7 Ornithology

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7 Ornithology

7.1 Executive Summary

7.1.1 A comprehensive suite of field surveys was undertaken to evaluate the ornithological interests at the Proposed Development site covering two breeding seasons (2018 and 2019) and two non-breeding season periods (October 2018 to March 2019 and October 2019 to March 2020).

7.1.2 The likely significant effects on ornithological interests at the Proposed Development were assessed including noise and visual disturbance from construction activities, displacement (including barrier effects) due to presence and operation of the turbines and the risk of mortality due to collisions with operating turbines.

7.1.3 Important ecological features were identified and brought forward for assessment; these included four designated sites (Hoy Special Protection Area (SPA); Scapa Flow proposed SPA (pSPA); Hoy Site of Special Scientific Interest (SSSI) and Hoy and North Walls SSSI Moorland Fringes Local Nature Conservation Site (LNCS)) and eleven species (red-throated diver; peregrine falcon; great skua; great black-backed gull; hen harrier; white-tailed eagle; merlin; short-eared owl; curlew; dunlin and snipe).

7.1.4 Species-specific mitigation measures will be required to avoid significant adverse effects from disturbance due to construction activities for breeding red-throated diver and hen harrier.

7.1.5 There would be no likely impact and no effect due to construction disturbance at any 'confirmed' or 'probable' short-eared owl breeding sites however implementation of mitigation measures, as good practice, would be required to avoid disturbance to two 'possibly occupied' short-eared owl sites.

7.1.6 There would be no impact and no significant effects of construction disturbance on roosting hen harrier or breeding merlin or great black-backed gull.

7.1.7 Construction disturbance is likely to lead to the temporary loss of between one and ten great skua apparently occupied territories (AOTs). These AOTs are not on the SPA itself but are within the LNCS. This extent of loss, for one - two years only is a temporary, reversible affect and is assessed as a significant adverse effect at the less than local (site) level only, but not at any wider geographic scale. The effects on the LNCS are not considered to adversely affect the integrity of the area or the qualities for which it has been designated.

7.1.8 The loss of four pairs of curlew due to construction disturbance, if this was to occur, would be a temporary but reversible effect and would be assessed as a significant adverse effect at the less than local (site) level only, but not at any wider geographic scale.

7.1.9 The loss of six - seven pairs of snipe due to construction disturbance, if this was to occur, would be a temporary but reversible effect and would be assessed as a significant adverse effect at the less than local (site) level only, but not at any wider geographic scale.

7.1.10 There would be no impact and no significant effects on breeding red-throated diver from the Hoy SPA population due to operational displacement or barrier effects. Any effects on the red-throated diver population of Scapa Flow pSPA is considered to be less than that of the Hoy SPA red-throated diver population as the pSPA population of red-throated divers is larger than that of the Hoy SPA as it includes all the birds from Hoy, plus those from the smaller islands in Scapa Flow and from the Mainland of Orkney parishes adjacent to Scapa Flow.

7.1.11 There would be no displacement and no significant effects on breeding, roosting or foraging hen harrier from the Orkney population. There would be no displacement and no significant effects on breeding merlin, great black-backed gull or dunlin at any scale and no displacement and no significant effects on breeding or foraging short-eared owl at any scale, due to presence and operation of the Proposed Development.

7.1.12 The loss of two pairs of curlews due to the combined displacement and collision mortality impact is assessed as a significant adverse effect at the less than local (site) level only, but not at any wider geographic scale. The effects on the LNCS are not considered to adversely affect the integrity of the area or the qualities for which it has been designated.

7.1.13 Displacement of breeding great skuas due to the presence and operation of the Proposed Development is considered to range from one pair (but breeding elsewhere on the LNCS) to six pairs (lost from the LNCS population), equivalent to ranging from an effect that is not significant at any scale to a significant adverse effect at the less than local (site) level, but not at any wider geographic scale. This is considered a precautionary approach as displacement may not occur at this level. The effects on the LNCS are not considered to adversely affect the integrity of the area or the qualities for which it has been designated. This does not affect any great skua pairs located on the Hoy SPA, so there is no impact and no effect on the Hoy SPA great skua population due to operational displacement.

7.1.14 Displacement of four pairs of snipe, a species of less than local importance, is not considered significant at any scale.

7.1.15 The effects of collision mortality on the Hoy SPA red-throated diver, peregrine, great skua and great black-backed gull populations were assessed as not significant.

7.1.16 Collision mortality was assessed as having a significant adverse effect on the adult Hoy white-tailed eagle population at the regional scale.

7.1.17 The effects of collision mortality on breeding hen harriers from the Orkney population are assessed as not significant.

7.1.18 The cumulative collision risk to the Hoy SPA red-throated diver, peregrine and great skua populations is essentially the same as that carried out for the Proposed Development on its own therefore no separate cumulative assessments are required for these species.

7.1.19 The cumulative collision risk estimates at 99.5 % avoidance, (considered suitably precautionary) would result in modelled declines of less than 3 % (relative to the baseline) in the Orkney female and Orkney male hen harrier populations over a 25-year period. The effects of these levels of cumulative collision mortality on the Orkney female and Orkney male hen harrier populations are assessed as not significant.

7.2 Introduction

Scope of Study

7.2.1 This chapter evaluates the likely significant effects of the Proposed Development on ornithological interests. It identifies, describes and assesses the likely significant effects on ornithological interests resulting from the construction, operation and decommissioning of the Proposed Development including the potential for disturbance due to construction activities, displacement (including barrier effects) due to avoidance of the turbines and the risk of mortality due to collisions with turbine blades.

7.2.2 The assessment focuses on the four features of the Hoy Special Protection Area (SPA) and other protected species in the wider countryside found to be regularly present at the site during field surveys. Other species of regional and local interest have also been considered as appropriate. This assessment was undertaken by Andrew Upton of Firth Ecology and Jude Hamilton of Aquatera Ltd.

7.2.3 The detailed methodology and findings of all field surveys undertaken to inform this assessment are presented in Appendix 7.1: Ornithology Technical Report. All environmentally sensitive information is contained in a separate confidential annex (see Appendix 7.2: Ornithology Confidential Annex - Environmentally Sensitive Bird Information) (this information is available for statutory bodies but not for public release). Full details of the methodology used for the collision risk calculations and worked examples are provided in Appendix 7.3: Collision Risk Report and the accompanying Annexes (spreadsheets). Information to inform a Habitats Regulations Appraisal (HRA) is presented in Appendix 7.4: HRA.

Description of the Site

7.2.4 The Proposed Development is located at Wee Fea, approximately 1.3 km to the west of Lyness on the island of Hoy, Orkney. The site is predominantly moorland with rough grassland in the eastern part and in areas throughout the site where the moorland has been ploughed out in the past. The Burn of Ore flows east through the site and the Burn of Longigill flows south through the mid-section of the site. Access to the site is via the existing track to Wee Fea off the B9047 road.

7.3 Legislation, Policy and Guidelines

Legislation

7.3.1 Relevant legislation documents have been reviewed and taken into account as part of this assessment. Of particular relevance are:

- EU Council Directive 2009/147/EC on the Conservation of wild birds (the 'Birds Directive') (European Parliament, 2009);
- The Conservation (Natural Habitats, &c.) Regulations 1994 (as amended) (UK Government, 1994);
- The Conservation (Natural Habitats, &c.) Amendment (Scotland) Regulations 2019 (Scottish Government, 2019);
- The Wildlife and Countryside Act (WCA) 1981, as amended (UK Government, 1981);
- The Nature Conservation (Scotland) Act 2004 (Scottish Government, 2004); and
- The Wildlife and Natural Environment (Scotland) Act 2011 (Scottish Government, 2011).

Planning Policy

7.3.2 Planning policies relevant to this assessment are presented below:

- Scottish Planning Policy (Scottish Government, 2014). This sets out all of the Scottish Government's Planning Policy of particular relevance to this assessment. It replaces National Planning Policy Guidance 14: Natural Heritage which describes how policies for conservation and enhancement of flora and fauna should be reflected in land use planning;
- Planning Advice Note (PAN) 1/2013 – Environmental Impact Assessment (Scottish Government 2013);
- PAN 51: Planning, Environmental Protection and Regulation (revised 2006) (Scottish Government, 2006);
- PAN 60: Planning for Natural Heritage (Scottish Government, 2000);
- Orkney Local Development Plan 2017 - 2022 (Orkney Islands Council, 2017a);
- Supplementary Guidance: Natural Environment Annex 1 Local Nature Conservation Sites, Local Nature Reserves and un-notified Geological Conservation Review Sites (Orkney Islands Council, 2017b); and
- Orkney Local Biodiversity Action Plan 2018 – 2022 (Orkney's Biodiversity Steering Group, 2018).

7.3.3 Chapter 5 of this EIA Report sets out the planning policy framework that is relevant to the EIA process.

Guidance

7.3.4 Current best practice guidance on assessing ornithological interests in relation to onshore wind farms has been followed. The following are of particular relevance to ornithology:

- Guidelines for Ecological Impact Assessment in the UK and Ireland; Terrestrial, Freshwater and Coastal. Version 1.1 (CIEEM, 2019);
- Recommended bird survey methods to inform impact assessment of onshore wind farms (Scottish Natural Heritage (SNH, 2017);
- Developing field and analytical methods to assess avian collision risk at wind farms (Band et al., 2007);
- Assessing significance of impacts from onshore wind farms on birds outwith designated areas: version 2 (SNH, 2018a);
- Avoidance rates for the onshore SNH collision risk model (SNH, 2018b);
- Assessing the cumulative impact of onshore wind farms on birds (SNH, 2018c);
- Assessing connectivity with Special Protection Areas (SPAs) (SNH, 2016a);
- Flight speeds and biometrics for collision risk modelling (SNH, 2014);
- Environmental Statements and Annexes of Environmentally Sensitive Bird Information Guidance for Developers, Consultants and Consultees. Version 2 (SNH 2016b);
- Dealing with construction and birds (SNH, 2016c);
- Good Practice during Wind Farm Construction (Scottish Renewables et al. 2019);
- Birds of Conservation Concern (BoCC) 4: the population status of birds in the United Kingdom, Channel Islands and the Isle of Man (Eaton et al. 2015); and

- Scottish Biodiversity List (SBL) (Scottish Government, 2013).

7.4 Consultation

7.4.1 The key points raised by stakeholders during Scoping[1] regarding ornithology are presented in Table 7.1. In addition, extensive pre-application consultation has been undertaken with SNH in relation to the bird survey scopes, population modelling and collision risk methodology. The main points are detailed in Table 7.1 together with the action undertaken by the Applicant in response to the consultation feedback.

Table 7.1 Consultation Responses

Stakeholder	Consultation Response	Applicant Action
SNH Scoping Response 6th June 2018	The proposed development is likely to have a significant effect on qualifying interests of Hoy SPA, Switha SPA and Scapa Flow proposed SPA (pSPA). The EIA must therefore provide sufficient information for Scottish Ministers to be able to undertake appropriate assessments in view of these sites' conservation objectives for their qualifying interests.	These three sites have been considered in the assessment. The size of the Proposed Development has been reduced from 30 turbines to six turbines and the location of the turbines moved to the eastern extent of the site to reduce the effects on the qualifying interests of Hoy SPA. Information to inform appropriate assessments is presented in Appendix 7.4 HRA.
	The development site borders Hoy SPA. The key issues are potential disturbance and/or displacement of breeding birds during the construction and operation of the wind farm, and the risk of birds colliding with the rotating turbine blades when flying through the development site. The qualifying species potentially affected are red-throated diver (*Gavia stellata*), great skua (*Stercorarius skua*), Arctic skua (*Stercorarius parasiticus*) and great black-backed gull (*Larus marinus*), which should be targeted by the survey work and assessment. Red-throated divers are likely to be a particular issue as the development site is situated directly between breeding lochs within Hoy SPA and their main feeding areas within Scapa Flow pSPA. The turbines are likely to	The qualifying interests of Hoy SPA have been considered in the assessment in relation to impacts due to construction disturbance, operational displacement (including barrier effects for red-throated diver) and collision mortality due to collision with operating turbines.

1 The Scoping Report (April 2018) was for a larger development of up to 30 wind turbines across a much larger area than the current site.

Stakeholder	Consultation Response	Applicant Action
	present a barrier and/or collision risk to divers commuting back and forth between the breeding lochs and feeding areas.	
	The development site borders Scapa Flow pSPA. The qualifying interest of the pSPA includes breeding red-throated diver, because of the important feeding areas within Scapa Flow used during the breeding season. Therefore, the potential onshore impacts on red-throated divers described above may also affect Scapa Flow pSPA. The EIA should also consider any disturbance or displacement of red-throated divers, and wintering bird interest of the pSPA, that may result from additional boat activity within Scapa Flow associated with construction phase of the development. This impact may be localised and less of an issue than the onshore impacts, if the additional boat activity isn't a significant increase in the traffic that already exists within Scapa Flow.	The onshore impacts on red-throated divers from Scapa Flow pSPA have been considered in the assessment. Disturbance or displacement of red-throated divers and wintering bird interests of Scapa Flow pSPA have been considered. Information to inform appropriate assessments is presented in Appendix 7.4 HRA.
	The development site is about 6 km north-west of Switha SPA that supports a winter roost of Greenland barnacle geese. We are not aware of any use of the development site by the geese, but the survey work in the winter needs to check this and if they are likely to be disturbed or displaced. It is perhaps more likely that, geese flying through the development site could be at risk from collision and the winter vantage point surveys work should assess this risk.	Greenland barnacle goose was included as a target species in winter vantage point surveys. No flight activity by this species was recorded at the site therefore this species was not considered further in the assessment.
	The detailed scope of all the bird survey work was discussed with OIC ahead of surveys commencing on the ground for the current breeding season. We are content with the scope of work planned and methodologies described in the OIC tender for the bird survey contract, and that they are appropriate for the	Surveys undertaken in line with the agreed scope of work.

Stakeholder	Consultation Response	Applicant Action
	assessment of the potential SPA impacts described above.	
	There may also be a need to undertake some population modelling in order to assess the impacts on SPA bird populations. We can provide further advice on this when we have the results of the initial survey work.	Noted. Further consultation with SNH regarding population modelling was undertaken (see below).
Royal Society for the Protection of Birds (RSPB) Scoping Response 22nd May 2018	RSPB Scotland has considerable concerns about the proposed scale and location of the proposed wind farm at this site, primarily in relation to potential impacts on the species associated with the adjacent Hoy Special Protection Area (SPA), as well as other sensitive species of conservation concern.	The size of the Proposed Development has been reduced from 30 turbines to six turbines and the location of the turbines moved to the eastern extent of the site to reduce the effects on the qualifying interests of Hoy SPA.
	The Hoy SPA and Site of Special Scientific Interest (SSSI) are both designated for a number of bird species including breeding Arctic skua, great skua, peregrine and red-throated diver. The EIA should fully consider the potential effects of the development on the SPA and SSSI. It should be demonstrated that the proposed development would not affect the integrity of the SPA or undermine its conservation objectives.	The qualifying interests of Hoy SPA and notified interests of Hoy SSSI have been considered in the assessment. Information to inform appropriate assessments is presented in Appendix 7.4 HRA.
	The EIA should consider impacts on the SPA's and wider regional red-throated diver population, including as a consequence of collision with turbines, as well as disturbance and / or displacement from breeding lochs / lochans and from the effects of increased energetic demands arising from turbines acting as a barrier between the pSPA marine foraging areas and freshwater nesting sites during the breeding season	The effects on the Hoy SPA red-throated diver population have been considered in the assessment in relation to impacts due to construction disturbance, operational displacement (including barrier effects for red-throated diver) and collision mortality due to collision with operating turbines.

Stakeholder	Consultation Response	Applicant Action
	Switha SPA is designated for non-breeding barnacle geese, which are known to feed on Hoy and South Walls, and the proposed development site is well within the 15km core range foraging distance (and 25km maximum) identified by SNH for the species. The EIA should fully consider barnacle geese and whether the proposed windfarm will impact upon the SPA population though direct collision or by creating a barrier effect for birds flying between preferred feeding and roosting areas.	Greenland barnacle goose was included as a target species in winter vantage point surveys. No flight activity by this species was recorded at the site therefore this species was not considered further in the assessment.
	The EIA should fully consider the potential effects of the development on Scapa Flow pSPA. It should be demonstrated that the proposed development would not affect the integrity of the site or undermine its conservation objectives.	The onshore impacts on red-throated divers from Scapa Flow pSPA have been considered in the assessment. Disturbance or displacement of red-throated divers and wintering bird interests of Scapa Flow pSPA have been considered. Information to inform appropriate assessments is presented in Appendix 7.4 HRA.
	The proposed development site significantly overlaps with the existing Hoy and North Walls Site of Special Scientific Interest (SSSI) Moorland Fringes LNCS. The Applicant should provide full information seeking to demonstrate compliance with Policy 9 (A3) (Locally Important Sites) of the adopted Orkney Local Development Plan 2017.	This LNCS and the special wildlife features of the LNCS recorded at the Proposed Development site have been considered in the assessment.

Stakeholder	Consultation Response	Applicant Action
SNH meeting. Senior Casework Manager 21st August 2018	Second year of bird surveys required; these should focus on refined development scenarios.	A second year of bird surveys was carried out, focussed on a refined development scenario. The scope of the second year of bird surveys, including survey types, survey areas, methods and survey effort were agreed in consultation with SNH.
SNH telephone call. Senior Casework Manager 10th January 2019	SNH requested population modelling be undertaken to determine effect on the great skua and red-throated diver populations over the lifetime of the project.	Population modelling for great skua and red-throated diver Hoy SPA populations has been included in this assessment.
SNH telephone call. Senior Casework Manager 5th February 2019	SNH requested population modelling is also undertaken for hen harrier (*Circus cyaneus*).	Population modelling for the Orkney hen harrier population has been included in this assessment.
SNH email. Senior Casework Manager 4th March 2019	SNH stated in relation to Hoy great skua population modelling that "…using a rough rule of thumb that a population decline of >5% could be significant in terms of a population trend."	Noted. In the absence of any other available guidance regarding significance thresholds, this assessment considers population declines of >5 % could be significant in terms of a population trend for great skua.
SNH skype call. Senior Casework Manager 26th April 2019	Revised 2019 breeding bird survey scope. SNH is satisfied with the approach and explanations given and agrees with the effort levels suggested.	Surveys undertaken in line with the agreed scope of work.
SNH skype call. Senior Casework Manager 30th August 2019 Call to discuss the 2018 population modelling for great skua, red-throated diver and hen harrier	For great skua, SNH stated that a population decline of >5% could be significant in terms of a population trend. SNH confirmed the acceptability of a decline of up to 5% (modelled relative to the baseline) would also be applicable to the other species.	Noted. In the absence of any other available guidance regarding significance thresholds, this assessment considers population declines of >5 % could be significant in terms of a population trend for these and all other species.

Stakeholder	Consultation Response	Applicant Action
SNH email. Senior Casework Manager 21st February 2020 Consultation re: Collision Risk Assessment and Population Modelling	For hen harrier, SNH stated "the predicted decline in the Orkney/NHZ population of > 5 % in combination with other schemes could potentially represent a significant impact."	Noted. In the absence of any other available guidance regarding significance thresholds, this assessment considers population declines of >5 % could be significant in terms of a population trend for hen harrier.
	The collision risk estimates will need to be integrated into a cumulative impact assessment, especially for hen harrier where the assessment is undertaken at the Orkney/natural heritage zone (NHZ) level.	A cumulative impact assessment for the Orkney/NHZ population has been included in the assessment.
SNH email Senior Casework Manager 20th April 2020	Collision risk modelling for white-tailed eagle (*Haliaeetus albicilla*). SNH suggest that the approach is based on distinguishing the age of birds. Adults are most likely to originate from the single breeding pair on Hoy (although other adults may turn up). It would therefore seem appropriate to pool the breeding season data. However, flights involving juvenile or sub-adult birds should be excluded from that analysis and treated separately, assuming there are sufficient flights to undertake collision risk modelling.	Insufficient at-risk flights were recorded to undertake separate age class collision risk modelling, but pooled calculations have been made and apportioned in line with numbers recorded across the flight buffer area (the widest recording area).
	For red-throated diver, where conditions were quite different in the two years, population level effects arising from each year's collision risk should be modelled separately. An average may also be used but using the individual years' data in addition helps to address uncertainty in model predictions. Where additional data can be used to inform interpretation of model predictions then this should be undertaken.	Population modelling has been undertaken separately for 'poor' and 'good' years equivalent to the 2018 and 2019 survey years respectively, and their average. Historical data from 2015 – 2019 has been used to inform interpretation of the model predictions.

Stakeholder	Consultation Response	Applicant Action
	Cumulative impact assessments. Orkney/NHZ assessments are not required for great skua and red-throated diver as these are qualifying SPA species. If the peregrine falcon (*Falco peregrinus*) flights are from birds associated/connected to Hoy SPA then no NHZ assessment is required. If the peregrine falcon flights are from birds which are not connected to the SPA, then an NHZ assessment would be helpful.	Cumulative assessments have been carried out for the Hoy SPA red-throated diver, great skua and peregrine populations.
	Avoidance rates. While it is acceptable to present a range of avoidance rates in an Environmental Report, we have adopted a policy of only amending species avoidance rates after evidence has been peer reviewed. Our default position will be to assess the potential collision risk on the basis of the current, published avoidance rate.	Noted.

7.5 Assessment Methodology and Significance Criteria

7.5.1 The assessment includes a full evaluation of the ornithological importance of the bird populations at the site and identification of any particularly sensitive areas. It has been carried out with reference to the assessment methodologies produced by SNH for the wider countryside (SNH, 2018a) and the Chartered Institute for Ecological and Environmental Management (CIEEM, 2019).

Study Area

7.5.2 The study area includes all areas within the zone of influence of the Proposed Development, with reference to SNH guidance (SNH, 2017). The 'zone of influence' is the area over which important ecological features may be subject to significant effects as a result of the Proposed Development. All statutory designated sites with ornithological interests as qualifying interests within 20 km of the Proposed Development were identified in the Scoping Report, and those with potential connectivity with the Proposed Development, as indicated in the Scoping Opinion, are shown in Figure 7.1. One non-statutory site, Hoy and North Walls SSSI Moorland Fringes Local Nature Conservation Site (LNCS) was also identified in the Scoping Opinion for inclusion in the assessment (Table 7.1). This site is also shown on Figure 7.1.

7.5.3 All protected species within the site and out to 2 km from the boundary of the site have been identified and considered in the assessment. An assessment of cumulative effects has been undertaken for species where relevant, which considers other developments within the relevant geographic scale (see Table 7.4) regardless of distance from the Proposed Development (see Section 7.12).

Desk Study

7.5.4 A desk study was undertaken to compile existing baseline data for the ornithological interests of the study area and its surrounds, including the locations of any relevant statutory and non-

statutory designated sites. A search was made for all statutory designated sites within 20 km and non-statutory sites over-lapping the site boundary. Historical records of protected or notable bird species within 2 km of the site were obtained from Orkney Raptor Study Group (ORSG) and other local data holders. The following sources of information were used for the desk study exercise:

- Scottish Natural Heritage (SNH) SiteLink website (https://sitelink.nature.scot/home) – statutory designated site boundaries, including SPAs and SSSI citation details;
- Supplementary Guidance: Natural Environment Annex 1 Local Nature Conservation Sites, Local Nature Reserves and un-notified Geological Conservation Review Sites (OIC, 2017);
- The Birds of Scotland (Forrester et al. 2007);
- ORSG data on breeding raptors within 2 km of the Proposed Development over the three-year period 2015 - 2017; and
- Red-throated diver breeding data for Hoy and within 2 km of the Proposed Development for the three-year period 2015 – 2017.

Field Surveys

7.5.5 A comprehensive suite of bird surveys was undertaken covering two breeding seasons (2018 and 2019) and two non-breeding season periods (October 2018 to March 2019 and October 2019 to March 2020). Full details of the methodology and findings of all surveys including survey dates and weather conditions are given in Appendix 7.1: Ornithology Technical Report. A brief overview of each survey is provided in Table 7.2.

Table 7.2 Summary of Bird Survey Work Undertaken

Survey Period	Survey Type	Time Period	Observation Hours/Visits
Year 1	Vantage Point (VP) Surveys	April 2018 – March 2019	Total 156 hours spread across two VPs (see Figure 7.2) (36 hours during the breeding season; 42 hours during the non-breeding season at each VP).
	Moorland Breeding Bird Surveys (MBS)	April 2018 – June 2018	Four visits
	Breeding skuas	May 2018 – June 2018	Three visits
	Scarce breeding birds (raptors and divers)	April 2018 – July 2018	Three visits to all areas plus follow-up as required for successful nests
	Focal diver watches	May 2018 – August 2018	82 hours of watches
Year 2	VP Surveys	April 2019 – March 2020	Total 216 hours spread across two VPs (see Figure 7.3) (66 hours during the breeding season; 42 hours

Survey Period	Survey Type	Time Period	Observation Hours/Visits
			during the non-breeding season at each VP).
	MBS	April 2019 – July 2019	Four visits
	Breeding skuas	May 2019 – June 2019 and August 2019	Three visits and two productivity checks
	Scarce breeding birds (raptors and divers)	April 2019 – July 2019	Three visits to all areas plus follow-up as required for successful nests
	Focal diver watches	May 2019 – August 2019	45 hours of watches
	Hen harrier roost watches	November 2019 – March 2020	Five watches across all suitable habitat out to 1 – 1.5 km

7.5.6 The VP survey area used during the Year 1 surveys required three VP locations however the proposed development area was reduced in size before the second year of surveys commenced in April 2019. The reduced survey area meant that VP2 was no longer required. Only data from VP1 and VP3 are used in the assessment. The location of the two VPs used in Year 1 and the visibility from each VP is shown in Figure 7.2. The location of the two VPs used in Year 2 and the visibility from each VP is shown in Figure 7.3.

Survey Limitations

7.5.7 Surveys were undertaken as far as possible, based on SNH guidance (SNH, 2017) however there were a number of instances where the survey methods undertaken, or interpretation of survey findings differed to the published methods, for example see Section 7.6.102. These differences are fully detailed in Appendix 7.1 Ornithology Technical Report. However, these were deemed unlikely to have resulted in any significant limitations to the survey findings.

Assessment of Likely Effect Significance

Approach to Assessment

7.5.8 The methodology used to assess the significance of likely effects on ornithological receptors has been adapted from guidelines produced by CIEEM (CIEEM, 2019).

7.5.9 In this approach, various national and international listings of species that provide the key focus for biodiversity conservation in the UK are recommended as objective starting points for identifying the important ecological features that need to be considered. Each species recorded at the site during field surveys has been considered for inclusion in the assessment based on the conservation importance of the species.

Importance of Bird Species

7.5.10 This assessment for the Proposed Development considers the value of bird species based on their legislative status and also on their numerical 'importance' at a geographical scale (Table 7.3 and Table 7.4). This gives rise to the potential for effects that may be significant on a legislative and/or geographic basis.

Table 7.3 Legislative Scale of Importance of Ornithological Receptors

Importance of Receptor	Criteria
SPA/SSSI qualifying interest/feature	Legislative importance – designated site
WCA Schedule 1 breeding bird	Legislative importance – specially protected species

Table 7.4 Geographic Scale of Importance of Ornithological Receptors

Importance of Receptor	Geographic Context	Criteria
Very High	International (European)	Any SPA, proposed SPA (pSPA) or Ramsar site with connectivity to the site; and Cited interest of a SPA, pSPA or Ramsar site. Cited means mentioned in the citation text for the protected site as a species for which the site is designated.
High	National (Scotland)	Other species that contribute to the integrity of a SPA, Ramsar site or SSSI, such as part of an assemblage where this is a notified feature; Any SSSI with connectivity to the site; Notified feature of an SSSI; A local population (non-breeding) of more than 1 % of the national population of a species; Any ecologically sensitive species, e.g. rare birds with <300 breeding pairs in the UK; and EU Birds Directive Annex I, Wildlife and Countryside Act 1981 (WCA) Schedule 1 species (if not covered above).
Medium	Regional (Orkney)	A regionally important breeding population of a species, either because of population size or distributional context; Any LNCS with connectivity to the site; and Any special wildlife feature of a LNCS with connectivity to the site.
Low	Local (Hoy)	Any other species of conservation interest, e.g. red species listed on the BoCC (Eaton et al. 2015) not covered above; and A breeding population of a species on the SBL.

Importance of Receptor	Geographic Context	Criteria
Negligible	Less than local (site)	Any other species of conservation interest, e.g. amber species listed on the BoCC (Eaton et al. 2015) not covered above; and SBL species (if not covered above).

7.5.11 The geographic context may vary from a less than local (site) scale up to international (Table 7.4). Other than the qualifying interests of designated sites, SNH's interest is in the status of species at the wider geographical scales (SNH, 2018a), so valuations for both breeding and wintering species have generally not been applied below the regional level.

7.5.12 The region in which the Proposed Development is situated is the SNH-defined 'North Caithness and Orkney Natural Heritage Zone 2', (NHZ2) (Wilson et al, 2015).

7.5.13 Conservation importance was assigned using the criteria set out in Table 7.4, including those adopted by SNH in Guidelines for Selection of Biological SSSIs (JNCC, 1995), using 1 % of the resource to define international and national importance (Frost et al. 2018). An additional category of local importance (low importance) was assigned for species approaching the threshold for regional importance and those for which the survey area held a notable concentration in a local context. A further category of 'negligible' importance' (less than local importance) was used for species that did not reach local importance but were still of some ecological value. In addition, listing on Annex I of the EU Birds Directive, Schedule 1 of the Wildlife and Countryside Act 1981 and SBL species were all considered in the evaluation process.

Magnitude of Impact

7.5.14 In accordance with CIEEM (2019) guidance, the following factors, where relevant, were considered when characterising the potential magnitude of a particular impact:

- extent (geographical area or size of population likely to be affected);
- scale (size, volume, amount, intensity) for example the percentage decline in a species population;
- duration (short, medium or long-term, permanent or temporary) in relation to ecological characteristics for example the life span of a species;
- frequency and timing; and
- reversibility. An irreversible effect is one from which recovery is not possible within a reasonable timescale or there is no reasonable chance of action being taken to reverse it. A reversible effect is one from which spontaneous recovery is possible or which may be counteracted by mitigation.

7.5.15 Impacts are also described as either beneficial or adverse. A beneficial impact is one that improves the quality of the environment e.g. by increasing species diversity or extending habitat whereas an adverse impact is one that reduces the quality of the environment e.g. destruction of habitat, removal of foraging habitat, habitat fragmentation, pollution.

Significance of Effects

7.5.16 Sensitivity of receptors is an important consideration when determining the levels of effect. The sensitivity of ornithological receptors to potential impacts of the Proposed Development is based on their capacity to avoid, tolerate, recover from or adapt to a particular impact.

7.5.17 CIEEM (2019) guidance states that "*For the purpose of ecological impact assessment, a 'significant effect' is an effect that either supports or undermines biodiversity conservation*

objectives for 'important ecological features' or for biodiversity in general. Conservation objectives may be specific (e.g. for a designated site) or broad (e.g. national/local nature conservation policy) or more wide-ranging (enhancement of biodiversity). Effects can be considered significant at a wide range of scales from international to local."

7.5.18 In this approach, and in line with SNH and CIEEM guidelines, it is not thought appropriate to attempt to describe significance in the simple terms of 'major', 'moderate', 'minor' or 'no effect', nor to present the assessment in the form of a matrix. Rather, the impacts and their effects are characterised as objectively as possible, with quantitative measures where appropriate, and their significance is considered in the context of their geographic influence.

7.5.19 An assessment of significance may be made at a wide range of geographic scales from local to international similar to those used for valuation (Table 7.4). However, the scale of significance of an effect may not be the same as the geographic context in which the feature is considered important. For example, the significance of an effect may be at a lower level than its listing or valuation; e.g. the effect on a nationally listed species, of regional importance at the site, may be assessed as significant at the local scale, particularly in view of policies for no net loss of biodiversity.

7.5.20 A significant effect is an effect that is sufficiently important to require reporting, so the decision maker is adequately informed of the environmental consequences of permitting a development. It does not necessarily equate to an effect so severe that consent for the project should be refused planning permission, particularly for very locally significant effects.

7.5.21 The SNH (2018a) wider countryside assessment guidance defines the key significance test as follows: "*An impact should be judged as of concern where it would adversely affect the favourable conservation status of a species, or prevent a species from recovering to favourable conservation status, in Scotland*." It notes that the key baseline population against which the assessment should be made for birds is the SNH NHZ population (NHZ2 'North Caithness and Orkney', in this case). Reference NHZ2 population estimates were derived from Wilson et al. (2015).

7.5.22 Cumulative assessments have been undertaken in relation to the Hoy SPA populations where relevant. The only non-SPA species for which a cumulative assessment has been carried out is hen harrier – since almost the entire NHZ2 breeding population is in Orkney, the cumulative assessment has been restricted to Orkney.

7.5.23 As the wider survey area supported breeding species specially protected under Schedule 1 of the Wildlife and Countryside Act 1981, information on the breeding sites and associated flight activity of the species listed on that Schedule have been provided in a Confidential Annex (see Appendix 7.2: Ornithology Confidential Annex). It is important that their breeding locations are kept confidential to minimise the risk of persecution and disturbance. Following SNH guidance (SNH, 2016b), the amount of information contained in the Confidential Annex has been kept to a minimum but includes detailed flight data that indicate breeding locations. The assessment of the effects that the Proposed Development may have on these species has been included within this chapter (but without identifying nesting locations).

Requirements for Mitigation

7.5.24 Following the determination of Important Ecological Features and assessment of likely effects, professional judgement was used, coupled with an understanding of the legal requirements outlined in Section 7.3, to assess and determine the requirements for appropriate mitigation (see Section 7.10). As per CIEEM guidance, where possible, the approach to mitigation follows the mitigation hierarchy of avoidance, mitigation, compensation and enhancement.

Assessment of Residual Effect Significance

7.5.25 The assessment of residual effects is undertaken in a similar manner to that of the likely effects but taking into consideration the proposed mitigation measures (see Section 7.11).

7.6 Baseline Conditions

Designated Sites

7.6.1 As confirmed by SNH and RSPB in the Scoping Opinion, there are a number of designated sites with ornithological interests in the surrounding area with potential for connectivity with the Proposed Development that require consideration in the assessment (see Table 7.5).

Table 7.5 Ornithological Designations

Name	Designation	Distance from Proposed Development (km)	Designated Feature
Hoy	SPA	0.19	Breeding fulmar (*Fulmarus glacialis*); breeding Arctic skua; breeding great black-backed gull; breeding great skua; breeding guillemot (*Uria aalge*); breeding kittiwake (*Rissa tridactyla*); breeding peregrine; breeding puffin (*Fratercula arctica*); breeding red-throated diver and breeding seabird assemblage.
Hoy	SSSI	0.19	Breeding Arctic skua; breeding bird assemblage; breeding fulmar; breeding great black-backed gull; breeding great skua; breeding guillemot; breeding peregrine; breeding red-throated diver and breeding seabird colony.
Scapa Flow	pSPA	0.49	Breeding red-throated diver (foraging in Scapa Flow); non-breeding black-throated diver (*Gavia arctica*); non-breeding eider (*Somateria mollissima);* non-breeding goldeneye (*Bucephala clangula*); non-breeding great northern diver (*Gavia immer*); non-breeding long-tailed duck (*Clangula hyemalis*); non-breeding red-breasted merganser (*Mergus serrator*); non-breeding shag (*Phalacrocorax aristotelis*) and non-breeding Slavonian grebe (*Podiceps auritus*).
Switha	SPA	6.56	Non-breeding Greenland barnacle goose (*Branta leucopsis*)

Name	Designation	Distance from Proposed Development (km)	Designated Feature
Hoy and North Walls SSSI Moorland Fringes	LNCS	0	Special Wildlife: Red-throated diver*; breeding birds of prey*; golden plover* (*Pluvialis apricaria*); curlew*(*Numenius arquata*); lapwing*(*Vanellus vanellus*); Dunlin* (*Calidris alpina*); Arctic skua*; great skua; black-headed gull* (*Chroicocephalus ridibundus*); herring gull*(*Larus argentatus*) and skylark* (*Alauda arvensis*). *nationally important species

7.6.2 The Proposed Development site is outwith any sites designated for ornithological interests at European or national levels; however, there are several designated sites with ornithological interests in the surrounding area.

7.6.3 Hoy SPA is located adjacent to the Proposed Development site. Hoy SPA is an extensive moorland site covering two-thirds of the land mass of Hoy and a marine extension that extends approximately 2 km into the surrounding coastal waters (see Figure 7.1). This site holds internationally important breeding populations of moorland birds including red-throated diver, Arctic skua, great skua and great black-backed gull. The western cliffs hold breeding peregrine falcon and a number of breeding seabird species including fulmar, guillemot, kittiwake, puffin and breeding seabird assemblage. Hoy SPA is considered of very high (international) importance in this assessment. The Hoy SPA qualifying interests recorded during the field surveys are detailed in the following sections.

7.6.4 The terrestrial boundary of Hoy SPA overlaps with that of Hoy SSSI (see Figure 7.1) This site is designated for geological, botanical and ornithological interests including moorland breeding birds and breeding seabirds. All of the SSSI ornithological notified interests are also SPA qualifying features therefore they are already covered in the assessment.

7.6.5 Switha SPA is a small grassy island off the east coast of South Walls to the south of Hoy, approximately 5.5 km south-east of the Proposed Development. Switha SPA is designated for its internationally important wintering population of Greenland barnacle goose. No Greenland barnacle geese were recorded during any of the field surveys therefore this site is not considered further in the assessment.

7.6.6 Scapa Flow proposed SPA (pSPA) is located approximately 0.5 km to the east of the Proposed Development, at its closest point. This is an extensive site covering the enclosed marine waters of Scapa Flow and the nearshore waters to the east of Orkney extending from Deerness to South Ronaldsay (see Figure 7.1). These sheltered waters support internationally important populations of wintering birds including black-throated diver; eider; goldeneye; great northern diver; long-tailed duck; red-breasted merganser; shag and Slavonian grebe. During the breeding season, this site provides important foraging habitat for breeding red-throated divers that nest on small lochans on the surrounding land. Only red-throated diver was recorded at the Proposed Development. The pSPA population of red-throated divers is larger than that of the Hoy SPA as it includes all the birds from Hoy, plus those from the smaller islands in Scapa Flow and from the Mainland or Orkney parishes adjacent to Scapa Flow. Scapa Flow pSPA is considered in the assessment as very high (international) importance in relation to breeding red-throated divers only.

7.6.7 The Proposed Development site overlaps the Hoy and North Walls SSSI Moorland Fringes LNCS, which is a large site covering the hill slopes to the east of Hoy SSSI, stretching from Lyrawa Hill in the north to the lower slopes of Binga Fea in the south. Throughout this site, the predominant habitat is blanket bog with a variety of other habitats including valleys with fast-flowing burns, native willows, trees and bracken. This site supports a range of breeding bird species including red-throated diver, great skuas, present in large numbers, and a much lesser number of Arctic skua and golden plover. The area is especially important for the number of breeding birds of prey. Many other species of birds nest in the variety of habitats present including curlew, lapwing, dunlin, herring gull and skylark. This LNCS is considered of medium (regional) importance in the assessment. The LNCS species recorded during the field surveys are detailed in the following sections.

Species

7.6.8 Full details of the findings of the field surveys including all flight line maps are presented in Appendix 7.1 Ornithology Technical Report and where relevant, Appendix 7.2: Ornithology Confidential Annex.

Divers

Red-throated Diver

7.6.9 Red-throated diver flight lines were frequently recorded during VP surveys in both years between April and early September. There was a considerable difference in the level of flight activity recorded between years with a total of 44 flight lines (totalling 56 birds) recorded in 2018 compared to 189 flight lines (totalling 238 birds) in 2019. Across the season there were 39 VP hours in 2018 and 69 VP hours in 2019, giving flight rates of 1.44 and 3.45 birds per hour respectively.

7.6.10 Additional focal diver watches each year were concentrated on flights to and from the breeding sites around the Proposed Development. The majority of these watches were conducted in July and August each year, when activity tends to be highest as chicks are being fed. The focal diver VPs used varied each year with an emphasis on different areas, so the results are not directly comparable between years. Nevertheless, the rate of flights that could be attributed to specific lochans or clusters of lochans followed the same trend as the coverage from the main VPs, with 68 flights from approximately 83 hours of watching in 2018 and 94 flights from approximately 45 hours of watching in 2019, at 0.82 and 2.10 flights per hour respectively.

7.6.11 The general patterns of flights to the various breeding waters are shown in Appendix 7.2 Ornithology Confidential Annex. There were multiple routes to and from all sites, generally heading out eastwards to Mill Bay or Ore Bay, on either side of the Sky Fea-Wee Fea ridge, or out south-east along the Burn of Heldale. A small minority of birds departed or arrived into the general area from the west or flew north-south across the ridges and valleys. The focal diver watches give an indication of the routes used from each breeding site, but do not give a quantitative measure of the use of each route because the views from the VPs generally tended to favour detection of birds arriving along the Burn of Ore (past the Proposed Development) rather than up from the Mill Burn (to the north of the Proposed Development). This is particularly the case for Site G, where it is known from previous experience that many flights use the northern route.

7.6.12 Data on the breeding red-throated divers for all of Hoy were obtained for the five-year period 2015 to 2019 (Table 7.6). For each year, this gave the total number of occupied sites (i.e. breeding pairs, plus pairs making a scrape but not laying eggs) and the total number of chicks fledged (i.e. the chicks known to have fledged plus the near-fledged chicks present on the last visit). Additionally, there were some smaller chicks present on the last visit for which the outcome was classed as 'unknown'. These numbers give a reasonable range for the minimum and maximum number of chicks to have fledged each year, although there sometimes remained sites where the outcome was not conjectured.

Table 7.6 Summary of Red-throated Diver Breeding Numbers and Success for Hoy

Year	No. Occupied Sites	No. Successful	No. Outcome Unknown	No. Failed	Minimum-Maximum No. Young Fledged	Range of productivity rate per site
2015	64	41	8	15	49 – 56	0.76 – 0.88
2016	66	29	6	31	37 – 43	0.56 – 0.65
2017	55	12	9	34	12 – 18	0.22 – 0.33
2018	49	15	3	31	17 – 20	0.35 – 0.41
2019	61	29	2	30	39 – 43	0.64 – 0.70
Five-year average	**59**	**25.2**	**5.6**	**28.2**	**31 – 36**	**0.53 – 0.61**

7.6.13 Three of these years (2015, 2016 and 2019) had good numbers (more than 60 occupied sites) and two of these years (2017 and 2018) were much poorer in terms of numbers. Productivity, in terms of numbers and rates also varied widely, with 2015 clearly better than any other year and 2017 faring the worst. In the comments provided by the data holders, it was stated that in 2019 there was a noticeable difference in the distribution of breeding pairs, possibly indicating that new birds were involved (Jim Williams, pers. comm.).

7.6.14 The lochans local to the Proposed Development (those within 2 km of the Proposed Development and also the two most important waters and lochan clusters to the west) were checked for breeding divers in 2018 and 2019 during raptor and skua surveys, and from focal diver watches (see Figure 2.53 in Appendix 7.2 Ornithology Confidential Annex).

7.6.15 Historic data for these lochans was also obtained for the three-year period 2015 to 2017. A summary of the breeding activity for these sites is shown in Table 7.7. Even though 2018 was generally poor for Hoy as a whole, the area closest to the Proposed Development did similarly well in 2018 and 2019. There was a bigger difference at the more distant waters to the west of the Proposed Development where there were six successful pairs in 2018 and ten in 2019, with four and three failed breeding attempts respectively. It is more difficult to get an estimate for the number of pairs present but not laying eggs, at these more distant waters, since some of the lochans are a focal point for non-breeders and failed breeders (including from elsewhere) that vary in their presence across the season.

Table 7.7 Summary of Red-throated Diver Breeding Activity at Lochans Local to the Proposed Development

Site	Status	2015	2016	2017	2018	2019
Sites A to F (within 2 km of the Proposed Development)	Successful pairs	2	1	1	1	1
	Unsuccessful pairs	0	2	1	0	1
	Pairs not laying eggs	0	1	2	3	2

Site	Status	2015	2016	2017	2018	2019
	Total pairs here	**2**	**4**	**4**	**4**	**4**
Sites G and H (more than 2 km to the west of the Proposed Development)	Successful pairs	10	7	2	6	11
	Unsuccessful pairs	2	6	8	4	3
	Pairs not laying eggs (known for one lochan only)	0	0	0	1	0
	Total pairs here	**12**	**13**	**10**	**11**	**14**

7.6.16 In 2018, there were three lochans within 2 km of the Proposed Development where pairs appeared regularly but did not attempt to make a scrape; one of these pairs was on a recently used lochan, one on a lochan that had not been used for some years and one was the first record for that lochan. In 2019 these lochans were all occupied again, two of them progressing to making a scrape and the third successfully fledging a chick. This progress year-on-year, particularly at the long-disused and new lochans, indicates the arrival of new pairs in 2018, following on from the very poor year in 2017 and is part of the breeding distribution differences noted across the whole island.

7.6.17 The more than doubling in observed flight activity rates from 2018 to 2019 appears to be partly explicable by the increased breeding success at the more distant waters to the west of the Proposed Development, though the closer breeding sites were similarly occupied in each year. Large differences in flight rates between years have also been noted at other Orkney sites, where breeding success does not seem to be the full explanation. For example, at Hammars Hill (West Mainland, Orkney) the red-throated diver flight rates at the existing wind farm were nearly four times higher in 2016 than 2017; there had been two pairs nearby each year, both of them successful in 2016 and one in 2017 (Firth Ecology, 2020). Prevailing wind direction and possible inaccuracy in drawing flight lines were also potential factors at Hammars Hill but, even taken together with breeding success, these factors were not nearly enough to be an explanation for the very large difference in activity observed. There may be an element of individual preference in flight routes for different birds, perhaps changing between years; there will also be a random effect due to the relatively small number of hours sampled by VP watches, even when they are planned to capture data from all parts of the daylight hours each month.

7.6.18 The historic and recent red-throated diver data has been used to derive the five-year and two-year averages for various parameters for the local population around the Proposed Development (see Table 7.8). These data relate to the breeding sites in Table 7.7 i.e. all of those within 2 km of the Proposed Development, plus the two sites lying further to the west).

7.6.19 In general terms, across the whole of Hoy, 2015, 2016 and 2019 were all good years, while 2017 and 2018 were both poor years (Table 7.6). However, in the more local area around the Proposed Development, 2016 and 2019 were good years, 2015 and 2018 were intermediate and only 2017 was a particularly poor year (Table 7.7). Overall, the five-year and two-year averages for various breeding parameters close to the Proposed Development were remarkably similar (Table 7.8).

Table 7.8 Comparison of Red-throated Diver Numbers around the Proposed Development: Five-year Average 2015 – 2019 and Two-year Average 2018 - 2019

Breeding parameter	Five-year Average 2015 – 2019	Two-year Average 2018 – 2019
Total number of occupied sites including successful and failed breeders, plus pairs not laying eggs (whether building a scrape or not)	15.6	16.5
Number of successful pairs	8.4	9.5
Minimum number of chicks fledged	9.6	10.0*
Potential maximum number of chicks fledged	10.8	11.0*

** Number of chicks in 2018 and 2019 in each category are minimum estimates (tending to reduce the two-year averages relative to the five-year averages)*

7.6.20 In terms of the overall numbers on Hoy, data from the Orkney Bird Reports show that the numbers present in 2015 and 2016 were approaching the former high population levels from the 1990s and early 2000s, which consistently had 60 or more occupied sites. This dropped in 2004 to around 55 occupied sites, as again in 2017 and even lower in 2018, which was the year with the lowest overall numbers for at least two decades (Williams 2001:2013; Williams and Branscombe 2014 and Branscombe 2015:2019).

7.6.21 Total Hoy productivity on a par with that in 2015 was last seen in 2009 and 2004. The c.50 % drop in chick production in 2017 and 2018 was another significant aspect of those seasons.

7.6.22 However, the most important factor from a population perspective was the number of dead adults found in the 2017 breeding season – five were found in that one year, compared to a normal average thought to be less than one a year (Jim Williams, pers. comm.). Food shortage was postulated as the cause of this additional mortality and also of the poor breeding condition of the surviving birds.

7.6.23 If it does show up as a population level effect, the two years drop in productivity will take some years to work through. Remarkably, the dramatic hit on adult survival in 2017 appears to have already been mostly recovered by 2019 in terms of the overall breeding numbers.

7.6.24 The vast majority of breeders on Hoy are within the Hoy SPA and all of them feed (at least partly) within the proposed Scapa Flow SPA. The Hoy SPA red-throated diver population at designation was 58 pairs (6 % of the GB population) and its latest SNH assessed condition was 'Favourable Maintained[2]' with no specific negative pressures identified. The Scapa Flow pSPA red-throated diver population is 81 pairs (SNH, 2016d). The pSPA population of red-throated divers is larger than that of the Hoy SPA as it includes all the birds from Hoy, plus those from the smaller islands in Scapa Flow and from Mainland parishes adjacent to Scapa Flow.

7.6.25 All birds at the Proposed Development are taken to be from the Hoy SPA and Scapa Flow pSPA populations.

7.6.26 Red-throated diver is included in the impact assessment as of very high importance, as it is a qualifying feature of Hoy SPA and the proposed Scapa Flow SPA and a notified interest of Hoy

2 Last assessed on 30 August 2007 (SNH, Sitelink).

SSSI. It is also a wider countryside Annex I species and is specially protected from disturbance at its breeding sites under Schedule 1 of the Wildlife and Countryside Act 1981.

Raptors and Owls

Peregrine Falcon

7.6.27 Peregrines were seen occasionally and rather sporadically from the main VP watches, throughout the year. It was not usually possible to age the birds seen from VPs due to distance or light; of the total 23 individuals observed, six were identified as adults and the rest were unaged. All but one sighting was of a single bird, most often in direct transit across the survey area in various directions, but occasionally flying more slowly within it. One long, circling flight occurred over the lower ground near VP3, outside the edge of the timed flight buffer.

7.6.28 There are no breeding sites within 2 km of the Proposed Development. The closest breeding site is on the western cliffs of Hoy, at more than 4 km. SNH guidance suggests that the core hunting range for breeding peregrines is 2 km, but that birds have been recorded out to 18 km from their nests (SNH, 2016a).

7.6.29 Peregrine is a Hoy SPA qualifying species with six pairs (0.5 % of the GB population) at notification (SNH, 2009) and its latest SNH assessed condition was 'Favourable Maintained[3]' with no specific negative pressures identified. The peregrines on Hoy are not monitored fully in most years. The annual Orkney Birds Reports (Williams, 2003 and 2009:2013; Williams and Branscombe, 2014; Branscombe, 2015:2019) provide figures each year, but often there is a caveat for the coverage on Hoy. Generally, four to six pairs were found each year, sometimes with a note that additional single birds held territory. The highest number of pairs given for Hoy was seven in 2011, but this probably included a pair on South Walls, well outside the SPA. Thus, it appears that the Hoy SPA population is unlikely to exceed six pairs and may sometimes be fewer. Each year there will be additional non-breeders present, some of which may hold territories as single birds.

7.6.30 The birds appearing at the Proposed Development are most likely to be from the closest pair but will also include breeding birds from further away (though likely still to be Hoy SPA breeding birds) and non-breeders. During the winter, individuals from much further afield may contribute to the Hoy population, although they would probably be transient in their occurrence.

7.6.31 Peregrine is included in the impact assessment as of very high importance, as it is a qualifying feature of Hoy SPA and a notified interest of Hoy SSSI. It is also a wider countryside Annex I species and is specially protected from disturbance at its breeding sites under Schedule 1 of the Wildlife and Countryside Act 1981.

Hen Harrier

7.6.32 Hen harrier was the most frequently detected raptor from VP watches, with multiple individuals present in the general area throughout the year. The number of birds recorded in the breeding season within the flight buffer included at least two adult males, three females in 2018, four females in 2019, and several juveniles. In the non-breeding season, up to three different birds could be present together within the flight buffer.

7.6.33 The locations of hen harriers recorded breeding within 2 km of the Proposed Development in 2018 and 2019 are shown in Figures 2.51 and 2.52, respectively, in Appendix 7.2 Ornithology Confidential Annex.

7.6.34 The ORSG data for 2015 – 2019 provides information on the numbers of hen harriers present and breeding within the 2 km raptor survey buffer during the past five years (see Table 7.9 below and Figure 3.1 in Appendix 7.2 Ornithology Confidential Annex). The highest total numbers of female hen harriers in the 2 km buffer were recorded in 2018 and 2019, with nine and eight confirmed plus 'possibly occupied' sites in 2018 and 2019 respectively. Along the Burn of Ore,

3 Latest assessed condition on 29 May 2013 (SNH, Sitelink)

closest to the Proposed Development, the highest number of females was four in 2019 and the best breeding success was two nests fledging six young in 2018. By far the best breeding success in the 2 km buffer was also in 2018, with five successful nests and 13 young near to fledging.

Table 7.9 Hen Harrier Numbers around the Proposed Development 2015 – 2019 from ORSG data

Area	Breeding Status	2015	2016	2017	2018	2019
Burn of Ore	Successful site	0	0	1	2	1
	Failed site	2	1	1	1	3
	Possibly occupied site	1	0	0	0	0
	Total no. females	**3**	**1**	**2**	**3**	**4**
	Young near to fledging	0	0	2	6	4
Whole 2 km buffer	Successful site	1	2	2	5	2
	Failed site	2	1	3	3	4
	Possibly occupied site	2	3	1	1	2
	Total no. females	**5**	**6**	**6**	**9**	**8**
	Young near to fledging	2	5	5	13	7

7.6.35 The numbers around the Proposed Development may be put into the context of the total numbers recorded on Hoy each year, as shown in Table 7.10. In terms of successful sites and total females (including 'possibly occupied' sites) numbers were relatively consistent during this period. However, the number of confirmed and probable sites (i.e. excluding those only 'possibly occupied') appears to show a clear upward trend over the five years.

Table 7.10 Hen Harrier Numbers on Hoy from ORSG Data 2015 - 2019

Area	Breeding status	2015	2016	2017	2018	2019
All Hoy	Successful site	6	7	5	8	7
	Failed site	7	5	11	12	9
	Possibly occupied site	6	7	6	1	3
	Total no. females	**19**	**19**	**22**	**21**	**19**
	Young near to fledging	13	17	14	18	17

7.6.36 Hen harrier roost watches across the winter of 2019/20 concentrated on the suitable habitat within about 1.5 km of the Proposed Development and found birds roosting in three locations (see Figure 2.54 in Appendix 7.2 Ornithology Confidential Annex). In the previous winter, a further roost site had been seen at the south-west part of the 2 km buffer during VP watches from VP2. This roost site was at the edge of the 2 km buffer and out of direct line of sight from the turbine positions (behind a hill).

7.6.37 All of the hen harrier roost sites were found at more than 500 m from the Proposed Development. The number of birds at each roost site varied from zero to two, although three birds had been seen one morning at the most regularly used site in 2018/19 from main VP3. At this site, situated around a kilometre from the Proposed Development, at least one bird was seen on each roost watch in 2019/20.

7.6.38 Prior to the roost survey undertaken for the Proposed Development in 2019/20 there have been no other organised hen harrier roost surveys undertaken on Hoy, but from previous experience the surveyors were aware of one additional site within the 2 km buffer where a single bird had been seen to roost in the past (Stuart Williams, pers. comm.). This site was covered by the 2019/20 roost watches, but no confirmed roosting was seen.

7.6.39 In Orkney, hen harriers can drop into small patches of suitable vegetation, which are widespread in many areas. Individual hen harriers do not necessarily return to the same roost site each night, and watches in various places around the county indicate that there may be many potential roost sites that are used only intermittently, by just one or a few birds.

7.6.40 Hen harrier is an Annex 1 species and is also protected under Schedules 1 and 1A of the Wildlife and Countryside Act 1981, which provide protection against disturbance at its breeding sites and against harassment at any location. However, it is not a qualifying interest of any of the designated sites on Hoy. Hen harrier is included in the impact assessment as of high importance, due to its protected status and the numbers breeding, and present all year round, on Hoy – these make up an important element of the Orkney population.

White-tailed Eagle

7.6.41 In 2018, one pair bred at the north end of Hoy with two juveniles successfully fledged. This was the first successful breeding attempt since a young pair appeared in Orkney in 2013, after a breeding absence of over 140 years. The VP survey data showed at least one other sub-adult bird was also present on Hoy during the 2018 summer. However, there were no white-tailed eagle flights observed at risk from April 2018 through to the end of the breeding season in August. One of the two new juveniles was seen in the survey in December 2018 and possibly again in March 2019, but there were no flights at risk in the first non-breeding season of survey work (September 2018 to January 2019 for this species).

7.6.42 In 2019, the established pair raised one juvenile and again at least one sub-adult (2 - 3 year-old) was present but seen more regularly than before. There were several flights at risk during the 2019 breeding season (February to August for this species) and again in February and March 2020. Only one flight line, an adult, was at risk during the 2019/20 non-breeding season.

7.6.43 It is the adult population that is of greatest importance at this site as this relates to the single pair breeding on Hoy, and the only breeding pair present in Orkney. The species typically takes six years to reach breeding age, in which time the sub-adults may roam widely particularly in the spring. Other than the juveniles fledged from the Hoy nest, the sub-adult birds seen on Hoy to date were not related to the breeding pair and form part of a larger national non-breeding population. There was one confirmed observation of a known Hoy juvenile from VP watches.

7.6.44 White-tailed eagle is an Annex 1 species, and is also protected under Schedules 1, 1A and A1 of the Wildlife and Countryside Act 1981, which provides protection against disturbance at its breeding sites, against harassment at any location and against destruction of its nests. However, it is not a qualifying interest of any designated site in Orkney. White-tailed eagle is included in the impact assessment as of high importance, primarily due to the presence of the breeding pair on Hoy.

Golden Eagle (*Aquila chrysaetos*)

7.6.45 A single young golden eagle, two–three years old, was seen intermittently from VP watches and other fieldwork from April to September 2019. Most sightings were to the west or north of the Proposed Development, with only two flight paths passing through the wind farm buffer.

7.6.46 This individual was seen to hunt for mountain hares and there were many remains of hares scattered on the top of Sky Fea and nearby. In early August it was also seen to swoop at an adult great skua that was perched on the ground, but the skua moved off easily enough. However, in late August during the skua productivity checks two recently fledged great skuas were found as typical raptor kills, with a pair of wings attached to the breastbone. The keels of these were not merely notched but had been pecked almost completely away. It seems likely that the predator was either this golden eagle, or possibly one of the white-tailed eagles.

7.6.47 Golden eagles have not bred on Hoy since the 1980s. Since then they have been generally rare in Orkney with occasional single birds appearing every few years, mostly immatures. There were reports of at least one young bird on Hoy in 2018, but it was not seen during the survey work here.

7.6.48 As wandering immatures, the golden eagles seen on Hoy in 2018 and 2019 form part of the wider Scottish non-breeding population, likely to number a few hundred birds. Their intermittent occurrences on Hoy, and even more so near the Proposed Development, imply that there is no scope for a significant effect on the national population. Therefore, this species is not considered further in the impact assessment.

Merlin (*Falco columbarius*)

7.6.49 Merlin sightings from the VP watches were few and intermittent, despite a successfully breeding pair in the survey area in both years. This is perhaps largely a reflection of its small size and typically low flight altitude, both of which make detection difficult at any more than a few hundred metres from the observer.

7.6.50 There were less than ten merlin flights seen during each year of VP observations, with only one bird seen at risk height within the wind farm buffer (flying directly south across it on 4th March 2020). Even though other merlins at risk may have gone undetected, it is not possible to reliably extrapolate from such a small sample and collision risk workings have not been undertaken.

7.6.51 The closest breeding pair was well over a kilometre distant from the nearest part of the wind farm (see Figures 2.51 and 2.52 in Appendix 7.2 Ornithology Confidential Annex). Two other sites, occupied in 2018 only, were at a similar distance or more. The ORSG data from 2015 – 2019 shows only one other site within 2 km, occupied in 2015 (see Figure 3.2 in Appendix 7.2 Ornithology Confidential Annex).

7.6.52 Orkney Bird Reports indicate that merlins have been faring poorly in Orkney generally since a recent high point in 2005–2006, when there were at least 20 occupied sites, up to eight of them on Hoy (Williams 2001:2013; Williams and Branscombe 2014 and Branscombe 2015:2019). Since 2011, there have been no more than single figures proved breeding each year in Orkney, with between five and seven in the county during the five years 2015–2019. The Hoy numbers have also reduced, down to two–four pairs each year recently, but may now make up the majority of the Orkney population in some years.

7.6.53 Merlin is an Annex 1 species but is not a qualifying interest of any internationally or nationally designated site in Orkney. This species is also specially protected from disturbance at its breeding sites under Schedule 1 of the Wildlife and Countryside Act 1981. The distance of the breeding sites from the Proposed Development, the low number of sightings recorded during the two years of field surveys, and the thinness of the current Hoy distribution imply that there is little scope for a significant effect due to the Proposed Development on either the Orkney or Hoy merlin populations. Merlin is included in the assessment as of high importance.

Short-eared Owl (*Asio flammeus*)

7.6.54 All short-eared owl sightings from the VP watches were made between April and August. There were just four flight paths in 2018 and 17 in 2019. Only two flights were observed at risk height within the wind farm buffer, totalling 135 seconds.

7.6.55 The difference in observed flight rates between years may reflect the different breeding status of short-eared owls around the site. The breeding raptor watches in 2018 revealed only one

'possibly occupied' short-eared owl site about a kilometre to the north of the Proposed Development, with one other recorded as 'probably occupied' from the VP observations, also at about a kilometre distant from the Proposed Development (see Figure 2.51 in Appendix 7.2 Confidential Annex). At this site a male short-eared owl flew around for some time and then perched out in the open for more than half an hour – a good indication that an incubating female was nearby (Calladine et al, 2010). This male was seen again in the same area, hunting and perching, but neither of the potential territories appeared to be successful.

7.6.56 In 2019, no short-eared owls were seen during raptor watches, but one confirmed and two 'possible' sites were detected from the main VP observations (see Figure 2.52 in Appendix 7.2 Ornithology Confidential Annex). A nest, with three chicks nearly ready to fledge, was found just under a kilometre from the nearest part of the Proposed Development infrastructure and a fledged chick was subsequently seen being fed here. The other 2019 observations were much less conclusive, involving a bird seen once carrying prey away out of view to the north of the Proposed Development, and another very briefly displaying within the wind farm buffer. This last bird was found in flight on 10th June and performed one low-level wing-clap over a rushy area before flying low away; a short-eared owl was subsequently flushed from near there on the last MBS survey on 1st July.

7.6.57 Short-eared owls are known to be difficult to survey, often with few indications of breeding observed from VP watches. A study specifically to investigate the best survey protocol in Scotland (Calladine et al, 2010) concluded that there was 75 % likelihood of seeing short-eared owls from a combined four hours of watches at certain critical times and stages of the season. A total of 19 of these critical hours were watched from main VP1 across the potential territory within the wind farm buffer, with no other short-eared owl sightings recorded. Although wing-clapping is usually a good territorial indicator, the bird in question simply flew away from the area, rather than alighting. Male short-eared owls can be very belligerent to each other, and to other species, and territorial behaviours can be triggered if two males meet when out hunting, even though they may both be some distance from their territories (Andrew Upton pers. obs.).

7.6.58 The ORSG data from 2015 – 2019 showed that within 2 km of the Proposed Development, there were five 'possibly occupied' sites in 2015 and two occupied sites in both 2016 and 2017 (see Figure 3.3 in Appendix 7.2 Confidential Annex).

7.6.59 Orkney is important for breeding short-eared owls, and the species is a qualifying interest of the Orkney Mainland Moors SPA (SNH, 2008). Short-eared owl numbers can be variable from year to year and there appears to have been some large changes in recent years. Orkney Bird Reports show that the recent peak year for short-eared owls in Orkney was 2012, when 109 confirmed or probable territories were found across the county (three of them on Hoy) (Williams 2001:2013; Williams and Branscombe 2014 and Branscombe 2015:2019). Numbers dropped away to more normal levels of around 40 sites up to 2017, and then dropped again down to about 20 sites (excluding Eday) in 2018 and 2019. In these last two years there were six and eight sites on Hoy respectively, indicating an increase in the island's importance for this species.

7.6.60 The sharp reduction in short-eared owl numbers so apparent on Mainland Orkney is thought to be related to the spread of introduced stoats (*Mustela erminea*), which are now widespread since their first arrival in 2010 and may be competing with short-eared owls for prey, especially Orkney voles. Hoy does not have an Orkney vole population, hence its formerly minor importance for short-eared owls, but it also does not have stoats, which may explain the maintenance of the short-eared owl numbers on the island.

7.6.61 Short-eared owl is an Annex 1 species but is not a qualifying interest of any internationally or nationally designated site on Hoy. The potential for multiple pairs in the vicinity of the Proposed Development, and their apparent proximity, mean that this species is considered of high importance in the impact assessment.

Fulmar, Skuas and Gulls

<u>Fulmar</u>

7.6.62 Fulmars were very scarce across the survey area, with single birds in only two snapshot counts from Year 1 and eight from Year 2. Occasionally others were seen from VPs outside of the snapshot counts, but relative to the Hoy SPA population of many thousands of pairs (over 35,000 pairs in the Seabird 2000 census) (Mitchell et al, 2004a) there is no prospect of a significant impact therefore fulmar is not considered further in the impact assessment.

Great Skua

7.6.63 Great skuas were seen from every VP watch between April and September, with a few stragglers still present in October. They were by far the most frequent species in flight within the flight buffers, with a relatively constant presence in the air during the busiest period from June to August. There were far too many great skuas present to attempt standard flight path recording so an alternative method was used, wherein snapshot counts were carried out every five minutes.

7.6.64 Breeding skua surveys, covering out to 1 km from the Proposed Development, found similar numbers of apparently occupied territories (AOTs) in 2018 and 2019, with the same general distribution across the survey area each year as shown in Appendix figures A.29 and A.30 in Appendix 7.1 Ornithology Technical Report. There were clear concentrations of AOTs on the low ground to the east of Binga Fea (outside of the Hoy SPA boundary) and along the south side of the upper Burn of Ore (within the Hoy SPA). Very few were on Wee Fea or within the footprint of the Proposed Development. The total within the 2019 skua 1 km buffer, which was covered in both years, was 266 AOTs in 2018 and 251 AOTs in 2019.

7.6.65 Great skuas are spread across the moorlands on Hoy and in 2019 SNH and RSPB organised a survey of most of the island, to which the 2019 records from this survey work were contributed. Together with a survey of the south-west part of Hoy in 2018, the coverage on Hoy was effectively complete. The final results have not yet been officially compiled, but SNH have given an interim figure of 1,578 AOTs for the whole of Hoy, of which 1,415 AOTs were within the Hoy SPA (Kate Thompson, pers. comm.). The Hoy SPA population at designation was 1,900 breeding pairs (14 % of the biogeographic population (SNH, 2009) with site condition assessed as 'unfavourable declining[4]'.

7.6.66 There have been a series of great skua surveys conducted around the lower Burn of Ore area in recent years. These surveys did not all cover the same area, but there was a substantial overlap, including the bulk of the dense colony east of Binga Fea. The great skua counts in this overlapping area are shown in Table 7.11.

Table 7.11 Great Skua Numbers for East of Binga Fea Area from Various Surveys Undertaken in Recent Years

Year	Survey	No. Visits	Great Skua AOT Estimate	Reference
2008	RSPB Site of Local Nature Conservation Interest (SLNCI)	2	39	In Firth Ecology (2012)
2008	Ore Brae	2	37	Upton, 2009
2010	RSPB All-Hoy	1	18	In Firth Ecology (2012)
2010	Binga Fea	3	28	Aquatera, 2011
2011	Ore Farm	3	57	Firth Ecology, 2012

4 Last assessed condition on 8th July 2019 (SNH, Sitelink).

Year	Survey	No. Visits	Great Skua AOT Estimate	Reference
2015	A. Upton	1	57	Andrew Upton, pers. comm.
2018	This proposal	3	50	Fieldwork for the Proposed Development
2019	This proposal	3	67	Fieldwork for the Proposed Development

7.6.67 The findings in Table 7.11 clearly indicate a general increase in great skua AOTs in the area since 2008, with numbers rising sharply between 2010 and 2011 and then apparently remaining at that higher level, but with continued underlying variation as shown between 2018 and 2019. It also indicates that carrying out just a single survey visit may result in a low count, as found by the two different surveys in 2010.

7.6.68 Orkney-wide skua surveys have now been carried out in 2000, 2010 and 2019 (Table 7.12). These have each been based on single counts in most areas, with the survey work for the Proposed Development in 2019, and that for the area in south-west Hoy in 2018, being the largest sub-areas using a three-count method. Table 7.12 gives the Orkney and Hoy numbers from each of these surveys (where available).

7.6.69 The 2015 NHZ2 North Caithness and Orkney estimate is 1,868 AOTs which is effectively the Orkney population as so few great skuas breed in northern Caithness (Wilson et al, 2015). This 2015 estimate is based on trends at 24 colonies within NHZ2 between Seabird 2000 and their average size from 2006 – 2013, which gave a 16 % reduction. There was no separate estimate for Hoy, which had shown a more sharply downward trajectory from 2000 to 2010 than the smaller outlying colonies (many of which actually increased).

7.6.70 The fall in numbers on Hoy from 2000 to 2010 now appears to have been reversed to some extent.

Table 7.12 Great Skua Numbers in Orkney and Hoy from County-wide Censuses

Year	Survey	No. Visits	Orkney Estimate (No. AOTs)	Hoy Estimate (No. AOTs)
2000	Seabird 2000 (Mitchell et al, 2004b)	1	2,209	1,973
2010	RSPB (Meek et al, 2011)	1	1,710	1,346
2019	SNH/RSPB (Kate Thompson, SNH, pers. comm.)	1 - 3	not yet available	1,578

7.6.71 Great skua is a qualifying interest of the Hoy SPA and a notified feature of Hoy SSSI and is included in the impact assessment as a species of very high importance.

Arctic Skua

7.6.72 Arctic skuas were seen only once from VP watches in each breeding season, with one bird on 6th August 2018 and two on 2nd July 2019.

7.6.73 There were also single sightings from the MBS surveys each year, including a dark phase pair at the eastern edge of the survey area in 2018 from the late May visit (see Appendix 7.1 Ornithology Technical Report). This pair was not seen there subsequently and did not appear in 2019. In 2019 two birds were seen flying widely together around the upper Burn of Ore on 1st July but were not on territory – none had been there previously, and none were seen there from VP watches.

7.6.74 This species has undergone a sharp decline in Orkney and particularly so on Hoy since the late 1990s. Although the 2019 skua census results have not yet been published it is expected that they will show only a handful of pairs left on Hoy.

7.6.75 The territory briefly occupied in 2018 is in a location where Arctic skuas have been regularly present in the recent past. Fieldwork for previous wind farm applications, covering the same ground as the eastern part of the MBS area here, has documented one to three Arctic skua AOTs in 2008 (Upton, 2009), 2010 (Aquatera, 2011), 2011 (Firth Ecology, 2012) and 2015 (Andrew Upton, pers. comm.). 2019 was the first survey year with no birds holding territory in this area.

7.6.76 The breeding population of Arctic skua is a qualifying interest of the Hoy SPA and a notified feature of Hoy SSSI. However, the very low frequency of sightings and lack of confirmed breeding within the survey area over the two years of field surveys means that no measurable impact is expected on Arctic skua. Therefore, this species is not considered further in the impact assessment.

Great Black-backed Gull

7.6.77 This species was recorded from VP watches using the snapshot count method in the 2018 and 2019 breeding seasons (April to August) and in the 2019/20 non-breeding season (September to March). It was treated as a non-target species in the 2018/19 non-breeding season.

7.6.78 During the breeding season a maximum of three great black-backed gulls were seen during any one snapshot count, but the majority of snapshots had zero birds. The gulls were recorded particularly infrequently from VP1, where less than half of the three-hour watches had any at all. They were more frequent from VP3, and recorded in all of the watches from there, producing a clear spatial distribution of breeding season activity that was evident in both years.

7.6.79 Great black-backed gulls were less frequent overall in the non-breeding season, but more evenly spread across the flight buffers, so that the rate of sightings from VP1 was greater than during the breeding season, whilst at VP3 it was less.

7.6.80 In both seasons, activity was highest along the eastern edge of the flight buffers, away from the Proposed Development and this was most marked in the breeding season.

7.6.81 Two pairs of great black-backed gulls nested in the survey area each year, in the same locations both years (see Appendix figures A.27 and A.28 in Appendix 7.1 Ornithology Technical Report). These were both well outside of the Hoy SPA/Hoy SSSI boundary.

7.6.82 Great black-backed gull is categorised as a 'common' breeder in Orkney Bird Reports, implying a population of 1,001 – 10,000 pairs (Williams 2001:2013; Williams and Branscombe 2014 and Branscombe 2015:2019), and the last seabird survey in 1998 - 2002 (Seabird 2000) recorded 5,505 AON (apparently occupied nests) in the county (Mitchell et al, 2004c). This number had been relatively stable for some time previously – the first seabird census in 1969-70, recorded 5,999 AON, and the second census in 1985-88, recorded 5,657 AON (Mitchell et al, 2004c). Nevertheless between 1985-88 and Seabird 2000 there had been some large changes in numbers between different colonies in Orkney, with the two largest on Hoy down by about 60 % and that on Copinsay nearly doubling. Recording at sample colonies in Scotland since 2000 indicates a steady decline of nearly 70 % from the Seabird 2000 figure (JNCC, 2018a). If this is representative of Orkney, the Orkney population would now be around 1,700 AON.

7.6.83 The Hoy SPA great black-backed gull population was 570 pairs at designation (3 % of the GB population (SNH, 2009)) and the site condition was last assessed as unfavourable declining[5]. The current Hoy SPA population of great black-backed gulls is unknown (figures are still being collated from the 2019 gull and skua survey in Orkney) but it is very much less than previously, probably no more than low tens of pairs, down from over 1,000 pairs in 1985-88 and about 400 in Seabird 2000.

7.6.84 The great black-backed gulls breeding in the survey area were not located on, nor linked to the SPA, being independent of it for breeding, foraging and resting. Nor are they likely to have regular interactions with birds from the SPA, since any remnants of the SPA colonies are several kilometres distant. The birds seen flying in the survey area would have included these two local pairs, but the rates of activity clearly indicated additional birds from elsewhere. Only a small

5 Last assessed condition on 8th July 2019 (SNH, Sitelink)

proportion of these additional birds were likely to have been from the SPA and many may not have been from Hoy at all, since this species also nests on the adjacent smaller islands in Scapa Flow.

7.6.85 In the non-breeding season, great black-backed gulls are likely to be drawn from a much wider area beyond Orkney, and few, if any, would then be referable to the SPA breeding population.

7.6.86 The two pairs breeding near the site are of negligible importance, despite the apparent large declines across Hoy and Orkney since Seabird 2000. The birds flying through the survey area in the breeding season would be drawn from a wider area and would be likely to represent more than 1 % of the current Orkney population.

7.6.87 As a qualifying interest of Hoy SPA and a notified feature of Hoy SSSI, this species is included in the impact assessment as a species of very high importance, as a precautionary approach, even though much of the activity at the Proposed Development, at any time of year, is unlikely to relate to the Hoy SPA.

Herring Gull

7.6.88 Herring gull was not a target species during VP watches, but a brief note or summary of sightings was made for each watch, giving a broad indication of their occurrence and movements.

7.6.89 There was a small breeding colony at Hilltown, on lower ground about 800 m to the east of the Proposed Development, with 12 pairs estimated in 2018 and 13 pairs in 2019 (see Appendix figures A.27 and A.28 in Appendix 7.1 Ornithology Technical Report). The primary flight directions from here were away from the Proposed Development towards the nearby Ore Bay, or southwards to the fields at the edge of the moorland beyond the survey area. One or two birds were seen flying higher up in the Burn of Ore, and potentially at risk through the wind farm buffer, on just two or three occasions each year. Birds flying at risk also occurred infrequently in the summer when birds from the breeding colony occasionally milled about above the colony area (sometimes joined by additional birds loafing on fields beside Ore Bay). The highest number seen doing this was about 200 on 8th May 2019, staying to the east of the Proposed Development. Otherwise there were fewer than 20 birds circling around like this from four watches in 2018 and two watches in 2019, when some of them were noted as straying westwards as far as the vicinity of T1.

7.6.90 The occupation of this colony by herring gulls has not been consistent. Previous surveys of the same area found that the main species at the colony was common gull, with only a few pairs of herring gulls. The maximum counts from each year (with numbers of individuals converted to pairs by simply halving them) are as shown in Table 7.13.

Table 7.13 Maximum Gull Counts at the Hilltown Colony in Different Survey Years

Year	Survey	Black-headed Gull (No. Pairs)*	Common Gull (No. Pairs)*	Herring gull (No. Pairs)*	Lesser black-backed Gulls (No. Pairs)*	Great black-backed Gulls (No. Pairs)*
2008	Ore Brae (Upton, 2009)	0	30	1	0	2
2010	Binga Fea proposal (Aquatera, 2011)	0	13	0	0	1
2011	Ore Farm proposal (Firth Ecology, 2012)	23	8	2	0	1
2015	A. Upton (pers. comm.)	0	30	7	1	1

Year	Survey	Black-headed Gull (No. Pairs)*	Common Gull (No. Pairs)*	Herring gull (No. Pairs)*	Lesser black-backed Gulls (No. Pairs)*	Great black-backed Gulls (No. Pairs)*
2018	for the Proposed Development	1	5	12	0	1
2019	for the Proposed Development	0	2	13	0	1

** Where only individuals recorded, the number of individuals was converted to pairs by dividing by two.*

7.6.91 Herring gull is categorised as a 'common' breeder in Orkney Bird Reports, implying a population of 1,001–10,000 pairs (Williams 2001:2013; Williams and Branscombe 2014 and Branscombe 2015:2019), and the last seabird survey in 1998-2002 (Seabird 2000) recorded 1,933 AON (apparently occupied nests) in the county (Mitchell et al, 2004d). However there has been a long-term downward trend in Orkney from the first seabird census in 1969-70, with 7,831 AON, through the second census in 1985-88, with 2,726 AON down to the 1,933 AON in Seabird 2000 (Mitchell et al, 2004d). Recording at sample colonies in Scotland since 2000 indicates a further decline of perhaps 25 % from the Seabird 2000 figure (JNCC, 2018b). If this is representative of Orkney, the Orkney population would now be less than 1,500 AON.

7.6.92 There appear to have been no further large-scale gull surveys in Orkney since Seabird 2000, with only anecdotal reports from RSPB reserves (McMurdo Hamilton, 2016), and somewhat sporadic entries in the Orkney Bird Reports. An all-Orkney gull census was carried out in 2019, to which records from this survey work were contributed, but the results have not yet been published.

7.6.93 If the sampled decline since Seabird 2000 is reflected in Orkney, then the 12–13 pairs within the survey area may be up to about 1 % of the current Orkney population, but this is very uncertain, more so due to the fluctuating numbers at the Hilltown colony.

7.6.94 Herring gull is a special wildlife feature of the Hoy and North Walls SSSI Moorland Fringes LNCS. However, the distance of the colony from the turbine locations and the infrequency of flights within the wind farm buffer imply that there is unlikely to be any disturbance or displacement of breeding herring gulls and that collision mortality is likely to be low. The combined magnitude of all impacts on the colony itself is therefore expected to be low, with no scope for a significant effect on the LNCS or at any wider geographic scale. Therefore, herring gull is not considered further in the impact assessment.

Waders

Curlew

7.6.95 Curlews were found mostly near the edges of the moorland and in the rough grassland fields at the eastern edge of the MBS survey area, with few pairs located far into the hills, and usually associated then with the old ploughed-out patches of wet heath and bog. Where the MBS survey areas overlapped in 2018 and 2019, the number of territories was stable at 11–12 (see Appendix figures A.21 and A.22 in Appendix 7.1 Ornithology Technical Report).

7.6.96 Curlews were seen from VP3 during nearly all of the watches from March to July but much less commonly from VP1, and rarely anywhere outside that period.

7.6.97 Curlews are well-distributed in Orkney, with various recent population estimates at different scales. In 2005 an RSPB survey of much of the West Mainland moors found 359 pairs at an average density of 11 territories per km^2 (Cadbury et al, 2006); in the early 2000s the whole Orkney population was estimated at 6,202 pairs, with 5,082 on farmland and 1,120 on moorland (Forrester and Andrews, 2007); in 2015 the numbers for Orkney and northern Caithness together

(which comprise Natural Heritage Zone 2, per SNH) were put at a much lower 3,233 pairs (Wilson et al, 2015). The NHZ 2 figure came with a caveat to treat it with considerable caution, particularly since the extrapolation methods led to a higher estimate for Shetland (NHZ 1) than for Orkney, which was considered surprising and unlikely. Whatever the actual Orkney and NHZ numbers, it is widely thought that the breeding population in Orkney has recently been in decline – it may be that much of this is from the farmland areas, as agriculture continues to intensify incrementally.

7.6.98 Compared to the wider RSPB surveys in 2005, with an average density of 11 pairs per km^2, curlews are not at high density within the MBS survey areas in an Orkney context, with densities of 1.4 pairs per km^2 and 2.2 pairs per km^2 in 2018 and 2019 respectively (see Table 3.1 in Appendix 7.1 Ornithology Technical Report). However, the clear preference of curlews for the moorland edges rather than the interior means that the relative amounts of each habitat within the different MBS areas each year had a large influence on the resulting overall densities.

7.6.99 The curlew is now of considerable conservation concern as a Red List species (Eaton et al, 2015) and is a species for which some studies have found statistically significant reductions in numbers around UK wind farms, in both the construction phase and later during operation (Pearce-Higgins et al, 2009 and Pearce-Higgins et al, 2012). No measured flight observations were made from the VP watches at the Proposed Development, so it is not possible to attempt collision risk calculations. However, the displacement impacts found at wind farms, in terms of breeding numbers, would incorporate any element of collision mortality.

7.6.100 Curlew is red-listed and a special wildlife feature of the Hoy and North Walls SSSI Moorland Fringes LNCS. It is considered as a species of medium importance in the impact assessment, where it is assessed in terms of likely disturbance and displacement impacts only.

Snipe (*Gallinago gallinago*)

7.6.101 Snipe were most frequently seen from VP watches in the breeding season and only occasionally outside of it.

7.6.102 Snipe were fairly evenly distributed across the MBS survey areas, with similar densities of just over two per km^2 in each year (see Appendix figures A.23 and A.24 in Appendix 7.1 Ornithology Technical Report). However, it is unlikely that the survey method used here gives particularly accurate results in terms of either overall numbers or their precise distribution. Displaying snipe appear to prefer relatively calm, moist conditions (e.g. drizzle or light rain) in the early mornings or evenings – therefore a visit that takes all day to cover the area, in varying weather, only has potential to encounter ideal conditions over a part of the survey area. Even if a good count is possible, locating territories is not accurate, since the birds can fly widely in the general area and may form chasing groups, so that territory centres cannot be accurately pinpointed.

7.6.103 Snipe are well-distributed in Orkney, with various recent population estimates at different scales. The 2005 RSPB survey of much of the West Mainland moors found 96 individuals at an average density of three per km^2 (Cadbury et al, 2006); in the early 2000s the whole Orkney population was estimated at 5,402 pairs, with 5,245 on farmland and 187 on moorland (Forrester and Andrews, 2007); in 2015 the numbers for Orkney and northern Caithness together (which comprise Natural Heritage Zone 2, per SNH) were put at a much lower 3,326 pairs (Wilson et al, 2015). It is difficult to know whether this apparent decline is real, and if so, to what actual extent. It seems likely that breeding birds have been lost from farmland in Orkney as agriculture continues to intensify incrementally.

7.6.104 Compared to the wider RSPB surveys in 2005, with an average density of three per km^2, snipe are at somewhat lower density around the Proposed Development, measured at 2.4 per km^2 and 2.1 per km^2 respectively, for 2018 and 2019.

7.6.105 Snipe is a species for which some studies have found statistically significant reductions in numbers around UK wind farms, in both the construction phase and later during operation (Pearce-Higgins et al, 2009 and Pearce-Higgins et al, 2012). No measured flight observations were made from the VP watches at the Proposed Development, so it is not possible to attempt

collision risk calculations. However, the displacement impacts found at wind farms, in terms of breeding numbers, would incorporate any element of collision mortality.

7.6.106 Snipe is amber-listed (Eaton et al, 2015) and is considered of less than local (site) importance in the impact assessment where it is assessed in terms of likely disturbance and displacement impacts only.

Dunlin

7.6.107 Dunlins were restricted to the tops of the higher ridges within the survey area, including along the top of Wee Fea adjacent to the nearest proposed infrastructure. There were very different numbers detected each year from the part of the MBS survey areas that overlapped, with 13 territories detected in 2018 and just five in 2019 (see Appendix 7.1 Ornithology Technical Report).

7.6.108 Dunlin breeds across Orkney on hilltops and also lower-lying boggy ground. A population estimate of 1,261 pairs has been made for NHZ 2 (Wilson et al, 2015) with very wide confidence bars around it ranging from 402 – 3,252 pairs. Unless there are many more dunlins in northern Caithness than in Orkney, it seems most likely that the figure is at the lowest end of this range.

7.6.109 Breeding dunlin in the UK is an Annex 1 species; there are no sites for which it is a designated interest on Hoy.

7.6.110 One study has encountered dunlin in sufficiently high numbers to attempt statistical analysis of the effects of wind farm construction and operation (Pearce-Higgins et al, 2012). There were no clear differences in dunlin density between control and wind farm sites – nevertheless, this species is included in the impact assessment due to its close proximity to the Proposed Development on the Wee Fea ridge.

7.6.111 Dunlin is a special wildlife feature of the Hoy and North Walls SSSI Moorland Fringes LNCS and is considered as a species of medium importance in the impact assessment where it is assessed in terms of likely disturbance and displacement impacts only.

Golden Plover

7.6.112 Golden plovers were restricted to the tops of the higher ridges within the survey area, all at more than 800 m from the nearest part of the Proposed Development. There were different numbers detected each year from the part of the MBS survey areas that overlapped, with nine territories detected in 2018 and six in 2019 (see Appendix 7.1 Ornithology Technical Report).

7.6.113 There were very few flight records from VP observations, and these generally related to passage flocks rather than the local breeding birds. On 25th September 2018 a flock of approximately 200 birds flew south very high and on 18th November 2019 a group of 18 was seen. Collision risk calculations are not attempted for either the breeding or non-breeding populations of this species.

7.6.114 Golden plovers are thinly distributed on hilltops across Orkney. A population estimate of 1,474 pairs has been made for NHZ2 (Wilson et al, 2015) with narrow confidence bars around it ranging from 1,365–1,583 pairs. However, unless there are many more golden plovers in northern Caithness than in Orkney, it seems that this is a highly optimistic figure. The Hoy population is by far the largest in Orkney and is usually estimated in the region of just 100 pairs.

7.6.115 Breeding golden plover in the UK is an Annex 1 species; there are no sites for which it is a designated interest on Hoy. Golden plover is also a special wildlife feature of the Hoy and North Walls SSSI Moorland Fringes LNCS.

7.6.116 Golden plover is a species for which some studies have found statistically significant reductions in numbers around UK wind farms, in both the construction phase and later during operation (Pearce-Higgins et al, 2009 and Pearce-Higgins et al, 2012). However, these effects did not appear to extend beyond about 250 m and have not always been found in other studies (e.g. Fielding and Haworth, 2010). As the nearest pairs found here were about 800 m from the closest

turbine positions, there is no scope for any displacement impacts; therefore, this species is not considered further in the impact assessment.

Lapwing

7.6.117 Lapwings were few and erratic in their occurrence between survey years, with just three pairs each year, all but one of them in the fields at the eastern edge of the MBS areas (see Appendix 7.1 Ornithology Technical Report). In 2018, one pair was found on the previously ploughed-out ground within the turbine layout.

7.6.118 This species requires bare ground or very short vegetation for breeding, which is often associated with farmland where cultivation or heavy grazing occur. As such it is tolerant of a degree of human activity; in line with this, research around operating UK wind farms (Pearce-Higgins et al, 2009) and UK wind farms under construction (Pearce-Higgins et al, 2012) found no statistically significant reductions in lapwing numbers during either phase.

7.6.119 Lapwing is a special wildlife feature of the Hoy and North Walls SSSI Moorland Fringes LNCS. However, as no impact is expected for this species it is not considered further in the impact assessment.

Wildfowl

Geese, ducks and grebes

7.6.120 Few wildfowl species were noted from any survey work (see Appendix 7.1 Ornithology Technical Report). Greylag goose (*Anser anser*) was the most frequent and abundant species from VP watches and MBS walkovers, with tens of pairs breeding alongside the lower Burn of Ore. Flocks of up to 70 birds were present at the eastern side of the MBS survey area in April-May, presumably non-breeders. Flocks of up to 150 birds were seen from about two thirds of watches between September and March, mostly in transit across the survey area in various directions, and often only in low numbers. As a common Orkney breeder and an abundant migrant and winter visitor, this species is of no particular concern at the Proposed Development and is not considered further in the impact assessment.

7.6.121 Pink-footed goose (*Anser brachyrhynchus*) was seen very infrequently – just two small flocks of 20–25 birds on southwards passage (one in each autumn) and a single bird seen once each summer apparently paired with a greylag goose. This site is clearly not important for this species therefore it is not considered further in the impact assessment.

7.6.122 Mallard (*Anas platyrhynchos*) was seen in very small numbers throughout the year (no more than six together) mostly flying up and down the Burn of Ore to the dam situated below the Proposed Development. One or two pairs bred by the burn and field ditches each year, with two young broods found in 2018. As a common Orkney and Scottish species, mallard is not considered further in the impact assessment.

7.6.123 It is possible that a pair of red-breasted mergansers bred in both years along the mid or upper Burn of Ore, although this was not confirmed. Apart from one bird flying south over the low ground to the east of the wind farm buffer in September 2019, all the observations of red-breasted mergansers from VP watches and MBS walkovers were of birds on the burn or flying along its course. Although it is rather a scarce breeder nationally, it is not expected that this species will interact with the Proposed Development in any way and therefore it is not considered further in the impact assessment.

7.6.124 One pair of tufted ducks (*Aythya fuligula*) and one pair of little grebes (*Tachybaptus ruficollis*) were present on the pond close to the access track during the April 2019 MBS survey. However, neither species was seen there subsequently, and they are not considered further in the impact assessment.

Whooper swan (*Cygnus cygnus*)

7.6.125 There were just three observations from the VP watches: nine birds flying well to the west of the Proposed Development on 24th October 2018; 12 adults north across the wind farm buffer on 29th March 2019 and a family party of five flying west through the wind farm buffer on 19th February 2020. With so few flights at risk it is not considered realistic to undertake collision risk calculations. A single bird was present on the pond adjacent to the access track beside the Wee Fea plantation during the first MBS walkover in April 2019 – it was not seen subsequently.

7.6.126 The number of whooper swans on passage through Orkney each autumn is at least several hundred, with smaller numbers staying to winter in a few favoured locations in West Mainland and on Shapinsay and Sanday. Hoy does not have a regular wintering flock and is not an important part of the species' Orkney distribution and neither is the area around the Proposed Development on a regularly used flight path. There appears to be no scope for an impact of any magnitude on this species therefore whooper swan is not considered further in the impact assessment.

Other Open Ground Species

Red Grouse (*Lagopus lagopus scotica*)

7.6.127 Small numbers of red grouse were found across the MBS survey area and very occasionally seen in flight from the VP watches. This species is only thinly distributed on Orkney moorlands, which are mostly unmanaged for grouse, as is also the case around the Proposed Development.

7.6.128 Red grouse has been found to be unaffected by operational wind farms elsewhere in the UK (Pearce-Higgins, 2009) although declines have been found during construction (Pearce-Higgins et al, 2012) with a subsequent recovery. Its distribution each year within the MBS survey areas is shown on Appendix figures A.25 and A.26 in Appendix 7.1 Ornithology Technical Report for completeness, but because of its low numbers and the lack of documented long-term adverse effects, red grouse is not considered further in the impact assessment.

Moorland Passerines

7.6.129 Three species were mapped during MBS visits: skylark, stonechat (*Saxicola rubicola*) and wheatear (*Oenanthe oenanthe*). Meadow pipit was not mapped since the number of registrations entailed would have tended to distract from the more important species, and the quality of the data would have been very uncertain since this species is typically detectable over much shorter distances than the 100 m coverage of the survey method.

7.6.130 Skylarks showed a large difference between years, with a density of 20 per km^2 in 2018 falling to 12 per km^2 in 2019. Part of the difference may have been due to natural variation from year to year and part also due to the better weather throughout the MBS survey period in 2018 e.g. by making them more detectable (encouraging singing) or by directly influencing numbers. Stonechats were also more obvious in 2018, perhaps for the same reasons, but there were just two or three wheatear territories in each year.

7.6.131 These three species were all included in studies at large UK wind farms (Pearce-Higgins, 2009) that showed no statistically significant reduction in numbers of skylark and stonechat close to turbines, but did find a reduction in wheatears, modelled at a 44 % decline within 500 m. Wheatear also showed an avoidance of wind farm tracks, although conversely the birds around the Proposed Development were strongly associated with old tracks, probably because there is very little naturally outcropping rock in the general vicinity. A subsequent study of wind farms before, during and after construction, and associated reference sites (Pearce-Higgins, 2012), did not find any statistically significant effect on wheatears, but found positive effects on skylark and stonechat numbers during construction.

7.6.132 Given the lack of adverse effects at wind farms noted for skylark and stonechat, they are not considered further in the impact assessment. Wheatears were present in such low numbers at the Proposed Development that any reduction, if it occurred, would be of no significance beyond the site itself – it too is not considered further in the impact assessment.

7.7 Receptors Brought Forward for Assessment

7.7.1 A summary of the evaluation of ornithological receptors in shown in Table 7.14.

Table 7.14 Summary of Evaluation of Ornithological Receptors

Receptor	Site/Species	Evaluation	Further Consideration Required?
Statutory designated site (SPAs /pSPAs)	Hoy SPA	Very high (SPA)	Yes
	Switha SPA	Very high (SPA)	No
	Scapa Flow pSPA	Very high (SPA)	Yes
Statutory site (SSSI)	Hoy	High (SSSI)	Yes
Non-statutory site (LNCS)	Hoy and North Walls SSSI Moorland Fringes	Medium (LNCS)	Yes
Birds	Red-throated diver	Very high (SPA)	Yes
	Peregrine falcon	Very high (SPA)	Yes
	Hen harrier	High (Annex 1)	Yes
	White-tailed eagle	High (Annex 1, Nationally scarce)	Yes
	Golden eagle	High (Annex 1)	No
	Merlin	High (Annex 1)	Yes
	Short-eared owl	High (Annex 1)	Yes
	Great skua	Very high (SPA)	Yes
	Arctic skua	Very high (SPA)	No
	Fulmar	Very high (SPA)	No
	Great black-backed gull	Very high (SPA)	Yes
	Herring gull	Medium (LNCS)	No
	Curlew	Medium (LNCS)	Yes
	Snipe	Negligible (Less than local - Site)	Yes

Receptor	Site/Species	Evaluation	Further Consideration Required?
	Dunlin	Medium (LNCS)	Yes
	Golden plover	High (Annex 1)	No
	Lapwing	Medium (LNCS)	No
	Whooper swan	High (Annex 1)	No
	Greylag goose	Negligible (Less than local - Site)	No
	Pink-footed goose	Negligible (Less than local - Site)	No
	Mallard	Negligible (Less than local - Site)	No
	Red-breasted merganser	Very high (SPA)	No
	Red grouse	Negligible (Less than local - Site)	No
	Skylark	Medium (LNCS)	No

7.8 Standard Mitigation

7.8.1 A range of measures have already been applied as part of the iterative design process (see Chapter 2: Design Iteration), to avoid siting the turbines and associated infrastructure in the highest sensitivity areas for ornithological interests, including avoidance of breeding and roosting sites. A number of standard mitigation measures, including best practice methods, have also been identified to avoid effects associated with the construction phase of the Proposed Development on ornithological interests. Additional species-specific mitigation measures have been identified to avoid significant effects on particular ornithological receptors (see Section 7.10).

7.8.2 All ornithological mitigation measures will be incorporated into a Construction Environmental Management Plan (CEMP). This CEMP will outline all required mitigation for ornithological receptors, providing details of key sensitivities present and timings.

7.8.3 A suitably experienced Ecological Clerk of Works (ECoW) will oversee all works to ensure adherence to the mitigation measures.

7.8.4 Site clearance works including stripping of vegetation will occur, where possible, outwith the bird breeding season (April to August) therefore between September and March to ensure no active nests are damaged or destroyed by the works.

7.8.5 The extent of ground clearance will be minimised as far as practicable to avoid disturbance to habitats, particularly previously undisturbed habitats. All power and cabling on site from and between the wind turbines will be buried in trenches located adjacent to the access track where

possible in order to minimise ground disturbance. Cabling routes will avoid any areas of ornithological interest.

7.8.6 An ecological toolbox talk will be given to all construction personnel as part of site induction on the potential presence of ornithological species and any measures that need to be undertaken should such species be discovered during construction activities. The toolbox talk will also include the requirement to report and log any bird casualties at the Proposed Development during construction and operation of the site

7.8.7 As part of the Proposed Development proposals it will be necessary to develop and implement a Site Restoration Plan (SRP) as part of the CEMP to ensure the regeneration of those areas of habitat that have been temporarily lost through development.

7.8.8 In order to facilitate site restoration, reinstatement of vegetation will be focused on natural regeneration utilising vegetated turves or soils stripped and stored with their intrinsic seed bank. To encourage stabilisation and early establishment of vegetation cover, where available, topsoil and vegetation turves in keeping with the surrounding vegetation type will be used to provide a dressing for the final surface. A Habitat Management Plan which will aim to restore areas of degraded blanket bog will be developed and is outlined further in Chapter 8 (Ecology).

7.9 Likely Effects

7.9.1 Direct and indirect environmental effects of the Proposed Development's construction, operational and decommissioning phases, based on the project description as detailed in Chapter 3: Project Development, are evaluated for each of the important ornithological receptors in the following sections. Additional mitigation and enhancement measures are presented in Section 7.10.

7.9.2 The main likely significant effects of wind farms on birds are direct loss of breeding or foraging habitat, collision risk and indirect loss of habitat from disturbance (either temporary during construction or permanent through displacement due to operation of the Proposed Development) (Percival, 2005; Drewitt and Langston, 2006). Each of these is considered in turn in the following sections.

7.9.3 The issue of disturbance or displacement of wintering bird interests of Scapa Flow pSPA due to increased vessel activity within Scapa Flow associated with the construction phase of the Proposed Development was raised by SNH during Scoping (see Table 7.1). However, the level of vessel traffic required to deliver the components and materials to the port of Lyness from the Scottish Mainland is not considered likely to result in a significant increase in the vessel traffic that already exists within the busy Scapa Flow area which is part of Orkney Islands Council's harbour area and is regularly used by oil tankers visiting the nearby Flotta Oil Terminal, recreational dive boat traffic, fish farm vessels, inshore fishing vessels and inter-island ferry traffic. This issue is not considered further in this assessment.

Designated Sites

7.9.4 Hoy SPA and Scapa Flow pSPA are important at the international level, Hoy SSSI at the national level and Hoy and North Walls SSSI Moorland Fringes LNCS at the regional level.

7.9.5 Impacts on each qualifying interest, notified feature or special wildlife feature of an SPA/pSPA, SSSI or LNCS, respectively, during construction, operation and decommissioning phases of the Proposed Development are provided in the species accounts below.

7.9.6 Information on Hoy SPA and Scapa Flow pSPA and an assessment of whether there is the potential for any likely significant effects on qualifying interests of these sites as a result of the Proposed Development has been considered and where relevant, information to inform an appropriate assessment is provided in Appendix 7.4: HRA.

7.9.7 Any effects on the red-throated diver population of Scapa Flow pSPA is considered to be less than that of the Hoy SPA red-throated diver population as the pSPA population of red-throated

divers is larger than that of the Hoy SPA as it includes all the birds from Hoy, plus those from the smaller islands in Scapa Flow and from the Mainland of Orkney parishes adjacent to Scapa Flow.

Species

Construction Effects

Loss of Habitat

7.9.8 Direct loss of habitat due to the construction of the turbines and associated infrastructure would result in the loss of a relatively small area taken up by the footprint of the turbine bases, hardstanding areas, substation compound and building, borrow pit, temporary construction compound and access track. This would be likely to be an effect of negligible magnitude due to the prevalence of similar habitat in the surrounding area with no scope for any significant effects on any sites or species therefore direct loss of habitat is not considered further in this assessment.

Disturbance (Noise and Visual)

7.9.9 Disturbance is likely to be highest during construction owing to the increased activity of personnel and vehicles on-site, which itself can be an important source of potential disturbance. The estimated on-site construction phase for the Proposed Development is expected to last 18 months. The construction works will take place through the year, including the summer months when the weather is more favourable and ground conditions are drier. Noise and visual disturbance associated with construction activities could potentially affect breeding and foraging birds in the locality of the turbine positions, access tracks and other infrastructure components.

7.9.10 Birds that are disturbed at breeding sites are vulnerable to a variety of potential effects that could lead to a reduction in the productivity or survival of their populations; these include the chilling or predation of exposed eggs and chicks and damage of eggs and chicks due to panicked adults.

7.9.11 Birds subject to disturbance outside the breeding season may also feed less efficiently or resort to less favoured roosting areas, either of which may reduce their survival prospects. The potential impact will vary between species according to each species' tolerance of disturbance from human activity and the availability of suitable alternative breeding, foraging and roosting habitat.

7.9.12 For Schedule 1 species, any disturbance to active nest sites or breeding areas during construction would contravene the Wildlife and Countryside Act 1981, so must be avoided. These include red-throated diver, hen harrier and merlin around the Proposed Development. Short-eared owl and dunlin are Annex 1 species, but are not listed in Schedule 1, so the same strict avoidance of disturbance does not apply to these species, although their conservation status must be considered. Great skua, great black-backed gull and the other waders are not specifically protected from disturbance in any way other than to avoid damaging nests.

7.9.13 For Annex 1 and Schedule 1 breeding species consideration has been given to disturbance distances in Forestry Commission Scotland (FCS) guidance (Forestry Commission Scotland, 2006) and in a review of disturbance distances (RDD) commissioned by SNH (Ruddock and Whitfield, 2007).

7.9.14 The review by Ruddock and Whitfield (2007) is based on the knowledge of experienced fieldworkers visiting nest sites. The FCS paper indicates its sources of advice as the FCS Conservancy Offices, SNH Area Offices and RSPB regional offices, but does not give specific references for the 'safe working distances' that it suggests; it probably incorporates a large element of expert opinion from those bodies.

7.9.15 The FCS 'safe working distances' relate to forestry operations, whereas those from the Ruddock and Whitfield (2007) RDD review relate to the approach of a person on foot. Four RDD measures were compiled, being the 'alert distance' and the 'flight initiation distance', both of which are given for the incubation and chick-rearing phases. For each of these four measures the median

is given along with the 80 % range, which is the range of distances with the lowest and highest 10 % of estimates excluded. Therefore, the highest distance shown in the range is that beyond which 90 % of respondents considered that there would be no disturbance.

7.9.16 The species that could be significantly affected by construction disturbance are those that use the site or surrounding area to breed or roost; these are red-throated diver; hen harrier; merlin; short-eared owl; great skua; great black-backed gull and various waders.

7.9.17 Table 7.15 shows the peak breeding and roosting numbers that were found within 500 m of the proposed turbine locations and within 500 m of the other associated infrastructure (including site access tracks) during the baseline surveys (and from the ORSG and red-throated diver data). This distance has been used to identify the potential disturbance zone whilst also giving consideration to particularly sensitive species in a wider area beyond. The table also gives the distance between the breeding locations of each key species and the nearest turbine position.

Table 7.15 Peak Breeding and Roosting Numbers within 500 m of the Proposed Development, and Minimum Distances from Nearest Proposed Turbine

Species	Peak Breeding Pairs (or Roosting Individuals) within 500 m of Turbines	Peak Breeding Pairs (or Roosting Individuals) within 500 m of Turbines and Associated Infrastructure	Minimum Distance between known Breeding or Roosting Sites and Nearest Proposed Turbine
Red-throated diver	0	1	640 m
Hen harrier – nesting	0	1	510 m
Hen Harrier – roosting	0	0	625 m
Merlin	0	0	1,025 m
Short-eared owl	0 (confirmed or probable) 1 (possible)	0 (confirmed or probable) 1 (possible)	770 m (confirmed or probable) 230 m (possible)
Great skua	22 (2018); 7 (2019)	33 (2018); 17 (2019)	50 m
Great black-backed gull	0	2 (2018 & 2019)	750 m
Curlew	6 (2018); 3 (2019)	8 (2018); 9 (2019)	50 m
Snipe	9 (2018); 8 (2019)	11 (2018); 10 (2019)	20 m
Dunlin	1 (2018); 2 (2019)	1 (2018); 2 (2019)	200 m

Red-throated Diver

7.9.18 The closest potential red-throated diver breeding lochan is at 640 m from the nearest turbine position and 410 m from the nearest part of the access track. However, it is out of view of the whole of the Proposed Development footprint at ground level. The next closest potential breeding lochan is at more than 1,200 m from the nearest turbine and 950 m from the nearest part of the associated infrastructure (the access track).

7.9.19 The FCS Guidance gives a safe working distance of 300 m – 900 m from red-throated diver nest sites. Ruddock and Whitfield (2007) note that red-throated divers can be sensitive to human disturbance but would probably not be disturbed by someone on foot at 500 m – 750 m and that the large majority of breeding pairs are probably not disturbed when an observer is at 500 m. Line-of-sight affects this and, as long as over-flying birds do not detect an observer, birds at a breeding lochan will not be disturbed until a person comes in to view.

7.9.20 Since the closest lochan is out of view of the entire infrastructure at ground level, birds on the water or nest are not expected to be disturbed during any aspect of the construction, except possibly during installation of the nearest turbine. The next nearest turbine positions are at about 850 m and 950 m from this lochan. However, the pair from here will also be aware of other construction activities if they fly around the lochan (e.g. on take-off) or come in along the south side of the Wee Fea ridge; they may then be prompted to circle round in alarm rather than alighting directly. This is most likely to happen when construction is taking place along the western section of access track from T4 to T6 and along to T5.

7.9.21 This lochan has had a pair of red-throated divers on it for the past five years, although they did not lay eggs in 2018 or 2019. If they are present again it is expected that they would go on to lay eggs and would therefore constitute an active nesting attempt.

7.9.22 In the absence of mitigation measures, construction disturbance impacts are likely for this breeding pair. Disturbance impacts would be temporary but would last for the duration of the works therefore it is possible that two consecutive breeding seasons would be affected. Due to the legislative protection of this species, disturbance to a red-throated diver breeding site would be a significant adverse effect and must be avoided. Species-specific mitigation will be required to avoid any possibility of disturbance to breeding red-throated divers (see ORN1 and ORN2 in Table 7.27).

Hen Harrier - Breeding

7.9.23 The closest hen harrier nest site in the last five years is at 510 m from the nearest turbine position and 495 m from the nearest part of the associated infrastructure (hardstanding). The next closest hen harrier nest site is at 540 m from two of the turbines with all other sites being at 840 m or more from a turbine. The five closest nesting areas are all in full view of large parts of the Proposed Development.

7.9.24 The FCS Guidance relates to roosting hen harriers only, since the species does not commonly breed in mature plantations. The RDD review suggested a maximum buffer of 500 m – 750 m around nests, with a median distance of about 200 m – 300 m for static disturbance responses (i.e. when a bird is alert, rather than actually taking flight). When incubating, female hen harriers usually sit tight until an approaching person is within a few metres, but this does not mean that the intruder has not been detected well before then, and if the male appears, he will show alarm at considerably greater distances.

7.9.25 The wide range of distances given in the review suggests a wide range of sensitivity by different individual birds. Given the frequency with which all hen harriers in Orkney encounter humans and human activities, it can be expected that the birds here will, in general, be more habituated to them therefore the lower disturbance distance of 500 m would be more appropriate for this site. Hen harriers have been found breeding much closer than this to wind farm sites under construction e.g. a pair breeding successfully within 110 m of construction activities at a site in Aberdeenshire in 2004 (Natural Power, 2011).

7.9.26 Disturbance impacts would be temporary but would last for the duration of the works therefore it is possible that two consecutive breeding seasons would be affected. Due to the legislative protection of this species, disturbance to hen harrier breeding sites would be a significant adverse effect and must be avoided. Species-specific mitigation measures will be required to avoid any possibility of disturbance to breeding hen harriers at the two breeding sites at around 500 m from the nearest part of the proposed Development (see ORN1 and ORN3 in Table 7.27).

Hen Harrier - Roosting

7.9.27 The closest hen harrier roost site in 2019/20 is at 625 m from the nearest turbine position and 580 m from the nearest part of the associated hardstanding. The next closest hen harrier roost site is at 880 m with all others being at 920 m or more. The two closest roost sites are out of view from any part of the infrastructure at ground level.

7.9.28 The FCS guidance gives a safe working distance of 500 m –1000 m from hen harrier roost sites. For roosting hen harriers, Natural England advice is that a buffer of 600 m from construction-type work is sufficient not to cause displacement of roosting hen harriers, reduced to 300 m if the working areas are screened off from the roost. This is referred to in a planning report for Copeland District, Cumbria regarding a proposal for a waste management facility for low level radioactive waste adjacent to a harrier roosting area (Development Control and Regulation Committee, 2012). The 'operational phase' referred to in the report is that of disposal-site preparation and in-filling, with associated activity that would be more similar to wind farm construction than wind farm operation.

7.9.29 Since the closest roosting hen harrier was recorded at 580 m and out of line-of-sight of the Proposed Development at ground level, there would be no impact and no effect due to construction disturbance.

Merlin

7.9.30 The closest known merlin nest site to the Proposed Development is at just over 1 km from the nearest turbine positions; the next closest is at more than 1.4 km from the westward extent of the access track.

7.9.31 The FCS Guidance gives a safe working distance of 200 m – 400 m from merlin nest sites. The RDD review suggested a maximum buffer of 300 m – 500 m around nests, with a median distance of about 200 m – 400 m for static disturbance responses (i.e. when a bird is alert, rather than actually taking flight).

7.9.32 Given the much larger distances to the closest known merlin sites, there would be no impact and no effect due to construction disturbance.

Short-eared Owl

7.9.33 The closest known confirmed or probable short-eared owl site is at 770 m from the Proposed Development. The next two closest short-eared owl breeding sites (confirmed or probable) are about 840 m from the nearest turbine or associated infrastructure (access track). There were two locations of 'possibly occupied' short-eared owl sites closer to the Proposed Development; one, suspected in two recent years, is at 380 m from the nearest turbine and the other is within the turbine layout, around 200 m from the nearest turbine.

7.9.34 The FCS Guidance gives a safe working distance of 300 m – 600 m from short-eared owl nest sites. The RDD review suggested a maximum buffer of 150 – 500 m around nests, with a median distance of 75 m – 125 m for static disturbance responses (i.e. when a bird is alert, rather than actually taking flight).

7.9.35 Disturbance would be expected at either of the two 'possibly occupied' sites if birds were present during construction. However, no short-eared owls have been seen at either of these locations in any previous year, from various VP surveys and voluntary raptor monitoring and the habitat at the site around 200 m to the nearest turbine is somewhat marginal, being rushes open to grazing. Cattle were seen on more than one occasion in the rushes here over the 2019/20 winter, when a feed-ring was on the nearby track end. Sheep were also present throughout the year and a neighbouring rush patch was noted to be heavily influenced by their trampling and dunging. It is thought very unlikely that the rushes would have remained suitable for breeding short-eared owls in the 2020 breeding season.

7.9.36 If these sites were to be occupied during construction, disturbance impacts would be temporary but would last for the duration of the works therefore it is possible that two consecutive breeding seasons would be affected. Although it is not legally necessary to avoid such

disturbance, it is good practice to do so. This would be achieved through implementation of mitigation measures ORN1 and ORN4 (see Table 7.27).

7.9.37 Given the larger distances to the closest confirmed or probable short-eared owl sites, there would be no likely impact and no effect due to construction disturbance at any of these sites.

Great Skua

7.9.38 There were 33 great skua AOTs recorded within 500 m of all parts of the Proposed Development infrastructure in 2018, of which 11 AOTs were within 200 m. In 2019, there were just 17 AOTs within 500 m and only two within 200 m.

7.9.39 There is no mention of great skua within the FCS or RDD disturbance distance reviews. However, as an example from Hoy, a pair of great skuas was observed setting up territory near Ore Brae whilst it was under construction in 2011 (Firth Ecology, 2012). This pair of skuas was little affected by elements of construction work involving both a digger and a crane, operating in view from their territory, and within 200 m of it.

7.9.40 Given the greater number of turbines (six) and the greater length of associated access track at the Proposed Development (as compared to a single turbine), it is realistic to expect that any skuas within the layout or close outside it (e.g. within about 200 m) would be disturbed during construction, leading to abandonment of nesting attempts or reduced breeding success. Beyond 200 m it appears unlikely that there would be sufficient impact to compromise great skua breeding success. Therefore, the assessment here anticipates the loss of great skuas out to 200 m of all infrastructure elements during construction.

7.9.41 There were ten AOTs in 2018 within 200 m and just two AOTs in 2019, indicating that the Proposed Development is not a core area for great skuas. The proportion of the Hoy population (1,578 AOTs in 2019) represented by these numbers is 0.63 % and 0.13 %; the proportion of the LNCS population (163 in 2019) represented by these numbers is 6.1 % and 1.2 %. The actual losses during construction are assumed to fall somewhere between the two figures. These AOTs are not on the SPA itself but are within the LNCS. This extent of loss, for one - two years only is a temporary, reversible affect and is assessed as a significant adverse effect at the less than local (site) level only, but not at any wider geographic scale. The effects on the LNCS are not considered to adversely affect the integrity of the area or the qualities for which it has been designated.

Great black-backed gull

7.9.42 Only two pairs of great black-backed gulls were recorded, both approximately 750 m to the east of the nearest turbine location and one within 150 m – 200 m from the existing section of access track. There is no mention of great black-backed gull within the FCS or RDD disturbance distance reviews however, this species has a relatively high tolerance of human disturbance therefore it is unlikely that the pair closest to the access track would be adversely affected by construction disturbance. Beyond 200 m it is considered unlikely that there would be sufficient impact to compromise great black-backed gull breeding success. On this basis, there would be no impact and no effect on breeding great black-backed gull due to construction disturbance.

Breeding Waders

7.9.43 Pearce-Higgins et al. (2012) found that curlew densities declined on wind farms during construction by around 40 % within an average 620 m buffer around the turbines. Curlew numbers at the wind farms also fell relative to the reference areas (a fall close to statistical significance), boosting confidence in the likelihood of a real construction effect.

7.9.44 There were ten curlew pairs within 620 m of all infrastructure in 2019 and a similar number in 2018 (when one corner of the buffer (with three pairs of curlew in 2019) was not covered). A 40 % reduction is four pairs. If this was to occur, disturbance impacts would be temporary but would last for the duration of the works therefore it is possible that two consecutive breeding seasons would be affected. This effect would be reversible and would be assessed as a significant adverse effect at the less than local (site) level, but not at any wider geographic scale. The

combined significance with ongoing displacement during the operational phase is assessed in paragraph 7.9.97 below.

7.9.45 Pearce-Higgins et al. (2012) found that snipe densities declined on wind farms during construction by around 53 % within an average 620 m buffer around the turbines. However, snipe numbers at the wind farms during construction were not significantly different from the reference areas, giving less confidence that there was a real construction effect.

7.9.46 There were an estimated 13 displaying snipe within 620 m of all infrastructure in 2018 and 12 in 2019. A 53 % reduction would be about six – seven pairs. If this was to occur, disturbance impacts would be temporary but would last for the duration of the works therefore it is possible that two consecutive breeding seasons would be affected. This effect would be reversible and would be assessed as a significant adverse effect at the less than local (site) level, but not at any wider geographic scale. The combined significance with ongoing displacement during the operational phase is assessed in paragraph 7.9.100 below.

7.9.47 There was one Dunlin pair present each year within about 200 m of the nearest access track, along the crest of Wee Fea.

7.9.48 The Pearce-Higgins (2012) study found dunlin present at five of the wind farm sites, where it was apparently unaffected during construction.

7.9.49 On this basis, there would be no impact and no effect on breeding dunlin due to construction disturbance.

Operation Effects

Displacement

7.9.50 The presence and operation of wind turbines could potentially displace birds from breeding and foraging areas. Birds may avoid the operational turbines and the surrounding area due to the visual appearance of large vertical structures in the landscape, the mechanical noises and wind noises of the blades, or the presence of periodic maintenance vehicles and personnel. Displacement may also include barrier effects in which birds are deterred from using normal routes to and from feeding sites.

7.9.51 Displacement due to operational turbines could force birds into less suitable habitat and this might reduce their ability to survive and reproduce. If not displaced, birds may experience reduced foraging success or reduced productivity. Displacement effects can vary over time as birds habituate to the presence of operating turbines or site-faithful birds are lost from the population.

Red-throated Diver – Operational Displacement – Breeding Sites

7.9.52 It is only at the red-throated diver breeding lochan closest to the Proposed Development that displacement needs to be considered. This is at 410 m from the nearest part of the access track and 640 m from the nearest turbine position (the next closest potential breeding site is more than 1 km from the nearest turbine position and need not be considered in the assessment).

7.9.53 In Orkney, red-throated divers breed each year within 200 m of the turbines on Burgar Hill, where there has been at least one large turbine since before 2000. One pair also regularly nests close to the road and a lay-by on Hoy (Stuart Williams, pers. comm.) demonstrating habituation to road traffic and to occasional associated pedestrians.

7.9.54 Given that the closest breeding site to the Proposed Development is out of view of the access track at ground level, the movement of maintenance vehicles is not expected to cause any disturbance to nesting red-throated divers.

7.9.55 Since the turbines will be at more than 600 m, they too are not expected to cause any displacement effect.

7.9.56 On this basis there would be no impact and no effect on breeding red-throated divers due to operational displacement.

Red-throated Diver – Barrier Effects

7.9.57 Red-throated diver flights in transit between the breeding lochans on Hoy and their main feeding grounds in Scapa Flow broadly follow an east-west alignment (see Appendix 7.2 Ornithology Confidential Annex). There are two main routes for birds to and from the breeding lochans to the west of the Proposed Development; these are: either to the north of Wee Fea, up from Mill Burn, or crossing the wind farm buffer (or to the south of it) along Burn of Ore. Some birds also approach from the south, probably having come from North Bay via Burn of Heldale, or from loafing on Heldale Water. A small minority approach from the west and depart in that direction.

7.9.58 Theoretically, the most likely lochan to be obstructed by the turbines is the one closest to it, since this would require the largest proportional changes to flight routes for those birds that were otherwise going to fly across the wind farm to fly around it. From this lochan (Site A), birds were seen to depart and arrive primarily from the north-east and from the south-east, those departing heading for Mill Bay or Ore Bay. Additionally, birds went to or from the west and south/south-west (see flight lines attributable to Site A in Figure 2.63 in Appendix 7.2 Ornithology Confidential Annex).

7.9.59 From all fieldwork, 18 flights were observed to or from this potential breeding site, broken down into direction as follows:

- Seven out of 18 flights (39 %) to or from the north-east, away from the Proposed Development.
- Six out of 18 flights (33 %) to or from the south-east, across the Proposed Development.
- Three out of 18 flights (17 %) to or from the west, away from the Proposed Development.
- Two out of 18 flights (11 %) to or from the south/south-west, away from the Proposed Development.

7.9.60 One third of the observed flights would have traversed the Proposed Development. However, VP watches would not have detected arrivals from the north-east as readily as those from the south-east, so the proportion of flights crossing the wind farm buffer is likely to be overstated.

7.9.61 Of the birds flying across the wind farm, two were outgoing, departing after some initial looping around, and they could have readily avoided the wind farm area had turbines been present.

7.9.62 Of the lochans within 2 km, those increasingly distant from the Proposed Development had a steadily lower proportion of flights crossing the turbine positions (see Figures 2.64 to 2.68 in Appendix 7.2 Confidential Annex). Outgoing and incoming birds could readily re-route to pass either to the north or south of the turbines with minimal increase in flight distance.

7.9.63 The red-throated divers at Burgar Hill, Orkney, readily fly between the turbines there, even when there is no need for them to do so e.g. non-breeding birds that do not always alight but may spend some time looping around and between the turbines (Upton, 2012).

7.9.64 The potential barrier effect on breeding red-throated divers is judged to be nil or minimal and the effect on the Hoy SPA red-throated diver population is assessed as not significant.

Hen Harrier – Operational Displacement – Breeding Sites

7.9.65 The closest breeding sites are at 500 m or more from the nearest turbines and are not occupied in every year (e.g. both were occupied in 2018 but neither of them was occupied in 2019). There is evidence from various places that hen harriers are not deterred from nesting at this distance from wind turbines:

- At Burgar Hill, Orkney, one or two females have continued nesting each year at about 500 m from the turbines.
- At Hammars Hill, Orkney, a female hen harrier occupied a new site, to within 400 m of the turbines, after the wind farm was operational.

- Females occasionally occupy sites within 50 m of roads in Orkney (ORSG data and Stuart Williams, pers. comm.).
- A pair of hen harriers nested successfully within 110 m of construction activities at a wind farm in Aberdeenshire in 2004 (Natural Power, 2011).

7.9.66 Therefore, hen harriers are not expected to be displaced from recently used nesting locations, but if they were, then they would be expected to simply utilise a nearby alternative site with no reduction in the carrying capacity of the survey area. The operational displacement impact on breeding hen harriers is judged to be nil or minimal, and the effect is assessed as not significant.

Hen Harrier – Operational Displacement – Roosting Sites

7.9.67 The closest hen harrier roost site is at 625 m from the nearest turbine.

7.9.68 At this distance, hen harriers are not expected to be displaced from roost sites, but if they were, then they would be expected to simply utilise a nearby alternative site with no reduction in the carrying capacity of the survey area. The operational displacement impact on roosting hen harriers is judged to be nil or minimal, and the effect is assessed as not significant.

Hen Harrier – Operational Displacement – Foraging

7.9.69 Displacement of foraging hen harriers due to the presence and operation of wind turbines has been investigated at various locations. A study of bird activity around twelve large wind farms in the UK uplands detected a reduction in hen harrier flight activity of about 55 % within 250 m of the turbines, which was analysed statistically as equivalent to a 53 % reduction out to 500 m (Pearce-Higgins et al, 2009). Garvin et al (2011) quantified a reduction of 47 % in all raptor flight activity (including northern harrier (*Circus hudsonius*)) out to 500 m around a large, 86-turbine wind farm in Wisconsin, USA. In Aberdeenshire, an apparently similar level of flight avoidance round the wind farm was noted in the first five years after construction (Natural Power, 2011).

7.9.70 More locally at Holodyke, Birsay, pre- and post-construction observations indicated an apparent reduction in flight activity of about 40 % within 250 m of the turbine, but this effect did not extend much further out (Upton, 2014a). Compared to studies at large wind farms the lower effect at Holodyke could be due to it being a single machine, without large areas of ground surrounded on all sides by turbines.

7.9.71 However, such results are not universal. For example, several years of post-construction monitoring at Cruach Mhor, Argyll (Robson, 2012), Edinbane and Ben Aketil, both Skye (Haworth Conservation, 2013) have not found such large-scale effects. At these sites there has been consistent, or increasing, hen harrier flight activity within 500 m buffers of the wind farms, which implies that any finer scale displacement has been absorbed within the buffer. At the two Skye sites, there was evidence of displacement out to about 100 m only – the reason for this could be as much due to the proportionally greater reduction in foraging area within this radius (because of the extent of the hardstanding and track within it) as to actual avoidance of the turbines themselves.

7.9.72 Working in line with the intermediate 250 m buffer found at Holodyke, a broad estimate of the loss of foraging time within the 250 m wind farm buffer can be made as follows:

- The total observed time for hen harriers flying at less than 15 m above ground (or 20 m in 2018) within the timed flight buffers was 29,875 seconds across the two years of survey work – this can all be assumed to relate to foraging activity.
- Extrapolating this to the whole year is done by multiplying by the 4,513 available flying hours and dividing by the total of 186 watch hours from each VP. This gives an annual total of 362,993 seconds of foraging activity within the flight buffers.
- Applying the proportion of the 250 m wind farm buffer area of 1.38 km^2 to the total 2019 flight buffer area of 5.34 km^2 gives 93,807 seconds foraging within 250 m of the turbine positions.

This can be uplifted by, say, 33 % to allow for ground out-of-view and low-flying birds missed, giving 124,764 seconds for a whole year.

- The average foraging time per day is therefore 124,764/365 = 342 seconds per day.
- Based on a minimum of three birds present in the area each day, this averages 114 seconds per bird, per day of foraging within the 250 m wind farm buffer.
- If half of this foraging time was lost, the loss on average per bird is 57 seconds, or about one minute per day.

7.9.73 Displacement of foraging hen harrier activity, if it were to occur due to the operation of the Proposed Development, is estimated at about one minute per bird per day. This is judged to be negligible for each individual bird and the effect on the local hen harrier population is assessed as not significant.

Merlin – Operational Displacement – Breeding Sites

7.9.74 The closest known merlin nest site to the Proposed Development is at just over 1 km from the nearest turbine positions; the next closest is at more than 1.4 km from the westward extent of the access track.

7.9.75 At this distance from the Proposed Development, there would be no impact and no effect due to operational displacement.

Short-eared Owl – Operational Displacement – Breeding Sites

7.9.76 Breeding short-eared owls do not appear to be particularly susceptible to displacement from operational wind farms. Recent work to record the distribution of short-eared owls around various existing and proposed wind farm sites in West Mainland, Orkney found territories within 500 m of all three existing wind developments sampled (Andrew Upton, pers. comm.). This was the case in 2012, which was a year of record short-eared owl numbers, and again in 2013, when numbers had dropped by a third across the study areas. Despite the overall decline, the closest short-eared owl territory remained occupied at two of the wind farms (in both cases at less than 400 m from the nearest operating turbine), and at the third it moved a little further away (from 200 m to about 300 m). Research in the southern Pennines (Haworth and Thompson, 1990) found that the breeding distribution of short-eared owls was unaffected by the presence of features such as paths and minor roads.

7.9.77 The closest 'possibly occupied' site at the Proposed Development in 2019 was situated within the layout at about 200 m from the nearest turbine position (see Figure 2.52 in Appendix 7.2 Ornithology Confidential Annex). Despite the evidence referred to above, it may be assumed that this potential site will no longer be suitable for nesting short-eared owls.

7.9.78 However, no short-eared owls have been seen in this location in any previous year, from various VP surveys and voluntary raptor monitoring and the habitat is somewhat marginal, being rushes open to grazing. Cattle were seen on more than one occasion in the rushes here over the 2019/20 winter, when a feed-ring was on the nearby track end. Sheep were also present throughout the year and a neighbouring rush patch was noted to be heavily influenced by their trampling and dunging. It is thought very unlikely that the rushes would have remained suitable for breeding short-eared owls in the 2020 season.

7.9.79 There is other suitable breeding habitat nearby, including two 'possibly occupied' territories a short distance away beyond the 250 m wind farm buffer recorded in 2015 and 2016 (see Figure 3.3 in Appendix 7.2 Ornithology Confidential Annex), and a wide expanse of heather and rushes on the lower ground to the south-east where successful breeding has been recorded during previous survey work (Aquatera, 2011 and Firth Ecology, 2012).

7.9.80 The potential loss of one rarely used 'possible' breeding territory due to operational displacement is judged unlikely to reduce the carrying capacity of the survey area and its effect on the local short-eared owl population is assessed as not significant.

Short-eared Owl – Operational Displacement – Foraging

7.9.81 Short-eared owls may forage around the Proposed Development regularly but are not expected to suffer displacement due to operation of the Proposed Development. VP survey work in 2012 at the operational Holodyke turbine in West Mainland, Orkney found no difference in short-eared owl foraging rates at different distance bands out from the turbine (Upton, 2014a).

7.9.82 On this basis, any displacement of foraging activity due to the operation of the Proposed Development is judged to be minimal and the effect on the local short-eared owl population is assessed as not significant.

Great Skua – Operational Displacement – Breeding Sites

7.9.83 There appear to be no studies at wind farms that involve potential displacement impacts on great skuas. Some evidence is available from Stronsay where a single turbine now stands within the great skua colony on Rothiesholm Head (Andrew Upton, pers. comm.). The colony has been surveyed using a three-visit method for four years from 2015 to 2018. In that time a total of 200 great skua AOTs were recorded, of which 58 successfully fledged young at a success rate of 0.29. The skuas were spread fairly evenly across the central moorland including around the turbine. Within 250 m of the turbine there was a total of 18 AOTs, of which ten were successful at a success rate of 0.56. The closest great skua AOTs were at little more than 100 m from the turbine.

7.9.84 The turbines at the Proposed Development are considerably larger than the Stronsay turbine, so it may be expected that a wider area could be avoided by breeding great skuas. The assessment here is made on the basis that half of the great skuas nesting within 250 m of a turbine or within 100 m of the access track will be displaced. In 2018, the number of AOTs within these distances was estimated at 11; in 2019 it was just two, implying losses of between one and six AOTs. These numbers represent 0.06 % and 0.38 % of the Hoy population numbers in 2019 and 0.61 % and 3.68 % of the LNCS population (163 in 2019). None of them are located within the Hoy SPA boundary.

7.9.85 The locations of breeding great skuas recorded in 2018 and 2019 (see Appendix figures A.29 to A.31 in Appendix 7.1 Ornithology Technical Report) indicate some variability in the AOT distribution between years, especially in the vicinity of the development footprint. The total number within the survey area was very similar (within 6 %) each year, implying that the ground that will be most affected by the development is not a core area for skuas. The losses above assume that there will be no redistribution away from the affected area, however there is similar ground to the west where skuas were only thinly spread, with more pairs in 2019 than in 2018, therefore alternative suitable habitat is available nearby.

7.9.86 This does not affect any great skua pairs located on the Hoy SPA, so there is no impact and no effect on the Hoy SPA great skua population due to operational displacement.

7.9.87 Displacement of breeding great skuas due to operational displacement is considered to range from displacement of one pair (but breeding elsewhere on the LNCS) to six pairs lost from the LNCS population, equivalent to ranging from an effect which is not significant at any scale to a significant adverse effect at the less than local (site) level, but not at any wider geographic scales. This is considered a precautionary approach as displacement may not occur at this level. The effects on the LNCS are not considered to adversely affect the integrity of the area or the qualities for which it has been designated.

Great black-backed gull – Operational Displacement – Breeding Sites

7.9.88 Only two pairs of great black-backed gulls were recorded, both approximately 750 m to the east of the nearest turbine location and one within 150 m – 200 m from the existing section of access track. This species has a relatively high tolerance of human disturbance therefore it is unlikely that the pair closest to the access track would be adversely affected by operational displacement. Beyond 200 m it is considered unlikely that there would be sufficient impact to compromise great black-backed gull breeding success. On this basis, there would be no impact and no effect on breeding great black-backed gull due to operational displacement.

Waders – Operational Displacement – Breeding Sites

7.9.89 Pearce-Higgins et al. (2009) found that curlew densities declined within 500 m of wind turbines on 12 large UK upland wind farms by around 42 % and snipe numbers by 48 %. Dunlins were too scarce to be included in the statistical analyses.

7.9.90 These findings have not been universally replicated however, with another study finding no changes in the numbers of curlews around five large wind farms (Whitfield, Green & Fielding, 2010 (cited in Gabb, 2011) and no evidence for a decline in curlews around the Hammars Hill Wind Farm in Orkney six and seven years after construction (Firth Ecology, 2020). Snipe numbers at Hammars Hill were more difficult to interpret, but there was a clear indication that numbers close to the turbines had increased, possibly due to cessation of grazing and the recovery of the moorland vegetation.

7.9.91 The mechanism underlying the declines found around wind farms was not investigated and was therefore taken to be a combination of birds avoiding the turbines and any collision mortality suffered (Pearce-Higgins et al, 2009). A later study covering several years after construction at wind farms and on reference sites found little evidence for differences in population trends between the two. This was taken to imply that any increase in mortality through collisions had little effect on populations (Pearce-Higgins, 2012).

7.9.92 Breeding season carcass searches carried out at four wind farms in Orkney (from 2009 to 2018 at Burgar Hill and 2012 to 2018 at Hammars Hill, Holodyke and Ore Brae) recorded seven curlew carcasses (Upton, 2018). The timings and locations of these found curlew carcasses were as follows:

- Burgar Hill – July 2009 (by meteorological mast)
- Burgar Hill – June 2010
- Ore Brae – June 2013
- Burgar Hill – May 2015
- Ore Brae – July 2015
- Ore Brae– May 2017
- Burgar Hill – September 2017

7.9.93 Eleven snipe carcasses were also found during these searches (excluding feather patches only, which were considered most likely to have been predated). The timings and locations of these found snipe carcasses were as follows:

- Burgar Hill – June 2010
- Hammars Hill – May 2013
- Hammars Hill – March 2014
- Burgar Hill – June 2014
- Hammars Hill – September 2014
- Burgar Hill – May 2015
- Hammars Hill – May 2015
- Burgar Hill – May 2017
- Ore Brae – May 2017
- Ore Brae– April 2018
- Hammars Hill – June 2018

7.9.94 Snipe carcasses were found to remain at Hammars Hill until they rotted down but were removed within a few days at Burgar Hill and Ore Brae (Upton, 2018). Therefore, the overall numbers found during the searches (carried out at approximately 21 day intervals) will be lower than the true number of casualties for these two sites due to removal of carcasses by scavengers although the Hammars Hill findings are likely to be quite accurate.

7.9.95 Five curlew nests were found in 2017, and one in 2018, within 120 m of large wind turbines in Orkney – three of them within 50 m, two at 50 m – 100 m and one at c.120 m. Three of these nests appeared to hatch successfully (Upton, 2017 and 2018). Three of the nests were at Burgar Hill, two at Hammars Hill and one at Holodyke. There had been no curlew nests from the same level of survey work for the five years previously (2012 – 2016) and the reason for the sudden finding of multiple nests in 2017 is unknown.

7.9.96 At the Proposed Development there were six curlew pairs within about 500 m of the turbine positions in 2018 and four in 2019. Taking a precautionary approach, assuming displacement does occur at the level found in the Pearce-Higgins et al (2009) study, a 42 % reduction in curlew territories within 500 m of a turbine is 1.7 – 2.5 pairs, or around two pairs.

7.9.97 From the whole Orkney population of a few thousand pairs, displacement of two pairs would not be considered a significant effect at the regional level, however, given the high current conservation concern for curlew, the combined displacement and collision mortality impact here is assessed as a significant adverse effect at the less than local (site) level only, but not at any wider geographic scale. The effects on the LNCS are not considered to adversely affect the integrity of the area or the qualities for which it has been designated.

7.9.98 Two snipe nests were found in 2017 (Upton, 2017), and one in 2019, within 60 m of large wind turbines in Orkney. The 2019 nest was found during carcass searches at Ore Brae as part of the fieldwork for this application. There had been no snipe nests from the same level of survey work for the five years previously (2012 – 2016).

7.9.99 At the Proposed development, there were an estimated nine displaying snipe within 500 m of the turbine positions in 2018 and eight in 2019. Taking a precautionary approach, assuming displacement does occur at the level found in the Pearce-Higgins et al (2009) study, a 48 % reduction would be about four pairs.

7.9.100 From the whole Orkney population of a few thousand pairs, operational displacement of four pairs of breeding snipe is judged to be nil or minimal, and the effect is not significant.

7.9.101 At the Proposed Development there was one Dunlin pair present each year, within about 200 m of the nearest track along the crest of Wee Fea.

7.9.102 The Pearce-Higgins (2012) study found dunlin present at five of the wind farm sites, where it was apparently unaffected during construction, so it seems unlikely that the operational phase would result in displacement.

7.9.103 On this basis, it is considered that there would be no impact and no effect as a result of operational displacement.

Collision mortality

7.9.104 Birds that collide with a turbine blade are likely to be killed or fatally injured. Increased mortality rates from collision with turbines could potentially affect the maintenance of bird populations, particularly for species that are otherwise experiencing poor reproductive or survival levels due to other factors e.g. food availability. The frequency of collision with turbines is assumed to be dependent on the amount of flight activity across the site and the ability of birds to detect the rotating blades and take avoidance action.

7.9.105 Operational displacement and collision with turbines are spatially mutually exclusive (if a bird is displaced from the wind farm area it is not at risk of collision). However, displacement effects may change temporarily as birds that were at first displaced from an area may habituate to the presence of the operating turbines after a period of time and become exposed to the risk of collision.

7.9.106 The Band collision risk model (CRM) (Band et al. 2007) was used to determine quantitative estimates of collision risk based on the dimensions of a generic turbine model with a worst-case design envelope of 14 m minimum blade tip height and 150 m maximum blade tip height.

7.9.107 The calculated collision rates for each species considered in this assessment are presented in full in Appendix 7.3: Ornithology Collision Risk Report. Quantified collision risk assessments have been made for six target species (red-throated diver, peregrine falcon, hen harrier, white-tailed eagle, great skua and great black-backed gull), which were recorded flying through the risk window/wind farm buffer at rotor height in sufficient numbers to possibly result in a significant collision risk. Five other target species (golden eagle, Arctic skua, merlin, short-eared owl and whooper swan) were recorded through the wind farm buffer at risk height on one - two occasions only. With such a low level of flight activity across two full years of survey effort, the collision risk would clearly not be of significance for these five species, so collision risk modelling has not been undertaken for them. The 'birds flying through a risk window' model (SNH, 2000) was used to calculated collision risk estimates for red-throated diver. The 'birds using the wind farm airspace' model (SNH, 2000) was used to calculate collision risk estimates for the other five species. The following sections summarise the collision risk estimates for each of these species.

Red-throated Diver

7.9.108 The calculated red-throated diver collision risk estimates for the Proposed Development for each year are shown in Table 7.16.

Table 7.16 Calculated Red-throated Diver Collision Risk Estimates for the Proposed Development at 99.5 % avoidance and 99.8 % avoidance

Season	2018	2019	Overall Average
Breeding (April – mid-September) – 99.5 % avoidance	0.19	0.34	**0.265**
Breeding (April – mid-September) – 99.8 % avoidance	0.076	0.135	**0.106**

7.9.109 The comparison of the five-year and two-year averages for a number of variables pertaining to breeding numbers and breeding success at red-throated diver sites local to the Proposed Development (see Table 7.8) indicates that the two-year average collision risk based on the 2018 and 2019 data is likely to be representative of the recent longer-term average. The two-year average risk is 0.265 collisions per year at 99.5 % avoidance which is equivalent to the loss of one bird every three - four years.

7.9.110 Population modelling was carried out based on the demographic rates in Furness (2015) for the Hoy SPA red-throated diver population, with separate models for 'good', 'average' and 'poor' years. The 'good' year figures are based on the number of birds present in recent good years on Hoy and on a slightly improved productivity rate compared to the average, with survival rates held the same as the long-term average. The 'poor' year figures are based on the number of birds present and the approximate productivity found in 2017 and 2018, with adjustment downwards of the adult survival rate to produce an approximate 10 % per annum rate of population decline, as observed from 2016 through to 2018.

7.9.111 The variables used to define each population are given in Table 7.17, along with the resultant changes in the model outputs in each case.

Table 7.17 Collision Risk Estimates in Context of the Population Models for Good, Poor and Average Years for the Proposed Development at 99.5 % Avoidance Rate and an Average Year at 99.8 % Avoidance Rate

Parameter	'Good' Year at 99.5 % Avoidance (e.g. 2019)	'Poor' Year at 99.5 % Avoidance (e.g. 2018)	Long-term Average at 99.5 % Avoidance (e.g. 2018-2019 average)	Long-term Average at 99.8 % Avoidance (e.g. 2018-2019 average)
Adult survival rate	0.84	0.80	0.84	0.84
First year survival rate	0.72	0.72	0.72	0.72
Productivity	0.650	0.360	0.630	0.630
Number of breeding adults	120	100	110	110
Number of non-breeders	23	10	20	20
Calculated risk	0.34	0.19	0.265	0.106
Decline relative to the baseline after 25 years	**6.57%**	**5.07 %**	**5.66 %**	**2.30 %**
Impacted rate of annual population change	+ 0.11 %	-10.00 %	- 0.23 %	- 0.09%
Baseline annual rate of population change	+ 0.38 %	- 9.80 %	stable	stable
Baseline no. breeding adults after 25 years	132	7 – 8	110	110
Impacted no. breeding adults after 25 years	123	7	104	107 – 108

7.9.112 SNH have advised that a modelled decline greater than 5 % (relative to the baseline) over a 25-year period could be considered significant in terms of a population trend. At 99.5 % avoidance, the models for 'poor' and 'average' years are close to 5 % and the model for a 'good' year slightly exceeds the 5 % threshold (Table 7.17). However, the clear rally in numbers and productivity in 2019, back to near their long-term averages, from the low point in 2017 and 2018 shows emphatically that these deterministic models are very poor reflections of a real population.

7.9.113 The 2018-2019 average annual risk of 0.265 collisions per year at 99.5 % avoidance results in a modelled reduction of 5.66 % in the Hoy red-throated diver population (relative to the baseline) over a 25-year period, from 110 breeding birds down to 104 birds.

7.9.114 If the population was to have continued its dramatic decline of 10 % per year, the 2018 risk of 0.19 collisions per year at 99.5 % avoidance would result in a modelled reduction of 5.07 % in the red-throated diver population (relative to the baseline) over a 25-year period. However,

according to this model, there would be only 7 – 8 breeding birds left by that stage under both the unimpacted and impacted scenarios.

7.9.115 If the population was to recover (as it seems to have done in 2019) and go on with improved productivity and no decline in adult survival, the 2019 risk of, 0.34 collisions per year at 99.5 % avoidance would result in a modelled reduction of 6.57 % in the red-throated diver population (relative to the baseline) over a 25-year period. However, this model still shows a positive trajectory, with three additional breeding birds after 25 years despite the collisions.

7.9.116 The average risk is also shown at 99.8 % avoidance (see Table 7.16), illustrating the very large effect that changing this parameter can have. The calculated collisions reduce to 0.106 per year, and when fed into the average population model, result in a 2.30 % decline relative to the baseline after 25 years (Table 7.17).

7.9.117 An impact assessment may be made based on the average 2018-2019 collision risk and the average population model. However, this is a very limited exercise if it takes no account of both (i.) the likelihood of the calculated collision rate and (ii.) the likelihood that the model reflects the actual behaviour of the population.

7.9.118 There is considerable evidence from Orkney that, firstly, the accepted avoidance rate of 99.5 % for red-throated diver is very precautionary and, secondly, that the simple deterministic population model bears little similarity to a real red-throated diver population, particularly in taking no account of population processes that can counteract negative pressures.

7.9.119 Intensive carcass searches have been carried out at operational wind turbines in Orkney, since 2007 at Burgar Hill (with high red-throated diver activity) and since 2012 at three smaller developments (with lower diver activity) (Upton, 2018). No red-throated diver fatalities have been found during any of these searches, during which an avoidance rate of 99.5 % implies that three or more would have occurred. It is therefore clear that a 99.5 % avoidance rate is of low to very low likelihood and is considered very precautionary. At 99.8 % avoidance, one to two collisions would have been expected, so this rate appears to be of moderate likelihood. The 99.8 % avoidance rate is currently used on a precautionary basis for geese, for which the evidence initially presented suggested that a rate of more than 99.9 % was applicable (SNH, 2013). Geese and divers share various similarities in flight: size, flight action, apparent lack of manoeuvrability, and in not foraging or displaying whilst in the air – similar avoidance behaviour is therefore not unreasonable, hence the illustration of 99.8 % avoidance for red-throated divers in Table 7.17 above.

7.9.120 Population model outputs are not predicted outcomes in the real world. In natural bird populations there is almost always an external limiting factor that determines the overall level and trend of the population (Newton, 2013); this is frequently food supply, which may set a variable cap on population numbers from year to year irrespective of other factors. The comments from the data holders received along with the detailed Hoy red-throated diver data suggest that the low numbers and high adult mortality in 2017 may have been due to a poor food supply (Jim Williams, pers. comm.). An important implication of this is that when there is a sudden low point, such as during 2017 - 2018 on Hoy, this effectively overtakes any prior downward pressure from other minor factors (such as collisions) and tends to reset the population base irrespective of them.

7.9.121 Within any overarching environmental constraint, 'density-dependent' processes act in various ways to tend to stabilise a population (Newton, 2013). In general terms, non-breeders at seabird colonies are considered to act as a buffer to changes that have an adverse effect on the breeding population (Klomp and Furness, 1992). A common finding is that lower breeding density (e.g. from increased mortality) may lead to accelerated rates of recruitment from non-breeders, or to higher productivity rates, each tending to bring the breeding numbers back into balance. The apparently new birds that arrived onto the red-throated diver breeding grounds on Hoy in 2018 and 2019 may well represent such accelerated recruitment from the non-breeding pool following the high adult mortality in 2017. Red-throated divers usually lay two eggs and the proportion of double broods surviving is variable year-to-year, providing a mechanism by which density-dependent productivity rates can act to mitigate impacts.

7.9.122 The model used here is very simplistic (it is identical in its workings to a straightforward Leslie Matrix) and incorporates simple estimates of demographic rates. Adult survival is the most important, but this rate is based on research from elsewhere. More complex stochastic models may be used but are doubtfully more accurate given the lack of sufficient in-depth knowledge to enable the use of population-specific demographic rates. Any such model outcome would be very dependent on the assumptions behind it, particularly how it allowed for density-dependent effects; its accuracy would depend on whether the assumptions were borne out in real life.

7.9.123 The likelihood and significance of various scenarios, based on the 2018 – 2019 average calculated risk and the average population model are given in Table 7.18.

Table 7.18 Likelihood and Significance of Red-throated diver Collision Risk Estimates for the Proposed Development at 99.5 % and 99.8 % Avoidance for the 'Average' Hoy SPA Population Model

Avoidance Rate and Likelihood	Density Dependence (Allowed for or Not Allowed for)	Modelled 25-year Decline Relative to the Baseline	Significance of the Effect (on a Very High Value Receptor)	Overall Likelihood of Occurrence
99.5 %: very low likelihood	Not allowed for: very low likelihood	5.66%	Significant	Very Low
99.5 %: very low likelihood	Allowed for: high likelihood	less than 5 %	Not significant	Low
99.8 %: moderate likelihood	Not allowed for: very low likelihood	2.30 %	Not significant	Low
99.8 %: moderate likelihood	Allowed for: high likelihood	less than 2 %	Not significant	Moderate to High

7.9.124 The assessed effects of collision mortality on the Hoy SPA red-throated diver population may be summarised as follows:

- At 99.5 % avoidance (considered very precautionary), with no allowance in the model for density dependence, a modelled decline of 5.66 % (relative to the baseline) over 25 years is considered a significant adverse effect. The overall likelihood of this occurring is very low.
- At 99.5 % avoidance (considered very precautionary), with density dependence allowed for in the model, a modelled decline of less than 5 % (relative to the baseline) over 25 years is considered a non-significant effect. The overall likelihood of this occurring is considered low.
- At 99.8 % avoidance (considered suitably precautionary), with no allowance in the model for density dependence, a modelled decline of 2.30 % (relative to the baseline) over 25 years is considered a non-significant effect. The overall likelihood of this occurring is low.
- At 99.8 % avoidance (considered suitably precautionary), with density dependence allowed for in the model, a modelled decline of less than 2 % (relative to the baseline) over 25 years is considered a non-significant effect. The overall likelihood of this occurring is considered high.

Peregrine Falcon

7.9.125 The VP flight data for this species was pooled across the year since there was no clear seasonal pattern to the occurrences at the Proposed Development and few flights at risk within the wind farm buffer. This gave a single annual calculated collision risk figure of 0.09 collisions per year at the SNH-recommended 98 % avoidance rate, equivalent to one collision every 11 - 12 years.

7.9.126 The birds recorded at the site are likely to be from the Hoy SPA population which was six pairs at the time of designation.

7.9.127 A very approximate comparison is made to the estimated population size and survival rates for the Hoy SPA population (see Table 7.19). The breeding population is assumed to be six pairs, with four single non-breeders holding territory. A minimum productivity rate of 1.04 per pair has been calculated from the Orkney Bird Reports for 2009 – 2018 (51 known fledged young from 49 monitored pairs).

Table 7.19 Comparison of Calculated Peregrine Fatalities at the Proposed Development to the Background Mortality and Survival for the Hoy SPA Population.

Parameter	Number/Percentage	Description
Hoy SPA population size	22	6 pairs (12 birds) plus juveniles at 1.04 per pair (6 birds) plus non-breeders (4 birds)
Annual survival rate	0.71	0.80 for adults, 0.67 for 1–2 year-olds and 0.54 for 0–1 year-olds (weighted 12:4:6 as above, assuming non-breeders are 1–2 year-olds) (Craig et al, 2004)
Annual mortality rate (1 – survival rate)	0.29	-
Expected no. survivors	15.62	No. x survival rate
Expected no. background deaths p.a.	6.38	No. x mortality rate
Calculated fatalities p.a. at the Proposed Development	0.09	Year-round figure for the Proposed Development at 98 % avoidance
Calculated % decrease in survival	0.58 %	Fatalities / survivors x 100
Calculated % increase in mortality	1.41 %	Fatalities / deaths x 100

7.9.128 The percentage changes in the survival and mortality rates are relatively high compared to the low calculated risk figure due to the small population. However, some of the year-round risk will be borne by birds that are not part of the Hoy SPA, particularly over the winter.

7.9.129 The likelihood of collisions being as high as estimated is low, since the 98 % avoidance rate for peregrine is the default precautionary rate recommended by SNH in the absence of detailed specific information. However, the Hesta Head Wind Farm, South Ronaldsay, Orkney application considered peregrine collision risk in detail in the Environmental Statement Addendum

(ITPEnergised, 2018) due to there being a peregrine breeding site adjacent to the development. The collision risk there was calculated at 0.392 collisions per year at 98 % avoidance, but the impact assessment argued that 99 % was suitably precautionary, and 0.196 collisions per year was the key figure used when assessing the impact on the NHZ 2 population.

7.9.130 The evidence cited was that of the overall numbers of reported collisions, at a continental scale (Europe and the United States), compared to the estimated populations of peregrine and various species with higher accepted avoidance rates (e.g. red kite and golden eagle at 99 % and large gulls at 99.5 %). Peregrine was shown to have a lower 'vulnerability index' (i.e. the number of collisions divided by the population size) than red kite and large gulls in Europe and lower than golden eagle in the USA. The SNH response (SNH, 2018d) makes no reference to avoidance rates and appears to accept the arguments presented by the applicant.

7.9.131 Use of a 99 % avoidance rate here would mean an annual calculated risk of 0.045, or one collision every 22 – 23 years. The impacts on survival and mortality rates for the Hoy SPA population (assuming conservatively that all of the risk impacts on SPA birds) would be similarly halved i.e. a 0.29 % reduction in survival rate and a 0.70 % increase in mortality rate.

7.9.132 The Hoy peregrine population is small and relatively poorly monitored, making deterministic population modelling particularly unreliable due to the effects of both stochasticity and incomplete data. If a rise in the background mortality rate of more than 1 % is taken to be significant, a broad indication of the potential significance of the calculated collision risk can be gained from the inferred changes in demographic rates shown in Table 7.19. On this basis, the likelihood and significance of the collision mortality effect on the Hoy SPA peregrine population at different avoidance rates is given in Table 7.20.

Table 7.20 Likelihood and Significance of Hoy SPA Peregrine Collision Risk Estimates for the Proposed Development at 98 % and 99 % avoidance

Avoidance Rate and Likelihood	Calculated Increase in the Hoy SPA Mortality Rate	Calculated Number of Collisions over 25 years	Significance of the Effect (on a Very High Value Receptor)	Overall Likelihood of Occurrence
98 %: very low likelihood	+ 1.41 %	2.25 (2 – 3)	Significant	Very Low
99 %: moderate likelihood	+ 0. 70 %	1.12 (1 – 2)	Not significant	Moderate

7.9.133 The assessed effects on the Hoy SPA peregrine population table may be summarised as follows:

- At 98 % avoidance (considered very precautionary), collision mortality would result in a calculated rise in background mortality of 1.41 % which is considered a significant adverse effect. The overall likelihood of this occurring is very low.
- At 99 % avoidance (considered suitably precautionary), the calculated rise in background mortality would be 0.70 % which is considered to be a non-significant effect. The overall likelihood of this occurring is moderately likely.

Hen Harrier

7.9.134 The calculated hen harrier collision risk estimates for the Proposed Development for each season and for each year are shown in Table 7.21.

Table 7.21 Calculated Hen Harrier Collision Risk Estimates for the Proposed Development at 99 % avoidance

Season	2018	2019	2018/19 and 2019/20 pooled	Average
Breeding (April – August)	0.124	0.254	-	**0.19**
Non-breeding (September – March)	-	-	0.05	**0.05**
			Overall annual risk	**0.24**

7.9.135 The average breeding season collision risk based on two years of data for the 15 m – 150 m recording height band is 0.19 collisions per breeding season. The risk for the non-breeding season is estimated at 0.05 collisions per non-breeding season. Overall, the average annual collision risk is therefore 0.24 collisions per year at 99 % avoidance.

7.9.136 Of the annual risk, about 74 % (0.18) relates to females and 26 % (0.06) relates to males, based on the flight times at 15 m – 150 m across the flight buffers for the whole survey period (11,355 seconds for females at 15 m – 150 m out of a total of 15,320 seconds).

7.9.137 The breeding data for hen harriers shows that within a 2 km buffer around the Proposed Development, 2018 and 2019 had higher numbers of breeding females, and higher breeding success, than the previous three years (2015 – 2017) (see Table 7.9). This also applied along the Burn of Ore, which is the area in closest proximity to the Proposed Development. Thus, the VP flight data has been collected in relatively high-activity years, and the collision risk calculations are likely to be precautionary.

7.9.138 The birds present in the non-breeding season are not necessarily all Hoy, or even Orkney, breeders although the majority of them are assumed to be so and the full annual calculated risk is assessed here.

7.9.139 Population modelling was carried out for the Orkney hen harrier population, with separate models for males and females. These are simple, deterministic models that follow the same approach as a Leslie Matrix, using average demographic rates each year and showing uniform rates of change in population size. They do not attempt to reflect reality, in which the rates will vary from year to year, may be subject to occasional very large changes due to stochastic events and will incorporate density-dependent mechanisms that tend to keep a population stable. The models simply compute the expected numbers at each stage, based on the numbers and survival of the preceding stages.

7.9.140 Strictly speaking, matrix models should be carried out based on female-only numbers, but for a species with different demographic rates and different exposure to risk for each sex, it is also important to look at a separate male-only model, even if the figures underlying it are less robust.

7.9.141 SNH advised that a modelled decline greater than 5 % (relative to the baseline) over a 25-year period could be considered significant in terms of a population trend. The models show 25-year reductions in numbers of approximately 5 % (relative to the baseline) at 0.21 female, or 0.15 male collisions per year.

7.9.142 The average calculated risk above, of 0.18 females per year, results in a modelled decline of 4.35 % for the Orkney female numbers over 25 years relative to the model baseline. The calculated annual risk of 0.06 males per year results in a modelled decline of 1.98 % for the Orkney male numbers over 25 years relative to the model baseline. The models are deterministic and inflexible, such that any reduction in the underlying demographic rates will cause the model population to decline relative to the baseline, with no allowance for density-dependent

mechanisms to stabilise the population, and a continuously accumulating population deficit due to collisions. They do not take any account of the scenario where an over-arching environmental constraint may impose a lower population maximum independent of collisions e.g. poor food supply in the spring setting a limit on the number of birds that can attempt to breed. If this were to occur, it would effectively wrap-up and cancel-out any accumulating collisions, in that the population numbers would be restarting from the imposed level irrespective of how many collisions had occurred before.

7.9.143 Although the impact is best assessed in terms of the relative size of the modelled decline, it is very limited without consideration of the combined likelihoods of both, (i.) the calculated collision rate actually occurring, and (ii.) the population responding as inflexibly as the model.

7.9.144 For the first point, given that the recommended avoidance rate is necessarily precautionary, then there is a low likelihood that collisions will occur to the extent calculated.

7.9.145 For the second point, given that real raptor populations are known to be capped at times by food supply and to contain non-breeders that can very rapidly replace any lost breeding birds (Newton, 2013), then there is a very low likelihood that the populations would decline to the extent of the models purely due to collision mortality.

7.9.146 Overall, the likelihood of the population declining across Orkney by 4.35 % for females and 1.98 % for males, against the baseline after 25 years, is therefore low to very low.

7.9.147 These calculated rates are already below the 5 % threshold where concern might be raised so, given the low likelihoods that the impacts would occur to the extent calculated and modelled, the effects of the Proposed Development on the Orkney hen harrier population are assessed as not significant.

7.9.148 A cumulative assessment of the collision mortality impact due to all of the relevant wind farms in Orkney has also been carried out for hen harrier (see Section 7.12).

White-tailed Eagle

7.9.149 The calculated white-tailed eagle collision risk estimates for the Proposed Development for each season and for each age class are shown in Table 7.22. The low number of flights for this species meant that overall risk was calculated for each season and then allocated to age classes in proportion to their occurrences within the wider flight buffer area (see Appendix 7.3: Ornithology Collision Risk Report).

Table 7.22 Calculated White-tailed Eagle Collision Risk Estimates for the Proposed Development at 95 % avoidance

Season	Total calculated risk	Allocation to adults	Inferred adult risk	Allocation to sub-adults	Inferred sub-adult risk	Allocation to Hoy juveniles	Inferred Hoy juvenile risk
Breeding (February to August)	0.336	6 of 18 birds	0.112	12 of 18 birds	0.224	0 birds	0
Non-breeding (September to January)	0.024	3 of 5 birds	0.014	1 of 5 birds	0.005	1 of 5 birds	0.005
Overall annual risk	**0.36**	**-**	**0.126**	**-**	**0.229**	**-**	**0.005**

7.9.150 The year-round calculated risk to all age classes of white-tailed eagles is the sum of the breeding and non-breeding season figures and is 0.36 collisions per year at the SNH-recommended 95 % avoidance rate. The allocation to age classes, in line with their occurrence in the wider flight buffer area, gives estimated collision rates of 0.126 adults, 0.229 sub-adults (including all unaged immatures) and 0.005 juveniles per year.

7.9.151 It is the adult population that is of greatest importance at this site as this relates to the single breeding pair on Hoy. However, it is possible that the much higher incidence of adult sightings in the flight buffer in Year 2 of the survey (47 % of birds) compared to Year 1 (17 % of birds) may have been indicative of additional non-breeding adults present at times in 2019/20. A collision risk of 0.126 adult birds per year is equivalent to the loss of one bird every 7 – 8 years or three birds over 25 years. This is calculated at the accepted 95 % avoidance rate, which is based on a median rate of 95.4 % (interquartile range, 90.7 % – 97.6 %) calculated at Smøla Wind Power Plant, Norway (May et al, 2010).

7.9.152 There is evidence from more recent research at the Smøla Wind Power Plant that a higher avoidance rate may be appropriate at the Proposed Development. This is partly because:

- A higher rate has now been recalculated overall at Smøla, of 97.5 % (interquartile range 94.6 % – 98.9 %) (May et al, 2011);
- The highest risk at Smøla is in the spring, when 72 % of all fatalities have been found from March to May. This is when birds are displaying at breeding territories, of which there were nine within the wind farm or within 500 m of the nearest turbine in 2009. Due to this, the spring activity rates in the wind farm area were about five times those at other times of year; and
- The higher number of fatalities in the spring appeared also to be compounded by a measured reduction in the avoidance rate at that time of year in satellite-tagged birds. The tagged birds were all sub-adults and juveniles – their avoidance rate in the spring was 98.9 % (93.3 % – 100 % interquartile range) and was estimated at 100 % at all other times of year.

7.9.153 As the white-tailed eagle breeding site on Hoy is more than 5 km from the Proposed Development, and there are few birds present on Hoy at any one time, social interaction in the wind farm buffer is expected to be rare, and no territorial display flights at lower avoidance rates would be anticipated there.

7.9.154 Therefore, an avoidance rate higher than the SNH accepted rate of 95 % appears appropriate for the Proposed Development. Given the more recent recalculation of the avoidance rate at Smøla of 97.5 % (throughout the year) and the unlikely occurrence of social interactions at lower avoidance rates within the wind farm buffer, the evidence suggests that an avoidance rate of at least 98 % should be appropriately precautionary.

7.9.155 At 98 % avoidance, the annual adult risk would reduce to 0.05, or one collision every 20 years.

7.9.156 The single pair is too small a population to sensibly carry out any population modelling. The calculated collision rate at a more likely, but still precautionary, 98 % avoidance would result in one – two adult collisions over 25 years. There would potentially be a reduction in breeding productivity until the lost bird from the pair was replaced. There is a great deal of uncertainty around various aspects of the calculation of risk for white-tailed eagle, not least the very small population and the low number of observations at the Proposed Development. Given this, a conservative approach has been taken and collision mortality is assessed as a significant adverse effect on the adult Hoy white-tailed eagle population, at the regional scale.

7.9.157 The higher calculated collision rate for sub-adults of 0.229 at 95 % avoidance, or 0.092 at 98 % avoidance, is most appropriately assessed in terms of the national sub-adult numbers, which are likely to be 100 or more. A collision rate of about one every 11 years is assessed as not significant on the national sub-adult numbers or the whole national white-tailed eagle population.

Great Skua

7.9.158 The calculated great skua collision risk estimates for the Proposed Development for each year are shown in Table 7.23.

Table 7.23 Calculated Great Skua Collision Risk Estimates for the Proposed Development at 99.5 % avoidance

Season	2018	2019	Overall Average
Breeding (April – September)	7.26	7.04	7.15

7.9.159 The risk shown for each year is very similar, so that it is reasonable to simply take the average value, which is 7.15 estimated collisions per year at 99.5 % avoidance.

7.9.160 SNH have advised that a modelled decline greater than 5 % (relative to the baseline) over a 25-year period could be considered significant in terms of a population trend. The population models carried out for the Hoy great skua population show a 25-year reduction of about 5 % (relative to the baseline) at 8.1 collisions per year. The total average risk for the Proposed Development is 7.15 collisions per year which is equivalent to a reduction in the Hoy great skua population of 4.45 % (relative to the baseline) over the 25-year lifetime of the wind farm.

7.9.161 An impact assessment may be made based on the average 2018 - 2019 collision risk and the population model. However, this is a very limited exercise if it takes no account of both (i.) the likelihood of the calculated collision rate and (ii.) the likelihood that the model reflects the actual effects on the population.

7.9.162 There is evidence from Orkney that, firstly, the accepted avoidance rate of 99.5 % for great skua is clearly precautionary and, secondly, that the simple deterministic population model bears little similarity to a real great skua population, particularly in taking no account of population processes that can counteract negative pressures.

7.9.163 Carcass searches at wind farms adjacent to great skua breeding populations on the Mainland of Orkney, and at Ore Brae, have been carried out since 2007, alongside flight observations in certain years. This work was summarised up until 2014 (Upton, 2014b) and since then searches have continued at the Mainland sites up until 2018, and on Hoy up until 2019.

7.9.164 As at 2014 an estimated 553.3 great skua collisions would have occurred at Burgar Hill, Hammars Hill and Ore Brae before avoidance (Upton, 2014b). These figures were based on the flight path observations for years when watches were carried out, together with estimates for the intervening years. For the two largest wind farms at Burgar Hill and Hammars Hill the estimates for unwatched years up to 2014 were based on the numbers of great skua territories reported by RSPB on their adjacent reserve each year – the risk was taken to be proportional to the territory numbers.

7.9.165 Since 2014 there are additional expected casualties as follows:

- For 2015 – 2018 at Burgar Hill, the average of the 2007 – 2014 risk is applied – this is 52 collisions per year before avoidance. For four additional years, this is 4 x 52 = 208 additional expected collisions.
- For 2015 – 2018 at Hammars Hill, flight observations were made in 2016 and 2017, and the calculations of risk for those two years averaged 40 per year before avoidance. For the four additional years, this is 4 x 40 = 160 additional expected collisions.
- For 2015 – 2019 at Ore Brae, the average risk calculated in 2011 and 2012 is applied – this is 43.5 collisions per year before avoidance. For the five additional years, this is 5 x 43.5 = 217.5 additional expected collisions.
- For 2012 – 2018 at the single turbine at Holodyke. This site was not included in the Upton (2014b) review, but a risk of 15.6 collisions per year before avoidance was calculated prior to construction in 2004 – 2005. As at 2012 there was still one great skua territory at 500 m –

1,000 m from the turbine (as there had been previously) and the larger great skua population on the RSPB reserve beyond had increased markedly (the same population as used to calculate risk at Burgar Hill and Hammars Hill). Therefore, a conservative estimate of the collisions at Holodyke before avoidance is, 7 x 15.6 = 109.2 additional expected collisions.

7.9.166 Table 7.24 shows the expected number of great skua fatalities, before avoidance, at each of these wind farms up to the most recent search year.

Table 7.24 Total Estimated Great Skua Collisions Expected Before Avoidance at Wind Farms in Orkney where Carcass Searches have been Undertaken

Site	Estimated Collisions Before Avoidance up to 2014 (Upton, 2014b)	Additional Search Years	Additional Expected Collisions Before Avoidance	Total Expected Collisions Before Avoidance to Date
Burgar Hill	416.1	2015 - 2018	208.0	624.1
Hammars Hill	78.1	2015 - 2018	160.0	238.1
Holodyke	-	2012 - 2018	109.2	109.2
Ore Brae	59.1	2015 - 2019	217.5	276.6
Total expected collisions before avoidance				**1,248.0**

7.9.167 Over the course of the carcass searches at these sites, three great skua collision victims have been found: one at Hammars Hill in 2015; one at Holodyke in 2016 and one at Burgar Hill in 2017.

7.9.168 The observed avoidance rate for great skuas at these sites can therefore be calculated as: 1 – (3 / 1,248) = 1 – 0.0024 = 99.76 %.

7.9.169 Such a rate would halve the calculated collision risk at the Proposed Development to 3.6 collisions per year and the modelled population reduction would be 2.26 % after 25 years, relative to the baseline.

7.9.170 As discussed for red-throated diver above, population model outputs are not predicted outcomes in the real world. There may be an external limiting factor that determines the overall level and trend of the population, irrespective of collisions, and there will be various 'density-dependent' processes that tend to stabilise a real population (Newton, 2013). In general terms, non-breeders at seabird colonies are considered to act as a buffer to changes that have an adverse effect on the breeding population, as found for great skuas specifically (Klomp and Furness, 1992).

7.9.171 The model used here is very simplistic (it is identical in its workings to a straightforward Leslie Matrix) and incorporates simple estimates of demographic rates. Adult survival is the most important, but this rate is based on research from elsewhere. More complex stochastic models may be used but are doubtfully more accurate given the lack of sufficient in-depth knowledge to enable the use of population-specific demographic rates. Any such model outcome would be very dependent on the assumptions behind it, particularly how it allowed for density-dependent effects; its accuracy would depend on whether the assumptions were borne out in real life.

7.9.172 The likelihood and significance of various scenarios based on the 2018 – 2019 average calculated risk and the population model are given in Table 7.25.

Table 7.25 Likelihood and Significance of Great Skua Risk Estimates for the Proposed Development at 99.5 % and 99.75 % avoidance

Avoidance Rate and Likelihood	Density Dependence (Allowed for or Not Allowed for)	Modelled 25-year Decline Relative to the Baseline	Significance of the Effect (on a Very High Value Receptor)	Overall Likelihood of Occurrence
99.5 %: low likelihood	Not allowed: very low likelihood	4.45 %	Not significant	Very low
99.5 %: low likelihood	Allowed: high likelihood	less than 4 %	Not significant	Low
99.75 %: moderate likelihood	Not allowed: very low likelihood	2.26%	Not significant	Low
99.75 %: moderate likelihood	Allowed: high likelihood	less than 2 %	Not significant	Moderate to high

7.9.173 The assessed effects on the Hoy SPA great skua population may be summarised as follows:

- At 99.5 % avoidance (considered very precautionary), with no allowance in the model for density dependence, a modelled decline of 4.45 % (relative to the baseline) over 25 years is considered a non-significant effect. The overall likelihood of this occurring is very low.
- At 99.5 % avoidance (considered very precautionary), with density dependence allowed for in the model, a modelled decline of less than 4 % (relative to the baseline) over 25 years is considered a non-significant effect. The overall likelihood of this occurring is low.
- At 99.75 % avoidance (considered suitably precautionary), with no allowance in the model for density dependence, a modelled decline of 2.26 % (relative to the baseline) over 25 years is considered a non-significant effect. The overall likelihood of this occurring is low.
- At 99.75 % avoidance (considered suitably precautionary), with density dependence allowed for in the model, a modelled decline of less than 2 % (relative to the baseline) over 25 years is considered a non-significant effect. The overall likelihood of this occurring is moderate to high.

Great Black-backed Gull

7.9.174 The calculated great black-backed gull collision risk estimates for the Proposed Development for each season and for each year are shown in Table 7.26.

Table 7.26 Calculated Great Black-backed Gull Collision Risk Estimates for the Proposed Development at 98 % avoidance

Season	2018	2019	2018/19	2019/20	Overall Average
Breeding (April – August)	2.37	2.21	-	-	**2.29**
Non-breeding (September – March)	-	-	0.64	1.79	**1.79**
				Overall annual risk	**4.08**

7.9.175 The non-breeding season risk is about three times greater in 2019/20 than in 2018/19 (Table 7.26). This may be at least partly due to different recording methods between years, with greater confidence in the 2019/20 method and figures. Therefore, the 2019/20 figure is used to quantify non-breeding season risk, at 1.79 collisions per non-breeding season at 98 % avoidance.

7.9.176 Overall, the average annual collision risk for great black-backed gull is therefore 4.08 collisions per year at 98 % avoidance.

7.9.177 However, there is strong empirical evidence that clearly indicates much higher avoidance in this species at onshore wind farms. At present, statutory nature conservation bodies recommend use of a 99.5 % avoidance rate for large gulls (including great black-backed gull) at offshore wind farms. This 99.5 % avoidance rate is based on evidence from terrestrial wind farms, reviewed and evaluated thoroughly (Cook et al, 2014; JNCC et al, 2014). A recent review by Furness (2019) concludes that it would be appropriate and more consistent for SNH to recommend use of avoidance rates of 99.5 % for large gulls (including great black-backed gull) at terrestrial wind farms. The equivalent risk figures at 99.5 % would simply be one quarter of those calculated at 98 %.

7.9.178 Application of a 99.5 % avoidance rate would reduce the 2018 breeding season collision risk to 0.59 and the 2019 breeding season risk to 0.55, averaging 0.57 collisions per breeding season at 99.5 % avoidance, or one fatality every 1.7 years (one – two years).

7.9.179 For the non-breeding season period, application of a 99.5 % avoidance rate would reduce the 2018/19 non-breeding season collision risk to 0.16 and the 2019/20 non-breeding season risk to 0.45. Using the 2019/20 value of 0.45 collisions per non-breeding season as representative, the risk is equivalent to one fatality every 2.2 years (two – three years).

7.9.180 Overall, the total collision risk for great black-backed gull calculated at 99.5 % avoidance is 1.02 collisions per year.

7.9.181 The bulk of the breeding season risk is not considered to involve the remnant Hoy SPA population, the scattered pairs of which now lie several kilometres away to the west of the Proposed Development. The two adjacent pairs are well separated from the SPA birds and probably have more connection with the colony on the nearby island of Fara plus any other pairs on the east coast of Hoy and the other adjacent islands in Scapa Flow (all outwith the SPA).

7.9.182 Since the breeding season risk at 99.5 % avoidance is less than one per year, and little of it will pertain to the Hoy SPA birds, the effect of collision mortality on the Hoy SPA breeding great black-backed gulls is assessed as not significant.

7.9.183 The bulk of the breeding season risk will apply to the much wider and larger Orkney population of great black-backed gulls, which probably still totals several hundred pairs. The effect on this population is assessed as not significant.

7.9.184 In the non-breeding season, the birds present at the Proposed Development are even less likely to be connected to the Hoy SPA breeding population and all of this element of the risk may be assigned to the much larger, Scottish wintering population (estimated at 7,500 – 10,000 birds)(Forrester and Andrews, 2007). At less than one fatality per year, the effect of the calculated collisions at the Proposed Development on the wintering Scottish population of great black-backed gulls is assessed as not significant.

Decommissioning

7.9.185 The Applicant is seeking in-perpetuity consent for the Proposed Development. In the event of decommissioning, or replacement of turbines, it is anticipated that the mitigation required, and the significance of the residual effects will be of similar or less than those identified within this chapter for construction. Decommissioning would be undertaken in line with best practice processes and methods at that time and will be managed through an agreed Decommissioning Environmental Management Plan.

7.10 Additional Mitigation and Enhancement

7.10.1 The following specific mitigation measures for ornithological receptors are required to avoid the identified significant adverse effects of construction disturbance (see Table 7.27).

7.10.2 Several species specially protected from disturbance during breeding under Schedule 1 of the WCA were recorded during the baseline surveys, including red-throated diver, hen harrier and merlin (see Section 7.6). It will be essential to ensure that no Schedule 1 species are disturbed during the breeding season, particularly during the construction phase, so a Breeding Bird Protection Plan (BBPP) will be developed and implemented (ORN1). Where works affecting habitats that could be used by nesting birds must take place between April and August (inclusive), they will only be carried out following pre-construction breeding bird surveys by the Environmental Clerk of Works (ECoW). If any nesting Schedule 1 birds were to be found then potentially disturbing activities would be suspended within an appropriate zone (dependent on the location of the birds and the species involved, to be agreed with SNH, and following Ruddock and Whitfield, 2007). The BBPP will also include measures to ensure the protection of all other nesting birds.

Table 7.27 Mitigation Measures Specific to Ornithological Receptors

Ref.	Phase	Title	Description
ORN1	Construction	Implementation of a Breeding Bird Protection Plan, including pre-construction breeding bird surveys to inform the need for mitigation to avoid disturbance and nest damage.	A suitably qualified ECoW will be employed on site during the bird breeding season (April to August inclusive) to carry out pre-construction breeding bird surveys prior to commencement of works, to locate active nests and to inform how works can best be programmed to avoid disturbance. Any active nests will be cordoned off to a suitable distance (agreed in consultation with SNH) and construction operations delayed within the cordon until the young have successfully fledged (or breeding has

Ref.	Phase	Title	Description
			failed). The ECoW will also carry out a watching brief during works.
ORN2	Construction	Avoid disturbance to breeding red-throated divers: construction works to be constrained to safe working distance from any occupied red-throated diver lochan (500 m - 750 m to be agreed with SNH) during the breeding season (April to August).	During the breeding season (April to August), construction will not take place along the section of access track between T4, T5 and T6, nor installation of the turbine at T5, before mid-May. Construction may only commence within the aforementioned areas from mid-May onwards if pre-construction surveys indicate that the closest red-throated diver lochan is not occupied. If the lochan is occupied, construction of the aforementioned infrastructure will commence only after the breeding attempt is completed (young fledged) or has failed, or if no eggs are laid by mid-July.
ORN3	Construction	Avoid disturbance to breeding hen harriers: construction works to be constrained to safe working distance from any active hen harrier nest (500 m – 750 m to be agreed with SNH) during the breeding season (April to August).	During the breeding season (April to August) construction will not take place along the section of access track between T2 and T4 nor installation of the turbines at T3 and T4 before mid-May. Construction may only commence within the aforementioned areas from mid-May onwards if pre-construction surveys (ORN1) indicate that there is no occupied hen harrier nest site within 500 m. If nests are found within 500 m, construction of the aforementioned infrastructure will commence only after the breeding attempt is completed (young fledged) or has failed. Works may commence from mid-May if there are nests at 500 m – 750 m, but these nests will be monitored by the ECoW and the works would cease if disturbance was observed.
ORN4	Construction	Avoid disturbance to breeding short-eared owls: construction works to be constrained to safe	During the breeding season (April to August) construction will not take place along the section of access track between T2 and T4 nor installation of

Ref.	Phase	Title	Description
		working distance from any active short-eared owl nest (300 m – 500 m to be agreed with SNH) during the breeding season (April to August).	the turbines at T3 and T4 before mid-May. Construction may only commence within the aforementioned areas from mid-May onwards and only if pre-construction surveys (ORN1) indicate that there is no occupied short-eared owl site within 300 m. If an occupied site is found within 300 m, construction of the aforementioned infrastructure will commence only after the breeding attempt is completed (young fledged) or has failed. Works may commence from mid-May if there are occupied sites at 300 m – 500 m, but these sites will be monitored, and the works would cease if disturbance was observed.

7.11 Residual Effects

Construction

7.11.1 Following the application of mitigation measures as shown in Table 7.27, the residual effects of the Proposed Development on ornithological interests are as follows:

Red-throated Diver

7.11.2 Disturbance due to construction will be avoided by implementation of mitigation measures ORN1 and ORN2. These mitigation measures will ensure that a suitably qualified ECoW will carry out pre-construction breeding bird surveys to locate any active red-throated nests prior to commencement of works. If any active red-throated diver nests are found within 500 m - 750 m (to be agreed with SNH), nests will be cordoned off and all works will be delayed within the cordon until the young have successfully fledged or the site is no longer in use.

7.11.3 During the breeding season (April – August) construction of the section of access track between T4, T5 and T6, and installation of turbine T5 will not take place before mid-May, which is the earliest that surveys could conclusively confirm if the site was occupied. Construction may only commence within the aforementioned areas from mid-May onwards if pre-construction surveys indicate that the closest red-throated diver lochan is not occupied. If an active nest is found, construction of the aforementioned infrastructure will commence only after the breeding attempt is completed (young fledged) or has failed or if no eggs are laid by mid-July.

7.11.4 Taking into account the above mitigation measures, there would be no impact and no effect on breeding red-throated divers due to construction disturbance.

Hen Harrier

7.11.5 Disturbance due to construction will be avoided by implementation of mitigation measures ORN1 and ORN3. These mitigation measures will ensure that a suitably qualified ECoW will carry out pre-construction breeding bird surveys to locate any active hen harrier nests prior to commencement of works. If any active hen harrier nests are found within 500 m - 750 m (to be agreed with SNH), nests will be cordoned off and all works will be delayed within the cordon until the young have successfully fledged or the site is no longer in use.

7.11.6 During the breeding season (April – August) construction will not take place along the section of access track between T2 and T4 nor installation of the turbines T3 and T4 before mid-May which is the earliest that surveys could conclusively confirm if the site was occupied. Construction may only commence within the aforementioned areas from mid-May onwards if pre-construction surveys indicate that there are no occupied hen harrier nest sites within 500 m. If any hen harrier nest is found within 500 m, construction of the aforementioned infrastructure will commence only after the breeding attempt is completed (young fledged) or has failed. If any active hen harrier nest is found within 500 m to 750 m, works may commence from mid-May with monitoring of the nest by the ECoW to check for signs of disturbance. If any disturbance was observed, construction would have to cease until the nest was no longer active due to breeding failure or fledging of young.

7.11.7 Taking into account the above mitigation measures, there would be no impact and no effect on breeding hen harrier due to construction disturbance.

Short-eared Owl

7.11.8 Disturbance due to construction will be avoided by implementation of mitigation measures ORN1 and ORN4. These mitigation measures will ensure that a suitably qualified ECoW will carry out pre-construction breeding bird surveys to locate any active short-eared owl nests prior to commencement of works. If any active short-eared owl nests are found within 300 m - 500 m (to be agreed with SNH), nests will be cordoned off and all works will be delayed within the cordon until the young have successfully fledged or the site is no longer in use.

7.11.9 During the breeding season (April – August) construction will not take place along the section of access track between T2 and T4 nor installation of the turbines at T3 and T4 before mid-May, which is the earliest that surveys could conclusively confirm if the site was occupied. Construction may only commence within the aforementioned areas from mid-May onwards if pre-construction surveys indicate that there are no occupied short-eared owl nest sites within 300 m. If any short-eared owl nest is found within 300 m, construction of the aforementioned infrastructure will commence only after the breeding attempt is completed (young fledged) or has failed. If any active short-eared owl nest is found within 300 m to 500 m, works may commence from mid-May with monitoring of the nest by the ECoW to check for signs of disturbance. If any disturbance was observed, construction would have to cease until the nest was no longer active due to breeding failure or fledging of young.

7.11.10 Taking into account the above mitigation measures, there would be no impact and no effect on breeding short-eared owls due to construction disturbance.

Other species

7.11.11 The destruction of nests due to construction will be avoided by implementation of mitigation measure ORN1. This mitigation measure will ensure that if pre-construction surveys locate active nests of any species in the planned working area, they will not be damaged or destroyed. Works would avoid an agreed cordon around the area and would not recommence there until any nest was no longer active due to breeding failure or young fledging.

Operation

7.11.12 Operational displacement would not result in any significant residual effects beyond the less than local (site) level. Displacement of breeding great skuas due to operational displacement is considered to range from displacement of one pair (but breeding elsewhere on the LNCS) to six pairs lost from the LNCS population, equivalent to ranging from an effect which is not significant to a significant adverse effect at the less than local (site) level only, but not at any wider geographic scale. This is considered a precautionary approach as displacement may not occur at this level. The effects on the LNCS are not considered to adversely affect the integrity of the area or the qualities for which it has been designated. There would be no significant residual effects on the Hoy SPA great skua population.

7.11.13 Operational displacement would result in displacement of two pairs of breeding curlew. From the whole Orkney population of a few thousand pairs, this would not be considered a significant effect at the regional level, however, given the high current conservation concern for curlew, the combined displacement and collision mortality impact is assessed as a significant adverse effect, at the less than local (site) level only, but not at any wider geographic scale. The effects on the LNCS are not considered to adversely affect the integrity of the area or the qualities for which it has been designated.

7.11.14 The calculated collision risk estimate for red-throated diver at 99.5 % avoidance (considered very precautionary) would result in a modelled decline in the Hoy SPA red-throated diver population of less than 5 % (relative to the baseline) over a 25-year period, when density dependence is taken into account in the model. The assessed effects of this level of collision mortality on the Hoy SPA red-throated diver population is assessed as not significant. The overall likelihood of this level of collision risk occurring is low.

7.11.15 At 99.8 % avoidance, (considered suitably precautionary) the modelled decline (relative to the baseline) would be less than 2 % over 25 years, when density dependence is taken into account in the model. The assessed effects of this level of collision mortality on the Hoy SPA red-throated diver population is assessed as not significant. The overall likelihood of this occurring is considered high.

7.11.16 The calculated collision risk estimate for peregrine at 99 % avoidance (considered suitably precautionary for this site), would result in a rise of 0.70 % in the background mortality rate for the Hoy SPA peregrine population. If a rise in background mortality rate of more than 1 % is taken to be significant, a rise of 0.70 % would be assessed as not significant for the Hoy SPA peregrine population. The overall likelihood of this occurring is moderately likely.

7.11.17 The calculated collision risk estimates for hen harrier would result in modelled declines of less than 5 % (relative to the baseline) in the Orkney hen harrier population over 25 years. The assessed effects of collision mortality on breeding hen harriers from the Orkney population are assessed as not significant.

7.11.18 For the adult white-tailed eagle population in Hoy, a collision rate of 0.05 collisions per year at 98 % avoidance (considered suitably precautionary for this site) would results in the loss of one – two adult birds over a 25-year period. Given that there is a great deal of uncertainty around various aspects of the calculation of risk for white-tailed eagle, not least the very small population and the low number of observations at the Proposed Development, a conservative approach has been taken and collision mortality is assessed as a significant adverse effect on the adult Hoy white-tailed eagle population.

7.11.19 The calculated collision risk estimates for great skua would result in modelled declines of less than 5 % (relative to the baseline) in the Hoy SPA great skua population over a 25-year period (at 99.5 % and 99.75 % avoidance). The assessed effects of collision mortality on breeding great skuas from the Hoy SPA population are therefore not significant.

7.11.20 For great black-backed gull, the average calculated collision rate for the breeding season is 0.57 collisions per breeding season at 99.5 % avoidance, equivalent to the loss of one bird every one – two years. However, the bulk of the breeding season risk will apply to the much wider and larger Orkney population, which is in the region of several hundred pairs. The assessed effects of collision mortality on breeding great black-backed gulls from the Hoy SPA population and the Orkney population are assessed as not significant.

7.11.21 For the non-breeding season, the average calculated collision rate for the non-breeding season is 0.45 collisions per breeding season at 99.5 % avoidance, equivalent one fatality every two - three years. In the non-breeding season, the birds present at the Proposed Development are even less likely to be connected to the Hoy SPA breeding population and all of this element of the risk may be assigned to the much larger, Scottish wintering population (estimated at 7,500 – 10,000 birds) (Forrester and Andrews, 2007). At less than one fatality per year, the assessed effects of collision mortality on the wintering Scottish population of great black-backed gulls is assessed as not-significant.

7.12 Cumulative Assessment

7.12.1 A cumulative ornithological assessment has been undertaken following the SNH (2018c) guidance on 'Assessing the cumulative impacts of onshore wind farms on birds, considering impacts on the favourable conservation status of key species within the relevant Natural Heritage Zone' (in this case NHZ2 'Northern Caithness and Orkney).

7.12.2 Cumulative effects have also been considered in relation to the Hoy SPA populations. Information to inform a Habitats Regulations Appraisal (HRA) is presented in Appendix 7.4 HRA.

7.12.3 All of the likely effects of wind farms identified above (habitat loss, collision risk, displacement and disturbance) have the potential to contribute to the cumulative ornithological impacts, so all have been considered in this cumulative ornithological assessment. However, the predicted effects of the Proposed Development with regard to habitat loss and disturbance are all so low it is considered that these would not make any material contribution to any potentially significant cumulative effects at the NHZ level. Cumulative disturbance and habitat loss are not, therefore, considered any further in this cumulative assessment. The cumulative assessment has therefore focussed on operational displacement and collision risk. Cumulative assessments have been carried out for those species for which it was considered the Proposed Development could materially contribute to a potentially significant cumulative risk: red-throated diver, peregrine, great skua, great black-backed gull, hen harrier and short-eared owl.

Cumulative Displacement

7.12.4 Cumulative displacement relating to the Hoy SPA qualifying interests involves Ore Brae only. Since Ore Brae lies at 1.9 km from the SPA boundary at its nearest point, it has no displacement impact on any of the qualifying interests nesting within the SPA, hence there are no further cumulative impacts greater than those assessed for the Proposed Development on its own.

7.12.5 The closest known nest site for hen harrier to Ore Brae is at 460 m, found during the survey work for the Proposed Development. The female here had not been deterred by the turbine and was in a new nesting location for the species. Therefore, no displacement impact on hen harrier is anticipated due to the turbine, and no further cumulative impacts greater than those assessed for the Proposed Development on its own.

7.12.6 The closest known nest site for short-eared owl to Ore Brae was about 700 m, in 2011 (Firth Ecology, 2012). The birds here appeared to successfully fledge at least one young and had not been deterred during construction works at Ore Brae. Therefore, no displacement impact on short-eared owl is anticipated due to Ore Brae, and no further cumulative impacts greater than those assessed for the Proposed Development on its own.

7.12.7 The great skuas and great black-backed gulls closest to Ore Brae are well away from the SPA boundary and are part of the Hoy and North Walls SSSI Moorland Fringes LNCS populations. Neither species occurs within 300 m of Ore Brae (apart from occasional, temporary great skua AOTs), and it has not had any displacement impact on their distributions. Therefore, the LNCS great skuas and great black-backed gulls will suffer no further cumulative impacts greater than those assessed for the Proposed Development on its own.

Cumulative Collision Risk

Red-throated diver Hoy SPA

7.12.8 The only other wind farm development that will affect the Hoy SPA is Ore Brae.

7.12.9 The average calculated collision risk for red-throated diver at the Proposed Development is 0.265 collisions per year at 99.5 % avoidance; the calculated collision risk at Ore Brae in 2008 was 0.008 per year at 99.5 % avoidance. The cumulative risk is therefore 0.273 collisions per year (see Table 7.28 Cumulative Collison Risk for Red-throated Divers from the Hoy SPA Population).

7.12.10 The additional risk is equivalent to a 3 % increase in risk compared to the Proposed Development. Such a small increase in collision risk is well within the uncertainty of many of the

elements of the collision risk calculation. Therefore, the cumulative collision risk to the Hoy SPA red-throated diver population is essentially the same as that carried out for the Proposed Development on its own (see paragraph 7.9.124) and no separate cumulative assessment is required.

Table 7.28 Cumulative Collison Risk for Red-throated Divers from the Hoy SPA Population

Development	Number of Turbines	Status	Annual Collision Risk Estimate (99.5 % avoidance)	Sum Total
Orkney's Community Wind Farm Project - Hoy	6	Application	0.265	0.265
Ore Brae	1	Operational	0.008	0.273
			Total	**0.273**

Peregrine Hoy SPA

7.12.11 The only other wind farm site or proposal that will affect the Hoy SPA is Ore Brae.

7.12.12 The calculated collision risk for peregrine at the Proposed Development is 0.09 per year at 98 % avoidance; the calculated collision risk at Ore Brae in 2008 was 0.006 per year at 98 % avoidance. The cumulative risk is therefore 0.096 collisions per year (see Table 7.29 Cumulative Collision Risk for Peregrines from the Hoy SPA Population Calculated at 98 % Avoidance).

7.12.13 The additional risk is equivalent to a 6.25 % increase in risk compared to the Proposed Development. Such a small increase in collision risk is well within the uncertainty of many of the elements of the collision risk calculation. Therefore, the cumulative collision risk to the Hoy SPA peregrine population is essentially the same as that carried out for the Proposed Development on its own (see paragraph 7.9.133) and no separate cumulative assessment is required.

Table 7.29 Cumulative Collision Risk for Peregrines from the Hoy SPA Population Calculated at 98 % Avoidance

Development	Number of Turbines	Status	Annual Collision Risk Estimate (98 % Avoidance)	Sum Total
Orkney's Community Wind Farm Project - Hoy	6	Application	0.09	0.09
Ore Brae	1	Operational	0.006	0.096
			Total	**0.096**

Great skua Hoy SPA

7.12.14 The only other wind farm site or proposal that will affect the Hoy SPA is Ore Brae.

7.12.15 The average calculated collision risk for great skua at the Proposed Development is 7.15 collisions per year at 99.5 % avoidance; the calculated collision risk at Ore Brae in 2008 was 0.38

per year at 99.5 % avoidance. The cumulative risk is therefore 7.53 collisions per year (see Table 7.30).

7.12.16 The additional risk is equivalent to a 5.3 % increase in risk compared to the Proposed Development. Such a small increase in collision risk is well within the uncertainty of many of the elements of the collision risk calculation. Therefore, the cumulative collision risk to the Hoy SPA great skua population is essentially the same as that carried out for the Proposed Development on its own (see paragraph 7.9.173) and no separate cumulative assessment is required.

Table 7.30 Cumulative Collison Risk for Great Skuas from the Hoy SPA population at 99.5 % avoidance

Development	Number of Turbines	Status	Annual Collision Risk Estimate (99.5 % avoidance)	Sum Total
Orkney's Community Wind Farm Project - Hoy	6	Application	7.15	7.15
Ore Brae	1	Operational	0.38	7.53
			Total	**7.53**

Great black-backed gull Hoy SPA

7.12.17 Although great black-backed gull is a Hoy SPA qualifying interest, the birds breeding close to the Proposed Development are well away from the SPA and not connected to it for foraging or roosting, nor by regular or frequent interactions with breeders that are located on the SPA.

7.12.18 The bulk of the calculated collision risk is therefore judged not to relate to the SPA population, and this would also be the case at Ore Brae.

7.12.19 There were no collision risk calculations undertaken for this species for Ore Brae, but as for the other Hoy SPA qualifying interests above, it may be assumed that the additional risk would be very low.

7.12.20 Since the bulk of the risk is to non-SPA birds, there is no meaningful calculation or estimation of cumulative risk that can be made for the SPA.

Hen harrier NHZ2 Northern Caithness and Orkney (Orkney)

7.12.21 There are a number of wind farms (operational, consented and in planning) where hen harrier collision risk has been calculated, either prior to construction or afterwards (Burgar Hill). These are all listed in Table 7.31 below.

7.12.22 Wind farms and turbines where no collision risk estimate was required in the planning process are omitted from the table; they include such developments as those on Westray, Sanday, Stronsay, Shapinsay, Burray, Flotta and on the Mainland of Orkney, the turbines at Ludenhill, Rennibister, Hatston, and Barns of Ayre, Deerness.

7.12.23 Three of the consented sites where hen harrier risk calculations were undertaken now have almost zero chance of being built due to grid connection constraints; these are Burgar Hill south extension, Akla, Berriedale (South Ronaldsay). For completeness, these are included in the table.

7.12.24 The prime concern is the breeding season risk across the county and where separate figures are available, they are used here.

7.12.25 For one site, all of the observed risk was during the non-breeding season and it has a zero risk for the breeding season.

Table 7.31 Cumulative Collison Risk for Hen Harriers from the Orkney Population

Development	Number of Turbines	Status	Annual Collision Risk Estimate (99 % avoidance)	Sum Total
Orkney's Community Wind Farm Project - Hoy	6	Application	0.19	0.19
Ore Brae	1	Operational	0.006	0.196
Costa Head	4	Consented	0.011	0.207
Burgar Hill	5	Operational	0.116	0.323
Burgar Hill north extension	1	Operational	0.0145	0.3375
Burgar Hill south extension	1	Consented	0.003	0.3405
Hammars Hill existing	5	Operational	0.0637	0.4042
Hammars Hill expansion	2	Application	0.0467	0.4509
Holodyke	1	Operational	0.0148	0.4657
Quanterness	64	Application	0.000	0.4657
Akla	1	Consented	0.010	0.4757
Upper Stove, Deerness	1	Operational	0.001	0.4767
New Holland, Holm	1	Operational	0.015	0.4917
Berriedale, South Ronaldsay	1	Consented	0.005	0.4967
Hesta Head	5	Consented	0.005	0.5017
Eday Community Turbine	1	Operational	0.0017	0.5034
Kingarly Hill	1	Operational	0.0014	0.5048
			Total	**0.5048**

7.12.26 The total cumulative breeding season impact on the Orkney hen harrier population is 0.505 collisions calculated at 99 % avoidance.

7.12.27 Survey work at several West Mainland sites found that 51 % of the observed breeding season flight at risk height related to females and 49 % to males (Upton, 2014a). This contrasts with

figures of 74 % for females and 26 % for males found on Hoy. For the overall cumulative assessment an approximate mid-figure of 60 % female and 40 % male risk is used.

7.12.28 The overall cumulative risk borne by females in the breeding season is estimated at 0.505 x 60 % = 0.303 at 99 % avoidance.

7.12.29 The overall cumulative risk borne by males in the breeding season is estimated at 0.505 x 40 % = 0.202 at 99 % avoidance.

7.12.30 The average calculated risk above, of 0.303 for females per year, results in a modelled decline of 7.21 % for the Orkney female numbers over 25 years relative to the model baseline. The calculated annual risk of 0.202 for males results in a modelled decline of 6.51 % for the Orkney male numbers over 25 years relative to the model baseline.

7.12.31 Table 7.32 shows the number of breeding female hen harriers found each year and their fledging success from Orkney Bird Reports (Williams 2003:2013; Williams and Branscombe 2014 and Branscombe 2015:2019) and Orkney Raptor Study Group data. There can be large increases and decreases from year to year.

Table 7.32 Numbers and Breeding Success of the Orkney Hen Harrier Population

Year	No. Breeding Females (Confirmed and Probable)	% Increase/ Decrease in Female Numbers	Young Near to Fledging	% Increase/ Decrease in Young Near to Fledging	Observed Productivity per Female
2002	47	-	48	-	1.02
2003	54	+14.9%	56	+16.7%	1.04
2004	74	+37.0%	80	+42.9%	1.08
2005	72	-2.7%	76	-5.0%	1.06
2006	68	-5.9%	71	-5.3%	1.04
2007	65	-4.4%	74	+4.2%	1.14
2008	62	-4.6%	64	-13.5%	1.03
2009	73	+17.7%	95	+48.4%	1.30
2010	80	+9.6%	84	-9.6%	1.05
2011	103	+28.8%	101	+20.2%	0.98
2012	103	0%	100	-1.0%	0.97
2013	93	-9.7%	97	-3.0%	1.04
2014	88	-5.4%	100	+3.1%	1.14
2015	82	-6.8%	51	-49.0%	0.62

Year	No. Breeding Females (Confirmed and Probable)	% Increase/ Decrease in Female Numbers	Young Near to Fledging	% Increase/ Decrease in Young Near to Fledging	Observed Productivity per Female
2016	82	0%	73	+43.1%	0.89
2017	72	-12.2%	67	-8.2%	0.93
2018	73*	+1.4%	65*	-3.0%	0.89
2019	75	+2.7%	62	-4.6%	0.83

** For 2018, coverage in a key part of West Mainland was particularly poor – an additional five breeding females and five fledged young have been added to account for this.*

Orkney Cumulative Collision Mortality – Model Limitations – Food Supply

7.12.32 The models used are deterministic and inflexible, such that any reduction in the underlying demographic rates will cause the model population to decline relative to the baseline, with no allowance for density-dependent mechanisms to stabilise the population, and with a continuously accumulating population deficit due to collisions.

7.12.33 They do not take any account of the scenario where an overarching environmental constraint may impose a lower population maximum independent of collisions, e.g. poor food supply in the spring setting a limit on the number of birds that can attempt to breed. If this were to occur, it would effectively wrap-up and cancel-out any accumulating collisions, in that the population numbers would be restarting from the imposed level irrespective of how many collisions had occurred before. Such food-limitation is a well-established population regulator, for which there is ample evidence in the history of hen harrier numbers in Orkney.

7.12.34 Amar and Redpath (2002) investigated the hypothesis that low food supply (particularly early in the breeding period when males provide females with most of their food) was limiting the number of Orkney Mainland Moors SPA breeding hen harriers and also their breeding success. The provision of supplementary food to males in spring 1999 and 2000 was found to increase the number of birds able to breed, with breeding birds defined as those associated with egg-laying. It had its effect by allowing all the fed males to breed (20 % of unfed males did not breed), and also by allowing them to breed with more females (a 33 % rate of polygyny was found compared to 5 % in unfed males).

7.12.35 Given this key effect of food supply in the early breeding season, it is reasonable to conclude that recent and future population declines in Orkney hen harriers are also most likely to be due to reduced spring food supplies. The implication of this is that a collision fatality during the previous breeding season would not be expected to have a carry-over effect – it becomes 'compensatory' and simply replaces a death/dispersal that would have occurred in any case during the winter or spring prior to the next breeding season. This compensatory principle has been used to explain the behaviour of raptor (and other bird) populations elsewhere and its effect can be very pronounced. For example, studies in Finland showed that high levels of Goshawk culling caused no long-term decline in the breeding population (Newton, 1998, p 448). The explanation was that man-induced mortality resulted in subsequently low natural mortality overwinter, when food would otherwise have been limiting.

7.12.36 The recent peak in hen harrier numbers in Orkney was in 2011 and 2012 at about 100 females, with numbers declining since to around 70 females, i.e. clearly now below the physical carrying capacity of the habitat in terms of nest sites. When this is the case the limiting factor is likely to

be food supply, which is probably the single most important factor in determining the size of the breeding population.

7.12.37 It follows that human impacts on hen harrier numbers have most effect as they relate to food supply, particularly in the quality of the habitat around the edges of the moorlands – good quality habitat sustains more prey, at higher densities.

Orkney Cumulative Collision Mortality – Model Limitations – Density Dependence

7.12.38 The models also do not allow for any accelerated replacement of collision victims from the non-breeding pool. Non-breeders are an important component of all healthy raptor populations, although they are much more difficult to quantify than the breeding numbers. The 2013 ORSG data suggests that 20 or more non-breeding female hen harriers may have been present on the Orkney Mainland Moors SPA at the population peak then. Even through periods of lower breeding numbers, there is always a non-breeding element.

7.12.39 These non-breeders can replace losses from the breeding adults and thus tend to stabilise the population in the event of additional mortality. Such replacement from a non-breeding pool is well-documented in some raptors e.g. for peregrine and merlin, where breeding birds that are illegally removed or killed, sometimes year after year, are often replaced the following year (or even within the same season).

7.12.40 In Orkney, the temporary removal of hen harriers from their territories, in order to fit radio transmitters, revealed how quickly replacement can occur (Picozzi, 1984). In the late 1970s and early 1980s, birds were removed from territories, prior to nest building, for no more than three hours before release back at the capture site. However, none of the handled birds returned immediately to their territories. Of two males (in 1976 and 1981) neither was replaced by other birds, despite one taking six days to return and the other not returning at all. However, of three females, all were replaced within a day, one of them within 30 minutes. Thus, replacement of breeding females, by at latest the following year, is very likely. Although males were not replaced in the same season, this occurred at a time when the ratio of males was low and polygyny probably higher than at present; if the sex ratio is less imbalanced currently, there is more likelihood of replacement happening, especially by the following year. Therefore, replacement would be expected to occur to a considerable degree in Orkney, and almost certainly in females.

Orkney Cumulative Collision Mortality – Model Limitations – Likelihoods

7.12.41 Although the impact is best assessed in terms of the relative size of the modelled decline, it is very limited without consideration of the combined likelihoods of both, (i.) the calculated collision rate actually occurring, and (ii.) the population responding as inflexibly as the model.

7.12.42 The results of carcass searches around wind farms in Orkney help to address the first point. Breeding season searches have been made since 2007 at Burgar Hill and since 2012 at Hammars Hill, Holodyke and Ore Brae. Using the figures in Table 7.31 above, the number of collision victims that were calculated at 99 % avoidance is:

- Burgar Hill, 2007 – 2018; 12 years at 0.116 = 1.392
- Burgar Hill north extension, 2010; one year at 0.0145 = 0.0145
- Hammars Hill, 2012 – 2018; seven years at 0.0637 = 0.446
- Holodyke, 2012 – 2018; seven years at 0.0148 = 0.104
- Ore Brae, 2012 – 2019; eight years at 0.006 = 0.048

7.12.43 The total expected collisions during these searches is 2.004, but no hen harrier fatalities have been found. The only recorded hen harrier death at a wind farm in Orkney is of a female in January 2014 near the Holodyke turbine (Stuart Williams, pers. comm.).

7.12.44 There is no direct persecution of hen harriers in Orkney and increased direct mortality due to human actions is limited to accidental deaths when birds are struck by motor vehicles or collide

with structures such as barbed wire fences and (potentially) overhead power lines and wind turbines. The mortality levels from all of these combined appears unlikely to be a serious factor in limiting the hen harrier population. Of these sources, wind turbines are probably the least important at the current level of wind farm development, and also for some time to come. Thus over the past 16 years at least five hen harriers have been killed and one injured on the roads during the breeding season: a female injured in Birsay in 2004; a female and fledgling killed at the same locality in St Andrews in 2006 (Williams, 2006); two males killed in the same year (probably 2010) in Orphir; and a male killed in Rendall in 2014. At least two have been found dead or dying on barbed wire fences, in 2004 (Adam, 2005) and 2012 (Forsyth, 2012), both in Harray. In addition, two nests in 2005 were thought to have failed due to an accident befalling either the associated female or male (Williams, 2005). In this time there has been just one hen harrier found near a wind turbine.

7.12.45 Given the extensive length of the fence network in Orkney, there are almost certainly unreported casualties. However, it is clear that the combined risk posed by road traffic, fences, power lines and the existing wind turbines prevented neither the population recovery early in the 2000s, nor the more recent increase up to 2012.

Orkney Cumulative Collision Mortality – Model Limitations – Summary and Impact Assessment

7.12.46 In summary, given that carcass searches show the recommended avoidance rate to be precautionary, then there is a low likelihood that collisions will occur to the extent calculated.

7.12.47 Also, given that real raptor populations are known to be capped at times by food supply and to contain non-breeders that can very rapidly replace any lost breeding birds (Newton, 2013), then there is a very low likelihood that the populations would decline to the extent indicated by the models due to collision mortality.

7.12.48 A few further observations may be made in considering an assessment of the collision mortality impact on the hen harrier populations:

- The inter-annual variation in breeding numbers is considerable. From 2002 to 2019 (see Table 7.32 above) 10 out of 17 annual changes were of 5 % or more, up or down, with the highest at + 37 %. Thus, an underlying trend of around 6 % to 7 % over 25 years due to wind farm collisions would be difficult to detect in practice amidst the normal levels of annual variation.
- Field methods for counting breeding raptors are by no means exact and in a population of around 70, missing as few as three – four birds would make a c.5 % difference. Again, a modelled reduction of around 6 % to 7 % over 25 years, would be largely obscured due to normal survey uncertainty.
- Any imposition of a low population ceiling due to other factors will cause accumulated collision effects to be reset to zero.
- Any element of accelerated replacement of lost breeders from the non-breeding pool (or other density dependent process such as increased productivity) will act to reduce the population-level effect of wind farm impacts.

7.12.49 The assessments of the cumulative collision mortality impacts calculated for the Orkney populations of female and male hen harriers are given in Table 7.33 Likelihood and Significance of Female Hen Harrier Collision Risk Estimates for the Orkney Population at 99 % and 99.5 % Avoidance and Table 7.34 Likelihood and Significance of Male Hen Harrier Collision Risk Estimates for the Orkney Population at 99 % and 99.5 % Avoidance. In these, the modelled population reductions after 25 years (relative to the model baselines) are the subjects of the assessments.

7.12.50 The modelled declines featured are those for collisions calculated at 99 % avoidance and those for collisions calculated at 99.5 % avoidance.

7.12.51 As discussed above, the likelihoods of the avoidance rates and the deterministic results of the models are both considered in the assessments.

Table 7.33 Likelihood and Significance of Female Hen Harrier Collision Risk Estimates for the Orkney Population at 99 % and 99.5 % Avoidance

Avoidance Rate and Likelihood	Density Dependence (Allowed for or Not Allowed for)	Female Modelled 25-year Decline Relative to the Baseline	Significance of the Effect on Females (a Very High Value Receptor)	Overall Likelihood of Female impact
99 %: low likelihood	Not allowed: very low likelihood	7.21 %	Significant	Low to Very Low
99 %: low likelihood	Allowed: high likelihood	less than 7 %	Significant	Low
99.5 %: moderate likelihood	Not allowed: very low likelihood	3.67 %	Not significant	Low
99.5 %: moderate likelihood	Allowed: high likelihood	less than 3 %	Not significant	Moderate to High

7.12.52 The assessed cumulative mortality effects on the Orkney female hen harrier population may be summarised as follows:

- At 99 % avoidance (considered very precautionary), with no allowance in the model for density dependence, a modelled decline of 7.21 % (relative to the baseline) over 25 years is considered a significant adverse effect. The overall likelihood of this occurring is low to very low.
- At 99 % avoidance (considered very precautionary), with density dependence allowed for in the model, a modelled decline of less than 7 % (relative to the baseline) over 25 years is considered a significant adverse effect. The overall likelihood of this occurring is low
- At 99.5 % avoidance (considered suitably precautionary), with no allowance in the model for density dependence, a modelled decline of 3.67 % (relative to the baseline) over 25 years is considered a non-significant effect. The overall likelihood of this occurring is low.
- At 99.5 % avoidance (considered suitably precautionary), with density dependence allowed for in the model, a modelled decline of less than 3 % (relative to the baseline) over 25 years is considered a non-significant effect. The overall likelihood of this occurring is moderate to high.

Table 7.34 Likelihood and Significance of Male Hen Harrier Collision Risk Estimates for the Orkney Population at 99 % and 99.5 % Avoidance

Avoidance Rate and Likelihood	Density Dependence (Allowed for or Not Allowed for)	Male Modelled 25-year Decline Relative to the Baseline	Significance of the Effect on Males (a Very High Value Receptor)	Overall Likelihood of Male Impact
99 %: low likelihood	Not allowed: very low likelihood	6.51 %	Significant	Low to Very Low
99 %: low likelihood	Allowed: high likelihood	less than 6 %	Significant	Low
99.5 %: moderate likelihood	Not allowed: very low likelihood	3.31 %	Not significant	Low
99.5 %: moderate likelihood	Allowed: high likelihood	less than 3 %	Not significant	Moderate to High

7.12.53 The assessed cumulative mortality effects on the Orkney male hen harrier population may be summarised as follows:

- At 99 % avoidance (considered very precautionary), with no allowance in the model for density dependence, a modelled decline of 6.51 % (relative to the baseline) over 25 years is considered a significant adverse effect. The overall likelihood of this occurring is low to very low.
- At 99 % avoidance (considered very precautionary), with density dependence allowed for in the model, a modelled decline of less than 6 % (relative to the baseline) over 25 years is considered a significant adverse effect. The overall likelihood of this occurring is low
- At 99.5 % avoidance (considered suitably precautionary), with no allowance in the model for density dependence, a modelled decline of 3.31 % (relative to the baseline) over 25 years is considered a non-significant effect. The overall likelihood of this occurring is low.
- At 99.5 % avoidance (considered suitably precautionary), with density dependence allowed for in the model, a modelled decline of less than 3 % (relative to the baseline) over 25 years is considered a non-significant effect. The overall likelihood of this occurring is moderate to high.

7.13 Summary

7.13.1 A comprehensive suite of field surveys was undertaken to evaluate the ornithological interests at the Proposed Development site covering two breeding seasons (2018 and 2019) and two non-breeding season periods (October 2018 to March 2019 and October 2019 to March 2020). These surveys comprised vantage point surveys, moorland breeding bird surveys, breeding skua surveys, scarce breeding bird surveys (raptors and divers), focal diver watches and hen harrier roost surveys.

7.13.2 The likely significant effects on ornithological interests at the Proposed Development were assessed including noise and visual disturbance from construction activities, displacement

(including barrier effects) due to presence and operation of the turbines and the risk of mortality due to collisions with operating turbines.

7.13.3 The Proposed Development site is outwith any sites designated for ornithological interests at European or national levels; however; there are several designated sites with ornithological interests in the surrounding area including Hoy SPA and Hoy SSSI designated for breeding moorland birds and seabirds; Scapa Flow pSPA designated for breeding red-throated diver and wintering divers, seaducks and grebes and Switha SPA designated for wintering Greenland barnacle goose.

7.13.4 The Proposed Development site overlaps Hoy and North Walls SSSI Moorland Fringes LNCS designated for moorland breeding birds.

7.13.5 Hoy SPA qualifying interests recorded at the site included red-throated diver, peregrine falcon, great skua and great black-backed gull. Two other Hoy SPA qualifying interests were recorded on one -two occasions only.

7.13.6 White-tailed eagle, hen harrier and short-eared owl recorded at the site were considered of high importance. Curlew and dunlin, both special wildlife features of the LNCS, were considered of medium importance and snipe was considered of negligible (less than local (site)) importance only.

7.13.7 Species-specific mitigation measures will be required to avoid significant adverse effects from disturbance due to construction activities for breeding red-throated diver and hen harrier. Mitigation measures will also be implemented to avoid disturbance to short-eared owl, which is considered good practice. These mitigation measures will ensure that a suitably qualified ECoW will carry out pre-construction breeding bird surveys to locate any active nests prior to commencement of works. If any active nests are found (within 500 m - 750 m for red-throated diver, 500 m – 750 m for hen harrier nests or within 300 m – 500 m for short-eared owl), nests will be cordoned off and all works will be delayed within the cordon until the young have successfully fledged or the site is no longer in use.

7.13.8 During the breeding season (April – August), construction will not take place in specified areas (see Table 7.27) before mid-May. Construction may only commence from mid-May onwards within these specified areas if pre-construction surveys indicate that the closest sites are not occupied. If an active nest is found, construction will commence in those specified areas only after the breeding attempt is completed (young fledged) or has failed. For hen harrier and short-eared owl, works may commence from mid-May with monitoring of the nest by the ECoW to check for signs of disturbance. If any disturbance was observed, construction would have to cease until the nest was no longer active due to breeding failure or fledging of young.

7.13.9 There would be no impact and no significant effects on breeding red-throated diver from the Hoy SPA population due to operational displacement or barrier effects.

7.13.10 There would be no displacement and no significant effects on breeding, roosting or foraging hen harrier from the Orkney population and no displacement and no significant effects on breeding or foraging short-eared owl at any scale, due to presence and operation of the Proposed Development.

7.13.11 Displacement of two pairs of curlews due to the presence and operation of the Proposed Development would be considered a significant adverse effect at the less than local (site) level only but not at any wider geographic scale.

7.13.12 Displacement of breeding great skuas due to the presence and operation of the Proposed Development is considered to range from one to six pairs equivalent to ranging from an effect which is not significant to a significant adverse effect at the less than local (site) level, but not at any wider geographic scales. This is considered a precautionary approach as displacement may not occur at this level. The effects on the LNCS are not considered to adversely affect the integrity of the area or the qualities for which it has been designated.

7.13.13 The effects of collision mortality on the Hoy SPA red-throated diver, peregrine, great skua and great black-backed gull populations were assessed as not significant.

7.13.14 Collision mortality was assessed as having a significant adverse effect on the adult Hoy white-tailed eagle population.

7.13.15 The effects of collision mortality on breeding hen harriers from the Orkney population are assessed as not significant.

7.13.16 The cumulative collision risk to the Hoy SPA red-throated diver, peregrine and great skua populations is essentially the same as that carried out for the Proposed Development on its own therefore no separate cumulative assessments are required for these species.

7.13.17 The cumulative collision risk estimates at 99.5 % avoidance, (considered moderate likelihood) would result in modelled declines of less than 3 % (relative to the baseline) in the Orkney female and Orkney male hen harrier populations over a 25-year period. The assessed effects of these levels of cumulative collision mortality on the Orkney female and Orkney male hen harrier populations are assessed as not significant.

Table 7.35 Summary of Likely Significant Effects

Description of Effect	Significance of Likely Effect		Mitigation Measure	Significance of Residual Effect	
	Significance	Beneficial/ Adverse		Significance	Beneficial/ Adverse
Construction					
Red-throated diver – breeding Disturbance (Noise and Visual)	Significant	Adverse	ORN1 Implementation of a Breeding Bird Protection Plan; ORN2 Avoid disturbance to breeding red-throated divers: construction works to be constrained to safe working distance from any occupied red-throated diver lochan (500 m - 750 m to be agreed with SNH) during the breeding season (April to August). During the breeding season (April to August), construction will not take place along the section of access track between T4, T5 and T6, nor installation of the turbine at T5, before mid-May. Construction may only commence from mid-May onwards within the aforementioned areas if pre-construction surveys indicate that the closest red-throated diver lochan is not occupied. If the lochan is occupied, construction of the aforementioned infrastructure will commence only after the breeding attempt is completed (young fledged) or has failed, or if no eggs are laid by mid-July.	No effect	Not applicable
Hen harrier – breeding Disturbance (Noise and Visual)	Significant	Adverse	ORN1 Implementation of a Breeding Bird Protection Plan; ORN3 Avoid disturbance to breeding hen harriers: construction works to be constrained to safe working distance from any active hen harrier nest (500 m – 750 m to be agreed with SNH) during the breeding season (April to August).	No effect	Not applicable

Description of Effect	Significance of Likely Effect		Mitigation Measure	Significance of Residual Effect	
	Significance	Beneficial/ Adverse		Significance	Beneficial/ Adverse
			During the breeding season (April to August) construction will not take place along the section of access track between T2 and T4 nor installation of the turbines at T3 and T4 before mid-May. Construction may only commence within the aforementioned area from mid-May onwards only if pre-construction surveys (ORN1) indicate that there is no occupied hen harrier nest site within 500 m. If nests are found within 500 m, construction of the aforementioned infrastructure will commence only after the breeding attempt is completed (young fledged) or has failed. Works may commence from mid-May if there are nests at 500 m – 750 m, but these nests will be monitored by the ECoW and the works would cease if disturbance was observed.		
Great skua – breeding Disturbance (Noise and Visual)	Significant (at less than local (site) level only)	Adverse	None (effects are temporary and reversible)	Significant (at less than local (site) level only)	Adverse
Breeding waders – Curlew and snipe Disturbance (Noise and Visual)	Significant (at less than local (site) level only)	Adverse	None (effects are temporary and reversible)	Significant (at less than local (site) level only)	Adverse

Description of Effect	Significance of Likely Effect		Mitigation Measure	Significance of Residual Effect	
	Significance	Beneficial/ Adverse		Significance	Beneficial/ Adverse
Operation					
Red-throated diver – Hoy SPA population – Collision mortality	Not significant	Adverse	None	Not significant	Adverse
Peregrine Hoy SPA population – Collision mortality	Not significant	Adverse	None	Not significant	Adverse
Hen harrier Orkney population – Collision mortality	Not significant	Adverse	None	Not significant	Adverse
Great skua Hoy SPA population – Collision mortality	Not significant	Adverse	None	Not significant	Adverse

Description of Effect	Significance of Likely Effect		Mitigation Measure	Significance of Residual Effect	
	Significance	Beneficial/ Adverse		Significance	Beneficial/ Adverse
Great black-backed gull Hoy SPA population – Collision mortality	Not significant	Adverse	None	Not significant	Adverse
White-tailed eagle (adults) Orkney population - Collision mortality	Significant (at the regional scale)	Adverse	None	Significant (at the regional scale)	Adverse
Curlew (Displacement and Collision mortality)	Significant (at less than local (site) level only)	Adverse	None	Significant (at less than local (site) level only)	Adverse
Snipe	Significant (at less than local (site) level only)	Adverse	None	Significant (at less than local (site) level only)	Adverse

Table 7.36 Summary of Cumulative Effects

Receptor	Effect	Cumulative Developments	Significance of Cumulative Effect	
			Significance	Beneficial/ Adverse
Red-throated diver (Hoy SPA)	Collision mortality	Ore Brae	Not significant	Not applicable
Peregrine (Hoy SPA)	Collision mortality	Ore Brae	Not significant	Not applicable
Great skua (Hoy SPA)	Collision mortality	Ore Brae	Not significant	Not applicable
Hen harrier (Orkney population)	Collison mortality	Ore Brae; Costa Head; Burgar Hill; Burgar Hill north extension; Burgar Hill south extension; Hammars Hill existing; Hammars Hill expansion; Holodyke; Quanterness; Akla; Deerness, Upper Stove; New Holland, Holm; Hesta Head; Berriedale, South Ronaldsay; Eday Community Turbine; Kingarly Hill.	Not significant	Not applicable

7.14 References

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