden, Colorado.
[107] Erickson, W. P., G. D. Johnson, M. D. Strickland, D. P. Young, Jr., K. J. Sernka, and R. E. Good. (2001). Avian collisions with wind turbines: A summary of existing studies and comparisons to other sources of avian collision mortality in the United States. National Wind Coordinating Committee, c/o RESOLVE, Inc., Washington, D.C.
[108] Hötker, H., Thomsen, K.-M. and Jeromin, H. (2006). Impacts on Biodiversity of Exploitation of Renewable Energy Sources: The Example of Birds and Bats – Facts, Gaps in Knowledge, Demands for Further Research, and Ornithological Guidelines for the Development of Renewable Energy Exploitation. Michael-Otto-Institut im NABU, Bergenhusen, Germany.
[109] Zwart, M.C., Robson, P., Rankin, S., Whittingham, M.J., & McGowan, P. J. K. (2015). Using environmental impact assessment and post-construction monitoring data to inform wind energy developments. Ecosphere 6(2):26.
[110] Hötker, H., Krone, O., & Nehls, G. (2017). Birds of Prey and Wind Farms: Analysis of Problems and Possible Solutions. Springer International Publishing.

strategy and population status can result in marked differences in the potential 'vulnerability' of different species to additional mortality from wind farms.

9.8.99 The risk of collision is also influenced by wind farm site location. For example, wind farms sited near to migratory routes, particularly where there is a 'bottleneck' effect caused by the surrounding topography, migration staging areas, flyways between roosting and feeding areas or anywhere where high numbers of birds may congregate, for instance where there is a high concentration of food supply, are often the most hazardous to birds.

9.8.100 The size of the wind turbine also influences collision risk, with larger turbines being associated with higher collision rates, as the volume of air swept by the turbine blades generally increases with capacity of the turbine. However, the general pattern, in relation to bird mortality, is for wind farms comprising fewer and larger turbines to result in lower collision rates overall in comparison to wind farms, of a similar electricity generation capacity, with more numerous, smaller wind turbines (Thaxter *et al*. 2017[111]). The overall collision risk per megawatt generated at the wind farm scale generally decreases with increasing turbine size (Hötker *et al*. 2006[112]). The spatial arrangement of wind farms can also have an important influence on collision risk. There is evidence that some collision susceptible species show macro-avoidance of wind farms as a whole, rather than individual wind turbines and that peripheral turbines are a greater hazard for some species (e.g. white-tailed eagle at Smøla wind farm). Therefore, as is the case with the Proposed Development, siting new wind farms adjacent to existing ones is, in general terms, likely to result in a lower collision hazard to birds (i.e. help to reduce collisions rates per turbine) in comparison to more widely spaced smaller groupings or individual wind turbines (Rasan & Dürr 2017[113])

Collision risk modelling results

9.8.101 Table 9.16 below gives the estimated number of collisions per year for each relevant species, the estimated total number of collisions over a 50-year lifetime of the Proposed Development and the estimated rate of collision (further details are provided in Technical Appendix 9.2: 'Collision Risk Modelling Report'). Species-specific assumed collision avoidance rates follow current SNH guidance (Avoidance Rates for the onshore SNH Wind Farm Collision Risk Model, September 2018). Species with only a single flight within the collision risk height band across the wind farm during the survey period have not been included in the analysis.

[111] Thaxter, C. B., Buchanan, G. M., Carr, J., Butchart, S. H. M., Newbold, T., Green, R. E., Tobias, J.A., Foden, W.B., O'Brien, S. & Pearce-Higgins, J. W. (2017). Bird and bat species' global vulnerability to collision mortality at wind farms revealed through a trait-based assessment. Proceedings of the Royal Society B: Biological Sciences, 284(1862),

[112] Hötker H, Thomsen K-M, Jeromin H (2006) Impacts on biodiversity of exploitation of renewable energy sources: the example of birds and bats – facts, gaps of knowledge, demands for further research, and ornithological guidelines for the development of renewable energy exploitation. Michael-Otto-Institut im NABU, Bergenhusen.

[113] Rasran, L., & Dürr, T. (2017). Collisions of Birds of Prey with Wind Turbines - Analysis of the Circumstances. Birds of Prey and Wind Farms, 259–282.

Table 9.16: Summary results of the collision risk model results – peak annual collisions estimated for target species at the assumed avoidance rates.

Species	Avoidance Rate (%)	West Collisions / year	East Collisions / year	Totals	
				Collisions over 50 years	Years between collisions
Osprey	98	0.04	0.01	2.36	21.19
Golden Eagle (All)	99	0.10	0.08	8.95	5.59
Golden Eagle (Juv.)	99	0.07	0.01	3.97	12.59
Golden Eagle (Sub-ad/ Ad.)	99	0.03	0.07	4.98	10.04
Red Kite	99	0.01	0.07	3.83	13.05
White-tailed Eagle	95	0.14	0.03	8.35	5.99
Golden Plover	98	0.01	~	0.55	91.68
Merlin	98	0.02	~	1.04	48.24
Peregrine	98	0.03	0.02	2.18	22.94

Common scoter

9.8.102 Common scoters are considered to be potentially vulnerable to collision with turbines when making flights between waterbodies, including flights during low visibility conditions (e.g. dawn/dusk). There has been one reported wind farm collision fatality, from incidental monitoring, at a site in the Netherlands (Dürr 2019[114]). As a relatively long-lived species, with low annual productivity and a small breeding population in Scotland, this increases the risk of population level effects, particularly when considering the potential for cumulative impact.

9.8.103 The results of the flight activity surveys, and the separation of the Proposed Development from the known breeding sites present in the wider area, indicate the that risk to this species from collision mortality is likely to be low.

9.8.104 Based on the available evidence, pre-mitigation operational collision mortality effects on breeding common scoter are conservatively assessed to be Negligible-Low, resulting in a significance level of Minor in the long-term, which is **not significant.**

Red-throated diver

9.8.105 Red-throated divers are considered to be morphologically and behaviourally vulnerable to collision with overhead lines and wind turbines (Bright *et al*. 2008[9], Humphreys *et al*. 2017[12]). As a relatively long-lived species, with low annual productivity, and a small breeding population size, on a precautionary basis it is assumed that there is risk of population level effects occurring. However, no divers have been reported as collision fatalities at any terrestrial windfarms within their breeding range in Scotland, Norway, Sweden, Finland or North America (Furness 2015[8]). There is one record, from incidental reporting, of a fatality at a wind farm in Germany (Dürr 2019[106]). Breeding red-throated diver commuting flight corridors are often avoided during the wind farm design process.

[114] Dürr, T. (2019). Vogelverluste an Windenergieanlagen (bird fatalities at wind turbines in Europe). Data collected from the central archives of Brandenburg State Office for the Environment (dated 7 January 2019).

As there also appears to be a strong displacement effect from operational wind turbines, this reduces the risk of collision mortality. SNH currently recommends an assumed avoidance rate of 99.5% for red-throated diver when using the Band CRM (SNH 2018[6]).

9.8.106 The results of the flight activity surveys, and the separation of the Proposed Development from the known breeding sites present in the wider area, indicate the that risk to this species from collision mortality is likely to be low.

9.8.107 Based on the available evidence, pre-mitigation operational collision mortality effects on breeding red-throated diver are conservatively assessed to be Negligible-Low, resulting in a significance level of Minor in the long-term, which is **not significant.**

Osprey

9.8.108 Osprey is at risk of collision with onshore wind turbines. There have been several reports of collision fatalities at wind farms in Scotland and a total of 38 incidental reports for the rest of Europe, including wind farms in Germany, Spain, France and Poland (Dürr 2019[5]). Proximity of wind farms to regularly used commuting routes and fishing lochs is likely to place this species within the collision risk zone during a high proportion of flights. In Germany the recommended minimum distance of wind turbines to osprey breeding sites is 1km (LAG VSW 2015[115]). Ospreys may range large distances from their nest sites to hunt (e.g. core range of 10km, some regular foraging up to 20km, SNH 2016[116]), such that several breeding pairs could be affected by one wind farm if it is located near to an important fishing loch or commuting route.

9.8.109 The results of the flight activity surveys, and the separation of the Proposed Development from the known breeding sites present in the wider area, indicate the that risk to this species from collision mortality is likely to be low. The collision risk modelling generated an estimate of 0.05 collisions per year, which equates to 2.36 over the 50-year lifetime of the Proposed Development. This level of additional annual mortality is considered to be insignificant at the national or regional population scale.

9.8.110 Based on the available evidence, pre-mitigation operational collision mortality effects on osprey are conservatively assessed to be Low, resulting in a significance level of Minor in the long-term, which is **not significant.**

Golden eagle

9.8.111 Golden eagles are potentially vulnerable to collision with wind turbines during display flights, interactions with other eagles, mobbing intruders, when hunting and moving between favoured hunting areas and nest / roost sites. However, there have been few confirmed reports of golden eagle collisions at onshore wind farms in Scotland. This is in contrast to very high numbers of collision fatalities recorded at certain wind farms in North America and a total of 22 reported incidents in mainland Europe, including wind farm sites in Spain, Norway and Sweden (Dürr 2019[5]). SNH currently recommends an assumed avoidance rate of 99% for golden eagle when using the Band CRM (SNH 2018[6]),

9.8.112 As a long-lived, relatively scarce raptor with a low reproductive rate, additive collision mortality could result in significant effects on population dynamics. Particularly if the population is already under pressure from other sources of mortality, such as human persecution / illegal killing. However, displacement effects, particularly in relation to

[115] Working Group of German State Bird Conservancies (Länderarbeitsgemeinschaft der Vogelschutzwarten LAG VSW) Recommendations for distances of wind turbines to important areas for birds as well as breeding sites of selected bird species (April 2015).
[116] SNH (2016). Assessing Connectivity with Special Protection Areas (SPAs) Guidance, Version 3 – June 2016.

territorial birds, appear to be the more important potential impact from operational wind farms on this species in Scotland (see above).

9.8.113 The separation of the Proposed Development from the known breeding sites present in the wider area and the alterations to the design of the wind farm to avoid placing turbines in locations that may attract relatively high levels of golden eagle activity has reduced the risk to this species. The collision risk model generated an estimate of 0.18 collisions per year, which equates to 8.95 over the 50-year lifetime of the Proposed Development. However, a high proportion of the golden eagle flight activity within the flight risk areas was by juvenile (i.e. assumed non-breeding) birds, so this additional mortality would not be borne by the breeding population alone. Additionally, evidence from extensive satellite tracking of young and adult birds indicates that all golden eagles currently display a consistently high macro-avoidance of wind farms in Scotland (see previous discussion on displacement effects for this species). Consequently, the risk of the predicted collision rate actually occurring is considered to be very low.

9.8.114 Based on the available evidence, pre-mitigation operational collision mortality effects on golden eagle are conservatively assessed to be Negligible-Low, resulting in a significance level of Minor in the long-term, which is **not significant.**

Red kite

9.8.115 Red kites are vulnerable to collision as they spend a lot of time hunting or searching for carrion as well as displaying and soaring, at a height that is similar to the typical turbine blade swept zone. There have been 530 reported incidents since 2002, the majority of which have been from wind farms in Germany (Dürr 2019[5]). The risk of red kite collision is considered to be highest at wind turbines located within 1,500m of a nest (Hötker *et al*. 2013[117], LAG VSW 2015[16]). Significant effects from wind farm mortality on juvenile and adult survival rates in Germany, at the national population level, have been predicted as a result of the continuing expansion of onshore wind farm development (Busch *et al*. 2017[118], Katzenberger 2019[119]). One wind farm in Scotland has reported 3 fatalities (Duffy & Urquhart 2014[24]).

9.8.116 The situation in Scotland is slightly different to mainland Europe as the population, whilst gradually expanding in most locations, remains relatively restricted to areas around the four re-introduction sites. There is much less overlap between the current distribution of the species and operational wind farms. However, this is likely to change in the future as the population grows, along with the ongoing expansion of onshore wind farms. A population viability analysis was carried out in 2016 for the North Scotland area due to concerns about the long-term status of this population from the effects of illegal killing (primarily poisoning). This is the closest red kite population to the Proposed Development. The analysis determined that a relatively small increase in mortality from wind farm development could result in significant demographic effects (Sansom 2016[120]). When the number of red kite wind farm fatalities increased to ten per year, the modelled

[117] Hötker, H., Krone, O. & Nehls, G. (2013). Greifvögel und Windkraftanlagen: Problemanalyse und Lösungsvorschläge. Schlussbericht für das Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit. Michael-Otto-Institut im NABU, Leibniz-Institut für Zoo- und Wildtierforschung, BioConsult SH, Bergenhusen, Berlin, Husum.

[118] Busch, M., Trautmann, S., Gerlach, B. (2017). Overlap between breeding season distribution and wind farm risks: a spatial approach. Vogelwelt 137:169–180.

[119] Katzenberger, J., Gottschalk, E., Balkenhol, N., & Waltert, M. (2019). Long-term decline of juvenile survival in German Red Kites. Journal of Ornithology.

[120] Sansom, A., Etheridge, B., Smart, J. & Roos, S. (2016). Population modelling of North Scotland red kites in relation to the cumulative impacts of wildlife crime and wind farm mortality. Scottish Natural Heritage Commissioned Report No. 904.

reduction in growth rate in comparison to the baseline scenario led to a predicted population decrease of 280 pairs by 2044. Potential cumulative effects with illegal killing would mean that a lower level of wind turbine mortality could result in a similar outcome. However, illegal killing was still considered the main factor limiting growth of the North Scotland population (Sansom 2016[30]).

9.8.117 The Proposed Development is not within 1.5km of any known nest sites. The collision risk model generated an estimate of 0.08 collisions per year, which equates to 3.83 over the 50-year lifetime of the Proposed Development. This level of additional annual mortality is considered to be insignificant at the national or regional population scale.

9.8.118 Based on the available evidence, pre-mitigation operational collision mortality effects on red kite are conservatively assessed to be Low, resulting in a significance level of Minor in the long-term, which is **not significant.**

White-tailed eagle

9.8.119 Since 2002 a total of 321 white-tailed eagles have been reported killed in collisions with wind turbines in mainland Europe, mostly at wind farms in Germany, Norway and Sweden (Dürr 2019[5]). At least two fatalities have been reported from wind farms in Scotland. The species high vulnerability to collision is thought to be related to flight behaviour, with a large amount of recorded activity at wind farm site at the blade sweep height (Hötker *et al*. 2013[27]).

9.8.120 Certain wind farm sites have been responsible for a high proportion of the total number of turbine fatalities reported in Europe. A long-term study at Smøla wind farm in Norway has included carcase searches and recording of collisions. This wind farm overlaps with an area that supports very high densities of breeding white-tailed eagles. Various studies at Smøla have reported very high collision rates with a large percentage being adult birds (May *et al*. 2013[32]). Although many of the adults killed were not thought to have been part of the local breeding population (Dahl 2012[121]). Between 2005 and 2016 a total of 75 white-tailed eagles were found dead at Smøla wind farm (Dürr 2019[5]). Comprising 30 adults, 27 sub-adults, 2 juveniles and 16 of undetermined age. A high proportion of recorded fatalities were during the spring and associated with increased territorial activity, potentially reducing the bird's awareness of the turbine blades (Nygård *et al*. 2010[122]).

9.8.121 Although very few white-tailed eagle fatalities have so far been reported at wind farms in Scotland the frequency of collisions is likely to increase in the future as the population, primarily associated with the western Isles and western seaboard, expands east into areas where wind farms are more prevalent. A population and range modelling study published in 2016 considered the potential impacts of illegal killing and renewable energy development on the Scottish white-tailed eagle population (Sansom *et al*. 2016[123]). It concluded that such sources of additional mortality would hinder population growth but should not result in population declines, in the medium-term at least.

9.8.122 The Proposed Development is not located close to any known nest sites but may occasionally be used for hunting by adults associated with a known breeding pair present

[121] Dahl, E.L., Bevanger, K., Nygård, T., Røskaft, E., Stokke, B.G. (2012). Reduced breeding success in white-tailed eagles at Smøla windfarm, western Norway, is caused by mortality and displacement. Biological Conservation 145, 79-85.

[122] Nygård, T., Bevanger, K., Dahl, E.L., Flagsted, Ø., Follestad, A., Hoel, P.H., May, R. & Reitan, O. (2010). A study of White-tailed Eagle movements and mortality at a wind farm in Norway. BOU Proceedings – Climate Change and Birds.

[123] Sansom, A., Evans, R. & Roos, S. (2016). Population and future range modelling of reintroduced Scottish white-tailed eagles (Haliaeetus albicilla). Scottish Natural Heritage Commissioned Report No. 898.

in the surrounding area. The collision risk model generated an estimate of 0.17 collisions per year for white-tailed eagle, which equates to 8.35 over the 50-year lifetime of the Proposed Development. This level of additional annual mortality is not considered to be significant at the national population scale but could affect breeding success for the small and expanding population within the region, if a high proportion of the predicted mortality were to affect territory holding adult birds.

9.8.123 Based on the available evidence, pre-mitigation operational collision mortality effects on white-tailed eagle are conservatively assessed to be Low, resulting in a significance level of Minor in the long-term, which is **not significant.**

Golden plover

9.8.124 Breeding golden plover are potentially vulnerable to collision with turbines, particularly during display flights and commuting between breeding and feeding areas, which may occur at night. During passage periods and in the winter, the flight altitude of golden plover flocks may also place them at risk of collision with turbine blades.

9.8.125 There have been no reported collisions of golden plover at UK wind farms to date. A total of 39 collision fatalities have been reported from wind farms in mainland Europe including sites in Germany, Spain, Netherlands and Norway (Dürr 2019[5]). Whilst this may indicate that the inherent risk is low, given the European population size, golden plover is a relatively small bird and carcases are likely to go un-noticed unless systematic searches are carried out. The apparent vulnerability to displacement effects also indicates that collision risk may be relatively low for this species. However, taking a precautionary approach golden plover is assumed to have a moderate vulnerability to wind turbine collision.

9.8.126 The collision risk model generated an estimate of 0.01 collisions per year for golden plover, which equates to 0.55 over the 50-year lifetime of the Proposed Development. However, this is likely to be a large underestimate of the actual risk due to the detection distance for this species being much lower than the standard 2km wide vantage point viewshed, resulting in under-recording of flight activity.

9.8.127 Based on the available evidence, pre-mitigation operational collision mortality effects on golden plover are conservatively assessed to be Negligible-Low, resulting in a significance level of Minor in the long-term, which is **not significant.**

Dunlin

9.8.128 Dunlins are considered to be at risk of collision with wind turbines during their song flights when the birds can rise to 50m above ground, which the males are typically carry out repetitively early in the breeding season (Cramp & Simmons 1983[124]). There have been four reported incidents of dunlin collision fatalities at wind farms in mainland Europe, three in Germany and one in the Netherlands (Dürr 2019). To date there have been no reported collisions of dunlin at wind farms in the UK. However, as a small species with cryptic colouration they are unlikely to be recorded apart from during systematic carcase searches. In the absence of evidence, it is assumed that they are at least moderately vulnerable to collision with wind turbines.

[124] Cramp, S. & Simmons, K.E.L. (1983). Handbook of the Birds of Europe, the Middle East and North Africa. The Birds of the Western Palearctic. Vol III. Waders to Gulls, Oxford University Press, Oxford.

9.8.129 Dunlin was not recorded during the flight activity survey but this is likely to be due to the short detection distance for this species, resulting in under-recording of flight activity.

9.8.130 Based on the available evidence, pre-mitigation operational collision mortality effects on dunlin are conservatively assessed to be Negligible-Low, resulting in a significance level of Minor in the long-term, which is **not significant.**

Greenshank

9.8.131 Greenshank are considered to be at potential risk of collision with wind turbines during breeding display flights that may last for several hours in areas with high breeding population densities. Males display regularly early in the breeding season, defending mating territories, and may interact with other males and females in flight, with chases occurring over long-distances. Display activity also occurs at nesting territories, which can be some distance from their courtship areas. Greenshank are also at risk of collision when commuting to and from nest sites and foraging areas. Females tend to incubate more during the day and males at night (Nethersole-Thompson 1979[125], Cramp & Simmonds 1983[57]). Consequently, flights between nesting and foraging areas may also be more concentrated around dawn and dusk, during the incubation period, which is likely to lead to under-recording during normal flight activity surveys. Following hatching the chicks (which are precocial) are led by the parent birds towards suitable chick-rearing habitats, which can be several kilometres from the nest site. Adults may also continue to display at areas used for chick-rearing (Nethersole-Thompson 1979[61], Cramp & Simmonds 1983[57], Pendlebury 2011[126]).

9.8.132 There have been no reported collisions of greenshank with wind turbines in Scotland or the rest of Europe (Dürr 2019[5]). However, collision incidents are likely to go undetected due to the relatively small size and cryptic colouration of the species. Humphreys *et al*. (2015[60]) reported that information on flight heights, from surveys for various wind farms in Scotland, indicated that at least a third of recorded greenshank flights occur within the typical rotor-swept zone (Furness & Trinder 2016[127]). However, this data included display flights, which are more likely to be within the collision risk zone than typical commuting flights. Information available from wind farm monitoring studies in Scotland (e.g. Rosehall and Achany 2003-2019) indicate that this is species is apparently not particularly vulnerable to collision mortality. Although, it is accepted that the available data on this issue is limited and that a precautionary approach to the assessment is warranted.

9.8.133 The confirmed breeding territory, associated with the western survey area, has been considered in the design of the wind farm. The initial layout of the wind turbines has been altered to avoid the area. The layout of the eastern cluster also avoids the locations where greenshank have been reported from other surveys. There was no evidence from the 2019 surveys of any other display areas or regular communing flights anywhere else within the western (or eastern) survey areas. No nesting territories were recorded within the survey area in 2019. The lack of any evidence for nesting, and chick-rearing territory display activity, is potentially consistent with a low density breeding population, where display activity is less frequently elicited. It is also possible that the 2019 breeding pair failed early in the season or that the nesting and chick-rearing areas were located outside

[125] Nethersole-Thompson, D. & Nethersole-Thompson, M. (1979). Greenshanks. T & AD Poyser, Berkhamsted.
[126] Pendlebury, C., Zisman, S., Walls, R., Sweeney, J., McLoughlin, E., Robinson, C., Turner, L. & Loughrey, J. (2011). Literatur e review to assess bird species connectivity to Special Protection Areas. Scottish Natural Heritage Commissioned Report No. 390.
[127] Furness, R.W. & Trinder, M. (2016). Greenshank collision mortality estimate based on ecological and behavioural studies. Scottish Natural Heritage Commissioned Report No. 893.

of the survey area. However, it is also recognised that commuting flight activity may have been missed, either due to the distance of the birds from the VP locations, or the timing of the watches relative to the peak periods of dawn/dusk activity. It is also possible that commuting flight activity did occur within the survey area (e.g. between nesting and preferred foraging areas) but that the birds tended to fly relatively low, possibly in valleys between waterbodies and along watercourses, which would have screened flights from many of the VPs. If this is the case, then the placement of the proposed wind turbines away from waterbodies and watercourses should also help to reduce the collision risk to this species.

9.8.134 Based on the available evidence, and taking a precautionary approach with respect to the uncertainties about potential inter-annual variation in flight activity near to the Proposed Development, the operational collision mortality effects on greenshank are conservatively assessed to be Low, resulting in a significance level of Minor in the long-term, which is **not significant.**

Merlin

9.8.135 Breeding merlin are potentially vulnerable to collision with turbines when displaying and in aerial interactions with conspecifics and other intruders. There have been at least two reported merlin fatalities at wind farms in Britain, both in Scotland (Humphreys *et al*. 2015[128]). Since 2002, a total of four collision-related merlin fatalities have been reported from wind farms in mainland Europe, including sites in Germany, Spain and Norway (Dürr 2019). Merlin appear to have a comparatively low vulnerability of collision with wind turbines. However, their small size and cryptic colouration means that collision incidents are likely to go un-noticed, particularly at sites where systematic carcase searches are not being carried out.

9.8.136 The collision risk model generated an estimate of 0.02 collisions per year for merlin, which equates to 1.04 over the 50-year lifetime of the Proposed Development. This level of additional annual mortality is considered to be insignificant at the national or regional population scale. However, it is likely to be an underestimate of the actual risk due to the detection distance for this species being much lower than the standard 2km wide vantage point viewshed resulting in under-recording of flight activity.

9.8.137 Based on the available evidence, pre-mitigation operational collision mortality effects on merlin are conservatively assessed to be Low, resulting in a significance level of Minor in the long-term, which is **not significant.**

Peregrine

9.8.138 Breeding birds potentially vulnerable to collision with turbines when displaying, mobbing avian intruders and hunting. Post-construction monitoring records show there has been a minimum of four collision mortalities with wind turbines recorded for peregrine in Britain (Humphreys *et al*. 2015), all of which occurred in Scotland. A total of 29 collision fatalities have been reported for peregrine, on a mostly incidental basis, at 15 wind farm developments across 5 European countries, not including the UK (Dürr 2019).

9.8.139 Peregrine flight speed and hunting behaviour, where they can be intently focused on the pursuit of other birds as prey with dramatic high speed 'stooping' attacks from above,

[128] Humphreys, E.M., Marchant, J.H., Wilson, M.W. & Wernham, C.V. (2015). Merlin (Falco columbarius): SWBSG Species Dossier 11. Report by BTO Scotland to SWBSG as part of Project 1403. Updated by SWBSG March 2017.

may place them at some increased risk of collision with turbines. Peregrine typically hunt over open ground or water away from woodland and woodland edge with the majority of prey taken on the wing (Cramp & Simmons 1988, Ratcliffe 1993). Proximity of wind turbines to nest sites also increases the risk of collision to recently-fledged young, particularly during practice flights.

9.8.140 Unlike other raptors, such as golden eagle, there appears to be little evidence for a behavioural displacement effect from operating wind farms (i.e. birds avoiding wind farms as a whole and thereby reducing the risk of collision).

9.8.141 The collision risk model generated an estimate of 0.05 collisions per year for peregrine, which equates to 2.18 over the 50-year lifetime of the Proposed Development. This level of additional mortality is considered to be insignificant at the national or regional population scale.

9.8.142 Based on the available evidence, pre-mitigation operational collision mortality effects on peregrine are conservatively assessed to be Negligible-Low, resulting in a significance level of Minor in the long-term, which is **not significant.**

Summary of pre-mitigation assessment

9.8.143 Table 9.17 provides a summary of the assessed pre-mitigation effect of collision mortality for each of the potentially affected receptors.

Table 9.17: Operation phase – pre-mitigation assessment of collision risk from wind turbines (potentially significant effects highlighted in bold)

Receptor	Sensitivity (whole Site)	Effect	Significance level	Duration	Confidence
Monadhliath SSSI	High	Negligible	Minor	Long-term	Near-certain
Common scoter	Medium	Negligible-Low	Minor	Long-term	Near-certain
Red-throated diver	Medium	Negligible-Low	Minor	Long-term	Near-certain
Osprey	Low (Local High)	Low	Minor	Long-term	Near-certain
Golden eagle	Medium	Negligible-Low	Minor	Long-term	Near-certain
Red kite	Low (Local High)	Low	Minor	Long-term	Near-certain
White-tailed eagle	Low (Local High)	Low	Minor	Long-term	Near-certain
Golden plover	Low (Local High)	Negligible-Low	Minor	Long-term	Near-certain
Dunlin	Medium	Negligible-Low	Minor	Long-term	Near-certain
Greenshank	Medium	Low	Minor	Long-term	Probable
Merlin	Low (Local High)	Low	Minor	Long-term	Near-certain
Peregrine	Low (Local High)	Negligible-Low	Minor	Long-term	Near-certain

Operational Disturbance from Maintenance Activities

9.8.144 The wind turbines would require periodic routine maintenance and occasionally there may be the need to replace large components such as rotor blades. Consequently, the amount of potential disturbance would vary depending on the scale, duration and timing of the maintenance activities. However, it is reasonable to assume that disturbance from such activities during the operation of the Proposed Development would be significantly lower than that which could occur during the construction phase.

9.8.145 Assuming that maintenance works are carried out at the least favourable time for birds during the breeding season, this effect has been assessed as no greater than negligible-low for any receptor, resulting in an effect significance level of not greater than minor, and **not significant** for all receptor species.

9.8.146 Table 9.18 provides the assessed pre-mitigation effect magnitude and effect level for each of the potentially affected receptors.

Table 9.18: Operation phase – pre-mitigation assessment of disturbance from maintenance activities (potentially significant effects highlighted in bold)

Receptor	Sensitivity (whole Site)	Effect	Significance level	Duration	Confidence
Monadhliath SSSI	High	Negligible	Minor	Short-term	Near-certain
Common scoter	Medium	Negligible-Low	Minor	Short-term	Near-certain
Red-throated diver	Medium	Negligible-Low	Minor	Short-term	Near-certain
Osprey	Low (Local High)	Negligible	Negligible	Short-term	Near-certain
Golden eagle	Medium	Negligible-Low	Minor	Short-term	Near-certain
Red kite	Low (Local High)	Negligible	Negligible	Short-term	Near-certain
White-tailed eagle	Low (Local High)	Negligible	Negligible	Short-term	Near-certain
Golden plover	Low (Local High)	Negligible-Low	Minor	Short-term	Near-certain
Dunlin	Medium	Negligible-Low	Minor	Short-term	Near-certain
Greenshank	Medium	Negligible-Low	Minor	Short-term	Near-certain
Merlin	Low (Local High)	Negligible	Negligible	Short-term	Near-certain
Peregrine	Low (Local High)	Negligible	Negligible	Short-term	Near-certain

Decommissioning Effects

Disturbance during decommissioning

9.8.147 Works associated with the decommissioning of the Proposed Development have the potential to disturb breeding and wintering birds. The exact timing of this work (approximately 50 years after the Proposed Development is operational), relative to the more sensitive periods of the year for breeding birds, is not known at this time; it has therefore been assumed that work may occur at the least favourable time relative to the relevant receptors.

9.8.148 Broadly similar potential sources of disturbance and effects on birds to the construction phase could arise during the decommissioning works. These effects are discussed in the previous section and are therefore not repeated here; however, it is likely that the duration and intensity of works would be less than that required during the construction phase.

9.8.149 A summary of potential decommissioning phase disturbance effects for each receptor, prior to mitigation, is given in Table 9.19 below.

Table 9.19: Decommissioning phase – pre-mitigation assessment of disturbance effects (potentially significant effects highlighted in bold)

Receptor	Sensitivity (whole Site)	Effect	Significance level	Duration	Confidence
Monadhliath SSSI	High	Negligible	Minor	Short-term	Near-certain
Common scoter	Medium	Negligible-Low	Minor	Short-term	Near-certain
Red-throated diver	Medium	Negligible-Low	Minor	Short-term	Near-certain
Osprey	Low (Local High)	Negligible	Negligible	Short-term	Near-certain
Golden eagle	Medium	Negligible-Low	Minor	Short-term	Near-certain
Red kite	Low (Local High)	Negligible	Negligible	Short-term	Near-certain
White-tailed eagle	Low (Local High)	Negligible	Negligible	Short-term	Near-certain
Golden plover	Low (Local High)	Negligible-Low	Minor	Short-term	Near-certain
Dunlin	Medium	Negligible-Low	Minor	Short-term	Near-certain
Greenshank	Medium	Negligible-Low	Minor	Short-term	Near-certain
Merlin	Low (Local High)	Negligible	Negligible	Short-term	Near-certain
Peregrine	Low (Local High)	Negligible	Negligible	Short-term	Near-certain

9.8.150 The decommissioning of the Proposed Development would have a positive benefit in terms of removing the potential collision risk. Habitat reinstatement would be decided in consultation with the statutory authorities at the time of decommissioning. Disturbance effects due to decommissioning would last no longer than 12 months. Apart from the shorter duration, the effects on birds would be similar to those during construction.

9.8.151 There will likely be disturbance to birds arising from decommissioning works. Assuming the least favourable timing of the works, the effect of the removal of the wind turbines, sub-station and associated infrastructure has the potential to result in effect significance levels of minor and **not significant** for all receptors. However, the effects should be restricted to the short-term, one breeding season only and would not be of the same potential scale as the construction effects.

9.9 Mitigation & Best Practice

Design Mitigation

9.9.1 The layout of the Proposed Development has been informed by a constraints assessment related to certain key receptors including breeding golden eagle and greenshank. Regularly used breeding locations have been mapped as constraints on the wind farm design and protected by set-back zones. Additionally, PAT and GET modelling methods have been used, in combination with the rests from the baseline surveys, to avoid areas of importance to hunting and ranging golden eagle. Further detail is provided in Technical Appendix 9.2 and the Confidential Annex.

Construction Disturbance

9.9.2 The following section provides a summary of the proposed best-practice measures which would help to further reduce potential effects on all receptors and help ensure that the proposed works proceed lawfully with respect to the legal protections. An outline BPP, which further details the proposed approach to minimising effects on breeding birds during the wind farm construction works, is provided in Technical Appendix 9.4.

<u>General Bird Protection Measures</u>

9.9.3 Pre-construction breeding raptor surveys, completed by suitably experienced ornithologists, are proposed in order to help inform the approach to the construction works associated with the Proposed Development so that breeding Schedule 1 species (e.g. golden eagle, merlin, red throated diver, common scoter and greenshank) active nest sites are protected and would not be disturbed by construction works, including vehicle movements along the main access track, during the breeding season.

9.9.4 In the spring / summer prior to any construction works being undertaken (including enabling works and ground investigations) surveys would be undertaken to identify any Schedule 1 species breeding activity and to demarcate areas potentially sensitive to disturbance. The Applicant would appoint a suitably experienced ECoW to oversee the works and help ensure that suitable protection zones are established and adhered to during the works. Species and site-specific buffer zones, following current best practice, would be established, appropriate to the specific circumstances, under the advice of a suitably experienced ornithologist.

9.9.5 In addition to the pre-construction surveys for Schedule 1 bird species, all works areas would be checked by a suitably experienced ecologist/ornithologist or the ECoW for the

presence of any nesting birds in advance of works commencing during the main bird breeding season. Should any active nest sites be found in areas where construction works are proposed, the location of the nest would be protected from damage and disturbance.

9.9.6 All works would be monitored by a suitably experienced ecologist / ornithologist or the ECoW to help ensure that protection measures are properly implemented and maintained and that works proceed in accordance with best practice and the requirements of the legislation protecting breeding birds. The ECoW would provide a toolbox talk before any personnel start on site which will cover the issue of breeding birds, their legal protections, what to look for and what to do should breeding bird behaviour or a potential nest site be found.

Black Grouse

9.9.7 Surveys for black grouse along the main access track would be undertaken in the Spring prior to works commencing, at which point the need for further monitoring would be reviewed.

9.9.8 A species protection plan for black grouse would be implemented, similarly to the approach that was agreed for the construction of Stronelairg Wind Farm, so that potential effects on lekking black grouse present near to the main access track is minimised during the peak spring lekking period.

Operational Monitoring & Habitat Management

Breeding Bird Surveys & Monitoring

9.9.9 A detailed breeding bird monitoring plan would be developed, in consultation with SNH, at least 12 months prior to the start of construction works.

9.9.10 The monitoring plan would detail survey methods, and the reporting mechanism, for each species listed in Table 9.2. The surveys would be completed by suitably experienced ornithologists.

9.9.11 General breeding bird surveys would start (as a minimum) in the breeding season prior to works commencing and for at least the first ten years of wind farm operation (i.e. annually for the first three years, then fifth and tenth years). At which point the need for further monitoring would be reviewed. The surveys would include the Proposed Development Area and appropriate buffer zones, including the surrounding golden eagle territories (i.e. within 6km of the Proposed Development) and the Glendoe Lochans SSSI area.

9.9.12 Surveys for breeding greenshank, following the methods detailed in Hancock *et al*. 1997, would be completed in at least one breeding season prior to construction works commencing. The survey would also include suitable methods to quantify flight activity.

9.9.13 Annual surveys for golden eagle would continue for the life-time of the wind farm and would include continuing to gather data on golden eagle breeding success and productivity.

9.9.14 Surveys for golden eagle, white-tailed eagle, common scoter, Slavonian grebe and red-throated diver would be co-ordinated with the RSPB, HRSG and the RECMP project officer to avoid any unnecessary duplication and disturbance.

Bird Carcase Monitoring

9.9.15 Systematic bird carcass searches would be completed annually for three years after the wind farm becomes operational and then in the fifth and tenth years. The searches would be within a 50m radius area of each turbine and would be completed on a monthly basis. The monitoring would be preceded by trails to determine values for site-specific biases that affect estimates of bird mortality, such as scavenger removal rates and search accuracy.

Breeding Eagle Protection & Conservation

9.9.16 The potential effects of the Proposed Development on golden eagle and white-tailed eagle, in particular, would be monitored as part of the pre- and post-construction breeding bird surveys (see above).

9.9.17 It is also proposed that the measures undertaken for Stronelairg Wind Farm to reduce the risk to golden eagle from that development (i.e. removal of deer carcases / gralloch from within the wind arm area and provision of winter larders in suitable locations) would also apply to the Proposed Development.

9.9.18 Support for continued eagle monitoring and conservation management measures within NHZ 10, as part of the existing Regional Eagle Conservation Management Plan, is also proposed.

Habitat Management Plan (HMP)

9.9.19 A HMP is proposed to address the effects of the construction of the Proposed Development on blanket bog vegetation communities (see Chapter 8: Ecology). Suitable areas for peatland restoration would be identified, e.g. actively eroding deep peat with only limited vegetation cover. The location and extent of these areas would be subject to refinement prior to completion of the final HMP but the area identified for restoration would be no less than the blanket bog permanently lost as a result of the Proposed Development. The confirmed peatland restoration areas would be shown on a figure in the final HMP. In order to maximise the potential benefit of these measures for moorland waders, where possible, they would be located within the same landholding but outside of the potential displacement effect zone for the existing and proposed wind farms. In developing the detailed HMP consideration will also be given to enhancement of blanket bog habitats within the Monadhliath SSSI. The Applicant will fully consult with all relevant parties during the development of the detailed HMP. The HMP will be subject to agreement with SNH and the relevant landowners prior to being implemented.

Decommissioning

9.9.20 The potential effects associated with decommissioning primarily relate to disturbance of species of conservation concern. Effects are likely to be much reduced in comparison with the construction phase. Disturbance during decommissioning works would be minimised through a similar approach to that set out above for the construction phase. Pre-decommissioning surveys for all potentially relevant species would be completed in the breeding season prior to works commencing.

9.10 Residual Effects

Construction Disturbance

9.10.1 Assuming the proposed breeding bird protection measures, as set out above and in Technical Appendix 9.4, are implemented effectively impacts on breeding birds, whilst not possible to eliminate, would be minimised and there should be **no significant** residual effects from the construction phase of the Proposed Development for any ornithological receptor. The effects would be short-term and of no greater than Minor significance for any receptor. Table 9.20 provides a summary of the residual assessment for construction disturbance.

Table 9.20: Construction phase – residual assessment of construction disturbance (potentially significant effects highlighted in bold)

Receptor	Sensitivity	Effect	Significance level	Duration	Confidence
Monadhliath SSSI	High	Negligible	Minor	Short-term	Near-certain
Common scoter	Medium	Negligible-Low	Minor	Short-term	Near-certain
Red-throated diver	Medium	Negligible-Low	Minor	Short-term	Near-certain
Osprey	Low (Local High)	Negligible	Negligible	Short-term	Near-certain
Golden eagle	Medium	Negligible-Low	Minor	Short-term	Near-certain
Red kite	Low (Local High)	Negligible	Negligible	Short-term	Near-certain
White-tailed eagle	Low (Local High)	Negligible	Negligible	Short-term	Near-certain
Golden plover	Low (Local High)	Negligible-Low	Minor	Short-term	Near-certain
Dunlin	Medium	Negligible-Low	Minor	Short-term	Near-certain
Greenshank	Medium	Negligible-Low	Minor	Short-term	Near-certain
Merlin	Low (Local High)	Negligible	Negligible	Short-term	Near-certain
Peregrine	Low (Local High)	Negligible	Negligible	Short-term	Near-certain

Direct Habitat Loss / Degradation

9.10.2 No significant effects from direct habitat loss or habitat degradation during construction are predicted for any receptor. No specific mitigation is proposed to address these effects. However, good practice construction environmental management measures, as set out in the outline CEMP (see Technical Appendix 3.1), will help to reduce potential effects on sensitive habitats (e.g. surfaces waters, which provide important foraging habitat for some receptor species). The proposed HMP will also help to address blanket bog habitat loss effects in the long-term. Effects on all receptors would be reduced to Negligible. Table 9.21 provides a summary of the residual effects assessment for direct habitat loss / degradation.

Table 9.21: Construction phase – pre-mitigation assessment of direct habitat loss / degradation (potentially significant effects highlighted in bold)

Receptor	Sensitivity	Effect	Significance level	Duration	Confidence
Monadhliath SSSI	High	None	n/a	n/a	Certain
Common scoter	Medium	Negligible	Negligible	Long-term	Near-certain
Red-throated diver	Medium	Negligible	Negligible	Long-term	Near-certain
Osprey	Low (Local High)	Negligible	Negligible	Long-term	Near-certain
Golden eagle	Medium	Negligible	Negligible	Long-term	Certain
Red kite	Low (Local High)	Negligible	Negligible	Long-term	Certain
White-tailed eagle	Low (Local High)	Negligible	Negligible	Long-term	Certain
Golden plover	Low (Local High)	Negligible	Negligible	Long-term	Near-certain
Dunlin	Medium	Negligible	Negligible	Long-term	Near-certain
Greenshank	Medium	Negligible	Negligible	Long-term	Near-certain
Merlin	Low (Local High)	Negligible	Negligible	Long-term	Certain
Peregrine	Low (Local High)	Negligible	Negligible	Long-term	Certain

Operational Displacement / Barrier Effects

9.10.3 No significant effects on any receptors are predicted to arise as a result of operational displacement or barrier effects. Therefore, no specific mitigation is proposed to address these effects. However, the proposed HMP will also help to address habitat displacement effects on breeding waders (particularly golden plover and dunlin) in the long-term. Table 9.22 provides confirmation of the assessment for each sensitive receptor.

Table 9.22: Operational phase – assessment of displacement and barrier effects (potentially significant effects highlighted in bold)

Receptor	Sensitivity	Effect	Significance level	Duration	Confidence
Monadhliath SSSI	High	Negligible	Minor	Long-term	Near-certain
Common scoter	Medium	Negligible-Low	Minor	Long-term	Near-certain
Red-throated diver	Medium	Negligible-Low	Minor	Long-term	Near-certain
Osprey	Low (Local High)	Negligible-Low	Minor	Long-term	Near-certain
Golden eagle	Medium	Negligible-Low	Minor	Long-term	Near-certain
Red kite	Low (Local High)	Negligible	Negligible	Long-term	Near-certain
White-tailed eagle	Low (Local High)	Negligible	Negligible	Long-term	Near-certain
Golden plover	Low (Local High)	Low	Minor	Long-term	Probable
Dunlin	Medium	Negligible-Low	Minor	Long-term	Probable
Greenshank	Medium	Negligible-Low	Minor	Long-term	Probable
Merlin	Low (Local High)	Negligible	Negligible	Long-term	Near-certain
Peregrine	Low (Local High)	Negligible	Negligible	Long-term	Near-certain

Operational Collision Risk

9.10.4 No significant effects related to operational collision risk were identified for any receptor (i.e. local level effects only, risk of material demographic effects on regional populations would be avoided).

9.10.5 Table 9.23 provides confirmation of the assessment for each sensitive receptor.

Table 9.23: Operation phase – residual assessment of collision risk from wind turbines (potentially significant effects highlighted in bold)

Receptor	Sensitivity	Effect	Significance level	Duration	Confidence
Monadhliath SSSI	High	Negligible	Minor	Long-term	Near-certain
Common scoter	Medium	Negligible-Low	Minor	Long-term	Near-certain
Red-throated diver	Medium	Negligible-Low	Minor	Long-term	Near-certain
Osprey	Low (Local High)	Low	Minor	Long-term	Near-certain
Golden eagle	Medium	Negligible-Low	Minor	Long-term	Near-certain
Red kite	Low (Local High)	Low	Minor	Long-term	Near-certain
White-tailed eagle	Low (Local High)	Low	Minor	Long-term	Near-certain
Golden plover	Low (Local High)	Negligible-Low	Minor	Long-term	Near-certain
Dunlin	Medium	Negligible-Low	Minor	Long-term	Near-certain
Greenshank	Medium	Low	Minor	Long-term	Probable
Merlin	Low (Local High)	Low	Minor	Long-term	Near-certain
Peregrine	Low (Local High)	Negligible-Low	Minor	Long-term	Near-certain

9.10.6 No significant effects from operational maintenance activities are predicted for any receptor. No specific mitigation is proposed to address these effects. However, similar best practice measures to the construction phase would be put in place to ensure that nesting birds are protected during any maintenance works that have the potential to cause disturbance. Effects on all receptors would be reduced to Negligible. Table 9.24 provides a summary of the residual effects assessment for operational maintenance activities and disturbance to breeding birds.

Table 9.24: Operation phase – residual assessment of disturbance from maintenance activities (potentially significant effects highlighted in bold)

Receptor	Sensitivity	Effect	Significance level	Duration	Confidence
Monadhliath SSSI	High	Negligible	Negligible	Short-term	Near-certain
Common scoter	Medium	Negligible	Negligible	Short-term	Near-certain
Red-throated diver	Medium	Negligible	Negligible	Short-term	Near-certain
Osprey	Low (Local High)	Negligible	Negligible	Short-term	Near-certain
Golden eagle	Medium	Negligible	Negligible	Short-term	Near-certain
Red kite	Low (Local High)	Negligible	Negligible	Short-term	Near-certain
White-tailed eagle	Low (Local High)	Negligible	Negligible	Short-term	Near-certain
Golden plover	Low (Local High)	Negligible	Negligible	Short-term	Near-certain
Dunlin	Medium	Negligible	Negligible	Short-term	Near-certain
Greenshank	Medium	Negligible	Negligible	Short-term	Near-certain
Merlin	Low (Local High)	Negligible	Negligible	Short-term	Near-certain
Peregrine	Low (Local High)	Negligible	Negligible	Short-term	Near-certain

Decommissioning Disturbance

9.10.7 Assuming the proposed breeding bird protection measures, as set out above, are implemented effectively prior to and during the decommissioning works potential effects on breeding birds would be minimised and there should be **no significant** residual effects for any receptor. The effects would be short-term and of no greater than Minor significance. Table 9.25 provides a summary of the residual assessment for decommissioning disturbance.

Table 9.25: Decommissioning phase – residual assessment of disturbance effects (potentially significant effects highlighted in bold)

Receptor	Sensitivity	Effect	Significance level	Duration	Confidence
Monadhliath SSSI	High	Negligible	Minor	Short-term	Near-certain
Common scoter	Medium	Negligible-Low	Minor	Short-term	Near-certain
Red-throated diver	Medium	Negligible-Low	Minor	Short-term	Near-certain
Osprey	Low (Local High)	Negligible	Negligible	Short-term	Near-certain
Golden eagle	Medium	Negligible-Low	Minor	Short-term	Near-certain
Red kite	Low (Local High)	Negligible	Negligible	Short-term	Near-certain
White-tailed eagle	Low (Local High)	Negligible	Negligible	Short-term	Near-certain
Golden plover	Low (Local High)	Negligible-Low	Minor	Short-term	Near-certain
Dunlin	Medium	Negligibel-Low	Minor	Short-term	Near-certain
Greenshank	Medium	Negligible-Low	Minor	Short-term	Near-certain
Merlin	Low (Local High)	Negligible	Negligible	Short-term	Near-certain
Peregrine	Low (Local High)	Negligible	Negligible	Short-term	Near-certain

9.11 Cumulative Effects

9.11.1 It was advised (during Scoping) by SNH that, if possible, any cumulative assessment is carried out at the regional or NHZ scale (i.e. Central Highlands, NHZ 10). Therefore, in this case, the focus of the assessment has been to determine the potential for significant cumulative effects on the NHZ 10 golden eagle population resulting from wind farm construction disturbance, collision mortality and displacement. This section of the assessment also considers potential cumulative effects from wind farm operation on golden plover, dunlin and greenshank in the NHZ 10 context. There are no anticipated potentially significant cumulative effects on any another ornithological receptors.

9.11.2 Cumulative impacts may be additive, antagonistic or synergistic. While antagonistic or synergistic effects may occur, the approach adopted in this assessment is the simpler additive approach, which attempts to sum similar impacts from different developments

based on the available information from published EIA documents. Whilst simple summation may not reflect biological realism for many species this is often the most practical approach and generally reduces the risk of arriving at an underestimate of the effect. Summation can, however, lead to individual errors being compounded and methodological limitations being amplified (see previous discussion on the limitations of collision risk modelling) and in some cases a correction may be needed, particularly when receptor populations are small.

9.11.3 In this case, only the potential for significant cumulative collision mortality or displacement effects to arise have been considered in any detail. The other potential effects of the Proposed Development (e.g. habitat loss, disturbance of breeding birds during construction) are not considered to represent a realistic risk of significant cumulative impact once proposed mitigation is factored into the assessment.

Summary of Available Information

9.11.4 The order in which developments have been factored into the assessment when considering cumulative impacts is set out below:

- Developments that are already operational, and those that are consented and likely to be built should be considered first as the impacts arising from these (once mitigation has been factored in) are unavoidable; and
- Applications that have been formally submitted to a planning authority or Scottish Government but have yet to be determined, consented and built should then be factored in. Confidential data (e.g. on Schedule 1 species) from such assessments will not necessarily be in the public domain.

9.11.5 A full list of the wind farm projects for the NHZ was collated and cross-referenced from Environmental Statements, where available. The SNH onshore wind farm (SNH, July 2019)[129] proposals data was used to assist in collating the latest status and locations of the wind farm projects, coupled with information gathered for this EIA Report. Sites which have been refused or withdrawn are not included within the list provided by SNH. The list does not include most small-scale applications and single turbines as SNH do not hold data on these applications. These sites are linked to information held in the SNH Casework Recording System, therefore should be considered as non-definitive data, subject to change without notice.

9.11.6 Wind farm projects at the feasibility / scoping stage, where noted, have been excluded from the cumulative assessment, as they generally do not have sufficient information on potential impacts to be included. Projects which have been withdrawn or refused have also been scoped out of this assessment.

9.11.7 Small wind farm proposals (i.e. small farm-based proposals, 3 wind turbines or less) were excluded from further consideration unless they were close enough to the Proposed Development to potentially directly affect breeding or wintering birds within the Site Boundary. Any of the proposed developments for which no quantified impact assessment was available at the time of this assessment were also not considered further.

9.11.8 Table 9.26 below provides a summary of information relating to wind farm proposals which are currently operational, in the planning process or post-consent / pre-

[129] SNH Dataset of Onshore Wind Farm Proposals (Last update: 5th July 2019). Available at: https://gateway.snh.gov.uk/natural-spaces/dataset.jsp?dsid=WINDFARM

construction stage that have the potential to result in cumulative effects at the scale of the NHZ.

Table 9.26: Wind farm projects considered in the assessment of cumulative effects on NHZ 10 populations

Project Status	Site name	No. of turbines / site area	Distance / Direction	Summary of relevant assessment information available (no. wader territories within wind farm)
Operational	Stronelairg	66 / 35km^2	<0.5km	Wind farm overlaps partially with three golden eagle territories, predicted to affect up to two pairs. Residual effects were reported as non-significant following implementation of a HMP and supplementary feeding plan. 14-15 golden plover territories. 9-11 dunlin territories. No records of greenshank.
	Corriegarth (inc. extension)	23 / 6km^2	8.3km NE	Used by non-breeding golden eagle only, although re-occupation of territory is possible (this has occurred). 7 golden plover territories. 4 dunlin territories. No records of greenshank.
	Dunmaglass	33 / 34km^2	10.3km N	Used by non-breeding golden eagle only, no nest within 2 km. Loss of foraging habitat. 4 golden plover territories. 3 dunlin territories. No records of greenshank
	Farr	40/ 7km^2	28.6km NE	Low frequency of use by golden eagle. 25 golden plover territories. 9-15 dunlin territories. No records of greenshank.
	Berry Burn	39 / 17km^2	64km NE	Infrequent activity by immatures golden eagles. No breeding territories affected. 3 golden plover territories. No records of dunlin. No records of greenshank.
	Paul's Hill I	28 / 19km^2	64km NE	Site is not located within or near any known breeding territories and unlikely to be regularly used by golden eagle. 1 golden plover territory. No records of greenshank.
	Rothes I	22 / 4km^2	75km NE	No records of golden eagle. Unknown no. wader territories.
	Rothes II	18 / 4km^2	75km NE	No records of golden eagle. 2 golden plover territories. No records of greenshank.

Project Status	Site name	No. of turbines / site area	Distance / Direction	Summary of relevant assessment information available (no. wader territories within wind farm)
	Moy	20 / 12km^2	37.7km NE	Golden eagle recorded, but limited information provided. 2 golden plover territories. No records of dunlin. No records of greenshank.
	Glen Kyllachy	20 / 8km^2	27.6km NE	No evidence of breeding golden eagle within 15km of the site. Low levels of activity recorded. 6-7 golden plover territories. 1-2 dunlin territories. No records of greenshank.
	Tom nan Clach	13 / 12km^2	40km NE	No breeding golden eagle territories within or near to the site. Low levels of activity by non-breeding birds. 7 golden plover territories. No dunlin territories. No records of greenshank.
Consented	Aberarder	12 / 4km^2	17.6km NE	No effects on any golden eagle breeding territories reported. Area is primarily used by non-breeding young golden eagles. 4 golden plover territories. No dunlin records. No records of greenshank.
	Cairn Duhie	20 / 6km^2	54.4km NE	No records of golden eagle. 6 golden plover territories. No dunlin records. No records of greenshank.
	Kellas	8 / area unknown	75km NE	No records.
	Meikle Hill	6 / 11km^2	73km NE	No records of golden eagle. 1 golden plover territory. No dunlin records. No records of greenshank.
	Dell	14 / 15km^2	0.5km NE	Two territories affected. Range use loss of 0.2% and 0.5% predicted. No significant effects reported. 10 golden plover territories. No dunlin records. No records of greenshank.

Project Status	Site name	No. of turbines / site area	Distance / Direction	Summary of relevant assessment information available (no. wader territories within wind farm)
In Planning	Cloiche	36 / 18km^2	n/a	Up to 4 golden eagle territories potentially affected. PAT model predicts range use overlap from 0.8 to 2.7% of the affected territories. For the closest territory centre the PAT model predicts a 2.7% overlap and the GET model a 2.4% overlap. 19 golden plover territories. 13 dunlin territories. 1-2 greenshank territories.
	Glenshero	39 / 34km^2	0.5km SE-SW	The PAT model predicted golden eagle range overlaps of: 4.3%, 2.0% and 3.5% for territories affected. No significant residual displacement effects reported. 14-15 golden plover territories. 5-7 dunlin territories. 3 greenshank territories.
	Paul's Hill II	6 / 19km^2	64km NE	No records of golden eagle No golden plover records. No dunlin records. No records of greenshank.

Golden Eagle – Cumulative Construction Effects

9.11.9 There is the potential for the construction phase of Proposed Development to coincide with the construction of Dell and Glenshero wind farms. However, the locations of the construction sites should avoid any direct disturbance to known golden eagle breeding locations. All proposals have committed to ensure that potential impacts on breeding golden eagle from construction disturbance is minimised through pre-works surveys and careful management of the works sites. There is also a legal requirement to ensure that breeding golden eagle are not disturbed. The effectiveness of well-managed construction works avoiding significant long-term disturbance effects on breeding golden eagle is evident from the previous works completed for Glendoe Hydroelectric Scheme and Stronelairg Wind Farm and that this has not prevented the re-occupation and successful breeding of golden eagle during and following construction works.

9.11.10 In conclusion, it is considered unlikely that cumulative effects from overlapping construction phases could raise impacts to a significant level for the NHZ 10 breeding golden eagle population. The cumulative effect is considered to be no greater than Minor significance.

Golden Eagle – Cumulative Operational Effects

9.11.11 In Scotland, golden eagles are considered to be at relatively greater risk of impact from range loss, resulting from wind farm displacement, than from collision mortality. Therefore, this assessment focuses on the potential for cumulative effects on breeding golden eagle arising from wind farm displacement.

9.11.12 The summarised reported assessments from the other wind farm projects potentially affecting the NHZ 10 golden eagle population are shown in Table 9.26. This confirms that

only Stronelairg, Dell and Glenshero wind farms are likely to have potential effects on the same breeding territories that could be affected by the Proposed Development.

9.11.13 In previous assessments SNH has advised that a 5% range overlap impact (using the PAT model) is a useful nominal threshold for potentially 'significant' range loss to occur.

9.11.14 In the Stronelairg ES the PAT model predicted range overlap of 6.6% and this was partially addressed through the improvement of habitat quality for golden eagle prey species (primarily red grouse) within a 485ha habitat management area. Supplementary winter feeding of golden eagles was also proposed. For the purposes of this assessment it has been assumed that the net effect of the Stronelairg Wind Farm proposals has not been significant for the affected pairs. The pair with the closest territory centre successfully fledged of one chick in 2019 (the wind farm became operational in 2018), which indicates that the breeding productivity of this pair has not been significantly affected, although longer-term monitoring would be necessary to confirm this.

9.11.15 The PAT model has been used to carry out an assessment of potential cumulative range loss for each breeding territory potentially affected by the Proposed Development. The details are provided in the Confidential Annex. In summary, considering the Proposed Development (final layout, mitigation design) in isolation the predicted range overlap would be a maximum of 2.7% for territory EA2. Predicted range overlap for the other three territories is EA1 1.6%, EA3 0.1% and EA4 0.8%. As previously discussed, these predicted overlap areas are all on the outer fringes of favourable habitats within the territories, based on an assumed 6km radius limit from the territory centre.

9.11.16 Treating the existing operational wind farms (Stronelairg and Corriergarth) as now part of the baseline (i.e. that any range loss effects that have occurred and have been 'absorbed' without suffering any significant effects on breeding success or productivity) the PAT model predicts that the Proposed Development, in combination with the other wind farm proposals affecting the same territories (i.e. Dell and Glenshero), would result in the combined range overlap of 5.2% for the EA2 territory. This is an increase from 2.7% when considering the Proposed Development in isolation. None of the other territories would experience more than 2% cumulative range overlap / potential loss.

9.11.17 The potential cumulative effect on the EA2 territory is at the potential threshold for significance. This is particularly relevant in the case of resident breeding pairs with low productivity and/or existing constraints on their territory due to the proximity of neighbouring breeding pairs or unsuitable areas (e.g. commercial forestry, operational wind farms). Although the EA2 territory is constrained due to the presence of other golden eagle territories either side, unsuitable habitat and the proposed wind farm, in this case, the impact would affect a relatively successful pair (five-year mean for this pair is 0.8 chicks fledged). It is certainly possible that this pair would be able to adjust to this constraint by exploiting existing prey sources elsewhere within their territory. The location of the Proposed Development, Dell and Glenshero (essentially within and around the fringes of the large plateau area that Stronelairg Wind Farm sits within) should help reduce the potential effect on this territory as these developments are clustered within a large area of primarily lower quality habitat, in relation to important topographic features, for golden eagle. However, without undertaking a more detailed study of habitat quality, prey availability and range use it is not possible to be more categorical about the potential magnitude of effect with respect to breeding productivity.

9.11.18 Monitoring of this pair, and the other affected breeding territories, is proposed in order to determine if this has any material effect in the long-term. Any notable adverse effects,

should they occur, could potentially be addressed through the RECMP, which SSE has committed to fund.

9.11.19 In conclusion, in combination with other proposals (i.e. Dell Wind Farm in the case of EA2) a potentially significant reduction in habitat availability within one golden eagle territory could occur during the operation of the Proposed Development. However, significant effects on this territory are considered to be uncertain given the recent history of breeding productivity for this pair and that the cumulative effect is very close to the nominal 5% threshold of potential significance.

9.11.20 The reported results of assessments of operational displacement for other existing and proposed wind farms located in the wider NHZ indicate that there are currently no other developments that could impact on breeding golden eagle population.

9.11.21 In conclusion, with respect to the wider NHZ 10 golden eagle population, 2 out of 21 breeding territories could suffer a reduction in breeding productivity as a result of cumulative wind farm displacement and loss of suitable habitat. In the context of the currently favourable conservation status of the NHZ population this is considered to be no greater than a Minor effect and **not significant**.

Conclusion

9.11.22 Based on a review of the available information about current operational and proposed wind farms located within the Central Highlands NHZ, it has been concluded that there would be no significant cumulative construction or operational effects on the regional breeding golden eagle population.

9.11.23 Significant cumulative collision risk is not considered to be a realistic potential outcome for the NHZ 10 population given current evidence of wind farm avoidance behaviour by adult and young golden eagles in Scotland.

Waders - Monadhliath SSSI

9.11.24 The Proposed Development, Glenshero and Stronelairg Wind Farms are all located within 2km the Monadhliath SSSI which is designated in part for the populations of golden plover, dunlin and dotterel that the area supports.

9.11.25 No potential effect on dotterel was reported from any of the published assessments for these projects, therefore cumulative effects on this species are assumed to be Negligible and **not significant**.

9.11.26 A small number of golden plover (c. 4) and dunlin (c. 3) territories were recorded within the SSSI boundary and within c. 500m of the Proposed Development and Glenshero wind farm. Cumulative displacement effects acting on this small number of territories is considered unlikely to exceed the effect levels reported in this assessment for the Proposed Development. On a precautionary basis, a long-term effect of Minor, and **not significant**, is concluded for this receptor.

Waders – Cumulative Operational Collision / Displacement Effects

9.11.27 There is uncertainty about the extent to which collision mortality is a potentially significant issue at the regional population level for waders. This is due to limitations in standard pre-construction survey methods and collision risk modelling and the lack of systematic and effective monitoring of collision fatalities at operational wind farms. However, the available evidence indicates that collision rates, at other than local scales,

are unlikely to reach a level where biological relevant demographic effects are detectable for golden plover or dunlin. Therefore this assessment focuses on potential cumulative displacement effects only for these species.

Golden Plover

9.11.28 Based on the available information for wind farm developments within NHZ 10, it is estimated that a maximum of 128 golden plover territories could be affected by operational displacement. Applying a highly conservative 80% effect (based on Sansom *et al*. 2016) this equates to a potential loss of 102 territories to an estimated breeding population of 2,702, which is 3.8% of the NHZ population. A more realistic worst case of a 50% reduction, which is still considered to be precautionary in view of the low apparent levels of operational displacement reported by some wind farm monitoring studies within the same NHZ (e.g. Farr Wind Farm, Fielding & Howarth 2013), would result in 64 territories being affected, which is 2.4% of the estimated NHZ breeding population. As discussed within the section of the assessment considering golden plover displacement, this outcome is likely to be an over-estimate of the actual level of effect but cannot be discounted based on the available scientific evidence. As the NHZ population is considered to be in unfavourable condition a precautionary assessment is that a potentially **significant** (Moderate) long-term cumulative operational displacement effect is possible at the NHZ 10 population scale. It should also be noted that, on the assumption that all of the other proposals in planning, considered in this assessment, were consented and built, potentially significant cumulative effects could occur irrespective of whether the Proposed Development were to be consented and built.

Dunlin

9.11.29 Based on the available information for wind farm developments within NHZ 10, it is estimated that a maximum of 55 dunlin territories could be affected by operational displacement. This represents 52.4% of the estimated NHZ 10 population. Clearly, this is likely to be a significant over-estimate of the potential impact. Given that the wind farms considered in the cumulative assessment occupy only c. 10% of the NHZ 10 area it seems highly unlikely that half of the population would be located within these sites. Accepting that not all of the NHZ provides suitable breeding habitat for this species, there is still likely to be a large discrepancy between the available population estimate and the actual population size. Additionally, the evidence from wind farm monitoring studies is that this species is not particularly vulnerable to operational wind farm displacement. In one long-term study (at Farr Wind Farm) there was no evidence of any appreciable effect on the dunlin population from eight years of wind farm operation (Fielding & Howarth 2015b). On the assumption that at all sites best practice will be followed to minimise potentially significant short-term disturbance impacts on this species during construction an assessment of a Low (**not significant**) long-term cumulative operational displacement effect at the NHZ 10 population scale is concluded.

Greenshank

9.11.30 Based on the available information for wind farm developments within NHZ 10, it is estimated that four greenshank territories could be affected by operational displacement. This represents about 50% of the estimated NHZ 10 population. As is the case with dunlin, it is considered highly unlikely that the two proposed wind farm sites within the NHZ reporting the presence of breeding greenshank (the Proposed Development and Glenshero Wind Farm) and occupying c. 2% of the NHZ area as a whole,

support half of the NHZ population. Nonetheless, it is certainly possible that the four territories exceeds a nominal 1% threshold for regional (NHZ) importance. The available evidence from monitoring studies in Scotland is that this species is not particularly vulnerable to operational wind farm displacement or, with respect to flight activity away from breeding display locations, to collision mortality. The Proposed Development has avoided the main loci of breeding territory registrations (from 2019 and from other recent surveys). The Glenshero proposals also largely avoid the known breeding territories. However, although a 'negligible' cumulative effect is considered to be a reasonable assessment at the national level, given the recognised ongoing uncertainties about potential displacement and collision mortality effects on greenshank, a Minor long-term cumulative operational effect is concluded at the NHZ 10 population scale, which is **not significant**.

9.12 Conclusion

9.12.1 The baseline description of the bird fauna present within the Proposed Development, and surrounding area that could be affected, has been derived from extensive desk study data and field surveys completed between August 2018 and August 2019. Surveys were carried out to assess the distribution of wintering, migratory and breeding bird species of conservation concern, as well as the potential sensitivity to wind farm development. The species present can be grouped broadly into sensitive breeding waterbirds (e.g. red-throated diver, common scoter), raptors (golden eagle, white-tailed eagle, merlin, peregrine), black grouse and waders (golden plover, dunlin, greenshank).

9.12.2 Within these groups there are a number of species using the Proposed Development area that merit special attention due to their European or national conservation status as a species, and / or for their potential sensitivity to wind farm development.

9.12.3 Annex I and / or Schedule 1 raptor species that regularly or occasionally hunt or pass through the Proposed Development area include golden eagle, white-tailed eagle, merlin, peregrine, red kite and osprey.

9.12.4 The wider area supports four golden eagle breeding territories. Potential effects of the Proposed Development on this species has been a key focus of the wind farm design and assessment process. The wind farm layout has been designed to reduce potential effects on the breeding territory located closest to the Proposed Development.

9.12.5 The Proposed Development area is of medium (i.e. regional-scale) importance for breeding golden eagle, dunlin and greenshank.

9.12.6 This assessment has considered the various potential effects arising from the construction, operation and decommissioning of the Proposed Development, and evaluated the significance of these impacts on the identified key receptors in the context of their conservation status, sensitivity to wind farm development and the magnitude of the potential impacts.

9.12.7 During construction of the Proposed Development, effects on birds may arise from loss of moorland habitat and from disturbance associated with construction activities. No significant habitat loss is predicted for any species, taking into consideration the scale of the Proposed Development and the extent of direct habitat loss in comparison to the abundance of the habitats present in the core survey area. Disturbance effects would be avoided, where possible, through careful scheduling of construction works and pre-construction surveys, to avoid disturbance to birds during the breeding season. Also the

effective design and implementation pollution prevention and control measures during construction to avoid / minimise adverse effects on aquatic habitats that provide important foraging rearose to species such as greenshank. With the proposed mitigation measures implemented residual effects from disturbance during the construction phase would not be significant.

9.12.8 During the 50-year operational phase, impacts may arise from collision with turbines and other structures resulting in injury or death, displacement / disturbance from areas where turbines are operating and disturbance by maintenance activities. Collision risk has been assessed using data systematically gathered during flight activity and a standard model used in wind farm EIA. Local-scale population effects are considered to be possible for some species. However, the residual impact of wind turbine collision is not considered to be significant at the regional population level for any receptor.

9.12.9 There is also the potential for significant displacement effects on breeding golden eagle, due to the close proximity of the Proposed Development to a regularly occupied and productive breeding territory, however this has been avoided through careful design of the wind farm layout.

9.12.10 No significant residual effects through displacement and / or disturbance from the operation of the Proposed Development are predicted in this assessment for any receptors.

9.12.11 The residual effects from decommissioning are considered to be broadly similar to those during construction and are therefore not more than minor for all species and not significant. Prior to decommissioning, a re-assessment of the avifauna using the site of the Proposed Development would be required in order to determine the specific mitigation measures required to reduce any potentially significant impacts.

9.12.12 No effects on Slavonian grebe are predicted (therefore no effect on the qualifying interest of the Loch Knockie and Nearby Lochs SPA) and no significant residual effects on the Monadhliath SSSI are predicted.

9.12.13 No significant residual cumulative construction effects are likely as a result of the Proposed Development in combination with other existing and proposed developments within the Central Highlands NHZ.

9.12.14 Potentially significant cumulative operational effects, at the NHZ 10 population scale, are considered to be possible for golden plover, on a precautionary basis. However, on the assumption that all of the other proposals in planning considered in this assessment were consented and built, potentially significant cumulative effects on golden plover could occur irrespective of whether the Proposed Development were to be consented and built.

9.13 References

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