7. ORNITHOLOGY

7.1 Introduction

This Chapter describes and evaluates the current avian interest of the site of the proposed Seven Hills Wind Farm, including both the northern and southern clusters[1] (henceforth referred to as 'the site') and the surrounding area. It assesses all potential effects of the Proposed Development on important bird species and, where necessary, describes proposed mitigation measures.

This Chapter considers effects on avian species only. Potential effects on habitats and non-avian animal species are considered separately in Chapter 6: Biodiversity (Flora and Fauna) and together, Chapters 6 and 7 provide an assessment of the potential effects of the Proposed Development on biodiversity. This approach (of assessing effects on bird species separately) is in recognition of the fact that avifauna are a key taxonomic group in the context of wind farm development both generally and for this site specifically.

Potential effects on international and national sites that are designated for birds have been considered in this chapter, both in terms of the bird species themselves, but also in terms of any supporting habitats for those bird species that may be located outside the relevant designated site boundaries (including other wetland sites designated for non-avian interests). An assessment of effects on Natura 2000 sites has also been provided within a separate Appropriate Assessment Screening Report and Natura Impact Statement (NIS).

The field survey methodologies were all carried out using survey standards recommended by NatureScot (formerly Scottish Natural Heritage (SNH), 2017), which are widely regarded as representing standard best practice in Ireland, and were carried out during suitable times of the year. Three full years of surveys have been completed, which is in excess of the two full years recommended by current NatureScot (2017) guidance. No significant gaps in the assessment have been identified (see Section 7.2.5).

This Chapter is supported by a number of Appendices:

- Technical Appendix 7-1: Bird Survey Report Winter 2018-19;
- Technical Appendix 7-2: Bird Survey Report Breeding Season 2019;
- Technical Appendix 7-3: Bird Survey Report Winter 2019-20;
- Technical Appendix 7-4: Bird Survey Report Breeding Season 2020;
- Technical Appendix 7-5: Bird Survey Report Winter 2020-21;
- Technical Appendix 7-6: Bird Survey Report Breeding Season 2021; and
- Technical Appendix 7-7: Avian Collision Risk Modelling.
- Technical Appendix 7-8: DAU Response
- Technical Appendix 7-9: Site Synopses for Designated Sites

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[1] *Note that the northern and southern cluster are referred to as 'wind farm I' and 'wind farm II' respectively in the baseline bird survey reports (Technical Appendices 7.1-7.6),*

7.1.1 Relevant Legislation and Policy

Relevant legislation and policy for ornithology includes:

- The EU Birds Directive (2009/4147/EC);
- European Communities (Birds and Natural Habitats) Regulations 2011, as amended.
- The Environmental Liability Directive (2004/35/EC) and European Communities (Environmental Liability) Regulations, 2008;
- The Wildlife Act (1976 – 2021; as amended); and
- The National Biodiversity Action Plan 2017-2021.

The legislation and policy listed above is described in more detail in Chapter 6 Biodiversity (Flora and Fauna). Chapter 2: Background to the Proposed Development provides a summary of wider Energy and Climate Change policy and targets and the strategic, regional, and local planning context for the Proposed Development.

7.1.2 Scope and Consultation

7.1.2.1 Consultation

A request for observations on the preparation of the EIAR for the proposed Seven Hills Wind Farm was sent to the Development Applications Unit (DAU) of the (then) Department of Culture, Heritage and the Gaeltacht on 17th August 2020 by MKO. A summary of the key points relating to ornithology taken from the Development Applications Unit (DAU) response, dated 23 September 2020, is provided in

Table 7-1, along with details of how the comments have been addressed in this Chapter. A copy of the DAU response is included in Technical Appendix 7-8.

Table 7-1 Key Issues raised by the DAU in relation to Ornithology

Summary of Key Issues	Comments/ Where addressed in Chapter
Survey methodologies should follow best practice and if necessary be modified to reflect the Irish situation. Two full years of bird surveys is normally considered to be necessary. When survey results are being presented in an EIAR it is important that best practice is followed and that the full survey methodologies used, are detailed, including dates and times.	Survey methods are described in Section 7.2.3, with full details, including dates and times provided within the baseline survey reports (Technical Appendices 7.1-7.6). Survey methods were based on current NatureScot guidance (SNH, 2017), which is widely regarded as representing standard best practice in Ireland. An extensive campaign of three years of breeding season surveys and three years of non-breeding season surveys has been completed, which was designed to specifically address past reasons for refusal of permission in respect of an older proposed project on the site. The survey period is in exceedance of the two years required by current NatureScot guidance and referred to in the DAU response.
Results for species need to be referenced back to the overall populations and their dynamics as, in some cases even a small risk to a population of a species could be considered significant. It is important that bird migration routes (day and	Species are evaluated in Table 7-9, which considers populations at a variety of geographical scales, where relevant data are available.

Summary of Key Issues	Comments/ Where addressed in Chapter
night) are assessed as well as the flight lines (day and night) of bird species travelling between roosting and feeding areas.	Surveys were undertaken year-round, including migration periods and therefore over the three years of survey would be expected to have picked up any regular diurnal migration routes. Current NatureScot guidance accepts that following nocturnal movements of birds beyond very short distances is almost impossible other than by use of radar, which it recommends "*is only used to assess sites where there is likely to be high nocturnal activity of important species*". Based on the results of three years of diurnal surveys there is no reason to expect there to be significant migration routes across the Site at night. Specific surveys for migrating birds at night were not considered necessary and were not undertaken. Three years of vantage point surveys have been completed, in excess of current NatureScot guidance, to identify flight lines across the Site. Surveys for relevant species (those most likely to travel between specific roosting and feeding areas such as Greenland white-fronted goose and whooper swan) included periods arounds dusk and dawn. Specific surveys for these species during the rest of the night (i.e. after dusk and before dawn) were not undertaken for the same reasons outlined above, i.e. that following nocturnal movements of birds beyond very short distances is almost impossible other than by use of radar, which is only recommended at sites where there is likely to be high nocturnal activity of important species. Based on the results of three years of diurnal surveys (including surveys at dawn and dusk) there is no reason to expect there to be significant flight activity by Greenland white-fronted goose and whooper swan across the Site at night. Nocturnal surveys for European golden plover, which can feed in agricultural fields at night, were undertaken to identify whether there were any significant differences between diurnal and nocturnal activity. These surveys would also have been expected to pick up nocturnal use of the Site by other waterbird species, including Northern lapwing. See Sections 7.2.3 and 7.3.1.2.7 for further details.
The EIAR process should identify any pre and post construction monitoring which should be carried out. The post construction monitoring should include bird and bat strikes/fatalities	Recommendations for monitoring are provided in Section 7.7.

Summary of Key Issues	Comments/ Where addressed in Chapter
including the impact on any such results of the removal of carcasses by scavengers.	
The impact of the Proposed Development on the flora/ fauna and habitats present should be assessed with particular regard to: Natura 2000 sites, e.g.: Special Protection Areas (SPA) designated under the EC Birds Directive (Directive 2009/147 EC). Other designated sites, or sites proposed for designation such as: Natural Heritage Areas. Proposed Natural Heritage Areas. Protected species and natural habitats, as defined in the Environmental Liability Directive (2004/35/EC) and European Communities (Environmental Liability) Regulations, 2008 including: Birds Directive – Annex I species and other regularly occurring migratory species, and their habitats (wherever they occur). Important bird areas such as those identified by Birdlife International.	Impacts have been considered for SPAs, NHAs and pNHAs within at least 15 km. Where relevant, impacts have been assessed for ornithological qualifying interests of these sites both within the sites themselves and outside the sites, e.g. where qualifying species regularly use areas outside the designated site boundaries. Impacts have also been assessed for other Annex I bird species, and other regularly migratory species, where populations are considered to represent Valued Ornithological Receptors (see Section 7.2.4). As such, protected bird species covered by the European Communities (Environmental Liability) Regulations (2008) have been included in the assessment. Important Bird Areas (IBAs) within at least 15 km were all found to overlap with statutory designated sites and so effects on IBAs are effectively covered within the impact assessment for statutory designated sites.
Cumulative and ex situ impacts: A rule of thumb often used is to include all European sites within a distance of 15 km. It should be noted however that this will not always be appropriate. Where bird flight paths are involved the impact may be on an SPA more than 15 kilometres away.	Cumulative impacts (Section 7.5.6) were assessed for other projects within a precautionary buffer of 20 km based on IWEA (2012) guidance. The cumulative assessment is based on core foraging ranges (i.e. the distance regularly travelled between roosting sites and foraging areas) of designated features of the relevant SPAs.
The Department notes that the Proposed Development is in close proximity to a number of Natura 2000 sites, Natural Heritage Areas (NHAs) and proposed Natural Heritage Areas (pNHAs). The Department is concerned that the Proposed Development may significantly affect the integrity of a number of European sites. These concerns relate to potential impacts upon bird species (e.g. Greenland white-fronted geese), both within and outside of the SPAs.	Impacts on sites designated for their bird populations (both within the sites themselves and outside the sites, e.g. where qualifying species regularly use areas outside the designated site boundaries, including other wetland sites designated for non-avian interests) have been assessed (Section 7.5.4.3). No adverse effects on the integrity of European sites are likely.
The Department highlights that the topography of the two linked development sites and potential constraints regarding the selection of vantage points, for ornithological surveys. Notwithstanding the above, the vantage point surveys should be undertaken in a manner that ensures sufficient data is collected to allow an	Topographical constraints from the vantage points are discussed in Section 7.2.5. These are not considered to represent a significant limitation. From the point of view of collision risk, the key issue is flight activity within each cluster rather than between clusters. Nonetheless, the location of vantage points allowed any flight

Summary of Key Issues	Comments/ Where addressed in Chapter
assessment of the importance of all the flight paths into, out of and between sites.	paths into, out of and between the two turbine clusters to be recorded. Also, the survey areas for feeding distribution surveys for swans and geese and breeding raptor surveys include the locations between the two clusters (see Section 7.2.3.2). Any effects on birds moving between the two clusters will therefore have been included within the assessment.
Consequently, the Department recommends that technological solutions (e.g. Radar, telemetry based tracking studies) are considered in conjunction with VPs surveys to ensure sufficient data is compiled for assessment. This is because an appropriate assessment must contain complete, precise and definitive findings and conclusions with regard to the implications of a proposal for the conservation objectives and integrity of a European site(s). Furthermore, surveys should be designed to also include an assessment of improved agricultural lands. These types of intensified landscape features have the potential to provide feeding habitat and attract wintering wildfowl species (e.g. whooper swan and GWF Goose).	Three years of vantage point (VP) surveys, which exceeds current NatureScot guidance, is considered more than adequate to assess flight activity during daylight hours. With regard to nocturnal activity, as noted previously, current NatureScot guidance recommends that radar "*is only used to assess sites where there is likely to be high nocturnal activity of important species*". Based on the results of three years of diurnal surveys there is no reason to expect there is likely to be significant nocturnal flight activity across the Site. The use of radar or telemetry-based tracking studies was not considered necessary and therefore these were not used. It is also recognised that goose collisions with wind farms are extremely rare, even where there are large numbers of geese using the wind farm area, as birds are very capable of avoiding operational turbines. Current NatureScot guidance states that 'geese do not collide with wind farms in numbers that are of conservation concern'. The collision avoidance rate for geese used in the collision risk model is consequently 99.8%. Current NatureScot guidance also states that whooper swans generally avoid wind turbines, and consequently they have an avoidance rate of 99.5% (see Section 7.5.4.2.2). Based on the above, the use of radar or other similar survey methods, which can entail significant costs can't be justified here, given the survey data collected indicates that the Site lies in an area of relatively low flight activity. Feeding distribution surveys for swans and geese were undertaken (see Section 7.2.3.2.4) over three winters, which is in excess of current NatureScot requirements. These allowed an assessment to be made of the usage of intensified landscape features that may be used for feeding by wintering wildfowl.

7.1.3 Effects Scoped Out

7.1.3.1 Impacts on Species which do not represent Valued Ornithological Receptors (VORs) at the Site

In accordance with Chartered Institute of Ecology and Environmental Management (CIEEM) guidelines (CIEEM, 2018) detailed assessment is only required for VORs. These VORs ('target species', SNH 2017) are limited to those species which are afforded a higher level of legislative protection, or are species included as a result of their behaviour which makes them more likely to be subject to impact from wind farms. In line with CIEEM guidelines it is not necessary to carry out detailed assessment of receptors that are sufficiently widespread, unthreatened and resilient to project impacts and would remain viable and sustainable. For example, it is generally considered that passerine species[2] are not significantly impacted by wind farms and they are therefore not included as VORs (SNH, 2017). This is because evidence suggests that passerines collide with wind turbines relatively infrequently. Moreover, most passerines have relatively large populations and high reproductive rates, making populations more resilient. A list of VORs, based on survey work completed, is included in Table 7-9 (Evaluation of Ornithological Receptors).

7.2 Approach and Methods

7.2.1 Study Area

The survey areas used for the ornithological impact assessment differ according to receptor as recommended by relevant good practice survey guidance (SNH, 2017). These are summarised in the Field Survey Methodology Section below and are described in more detail within the baseline survey reports (Technical Appendices 7.1-7.6).

For the assessment of impacts on bird species a variety of buffer distances have been applied to each turbine location and around all other infrastructure where appropriate. These buffers are in accordance with current guidance and evidence-based research. Further details are provided in the 'Assessment of Effects' Section below.

7.2.2 Information and Data Sources

A desk study was undertaken to collate existing information on bird populations in and around the Site, and to identify target species for baseline surveys.

This information, combined with baseline survey results, was utilised to put each target bird species recorded within the study area into context in terms of its national, regional and local importance.

Primary sources of contextual data from the desk study were as follows:

- National Parks and Wildlife Service (NPWS) website;
- National Biodiversity Data Centre (NBDC) website;
- A review of Greenland White-fronted Geese in Ireland 1982/83 – 2011/12 (Burke *et al.* 2014);

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[2] relating to the largest order (Passeriformes) of birds which includes over half of all living birds and consists chiefly of altricial songbirds of perching habits.

- The Irish Wetland Bird Survey (I-WeBS), species accounts (online) (BirdWatch Ireland);
- Birds of Conservation Concern 3: 2014-2019 (Colhoun and Cummins, 2013);
- Birds of Conservation Concern in Ireland 4: (2020-2026) (Gilbert *et al.* 2021); and
- Documents submitted as part of previous planning applications in relation to Seven Hills Wind Farm Phase I and Phase II in 2010 and 2012, and surveys undertaken subsequently between 2015 and 2018 (full list provided in Technical Appendices 7.1-7.6).

7.2.2.1 Designated Sites

The following websites were accessed for information on sites designated for ornithology in the vicinity of the site:

- NPWS (www.npws.ie); and
- NBDC (http://maps.biodiversityireland.ie/#/Map).

All European Sites within a distance of 15 km surrounding the site were identified. In addition, the potential for ecological connectivity with SPAs at distances of greater than 15 km from the site was also considered.

7.2.3 Field Survey Methodology

Baseline ornithology surveys were conducted during the period October 2018 to September 2021. Full details are presented in Technical Appendices 7.1-7.6.

7.2.3.1 Target Species

NatureScot guidance (SNH, 2017) recommends that species targeted for surveys are split into two groups: primary and secondary species. During field surveys, recording of secondary target species is subsidiary to recording primary target species. This approach is explained in more detail below.

7.2.3.1.1 *Primary Target Species*

Current NatureScot guidelines (SNH, 2017) state that "*in most circumstances the target species will be limited to those species which are afforded a higher level of legislative protection*." Kestrel, buzzard and sparrowhawk are not subject to a higher level of legislative protection than any other bird species and therefore following completion of the initial non-breeding surveys in 2018-19 were not considered as primary target species[3].

Primary target species were specifically limited to species upon which effects are most likely to be potentially significant in EIA terms, e.g. breeding and non-breeding species forming qualifying features for nearby SPAs or species listed on Annex I of the Birds Directive. This enabled recording to focus on the species of greatest importance without the distraction of having to record detailed flight data for a larger number of more common species.

[3] *Following the publication of the latest Birds of Conservation Concern in Ireland (BoCCI) 4: 2020-2026 (Gilbert et al., 2021), kestrel has now been moved to the Red-list. Kestrel has therefore since been classed as primary target species for breeding season surveys undertaken in 2021.*

Non-breeding Season Surveys

The primary target species during non-breeding season surveys included the following bird species (* excluded in 2019/20, ** only in 2018/19[4]):

- Whooper swan *Cygnus cygnus*;
- Greenland white-fronted goose *Anser albifrons flavirostris;*
- Eurasian wigeon *Mareca penelope*;*
- Peregrine falcon *Falco peregrinus*;
- Hen harrier *Circus cyaneus;*
- Merlin *Falco columbarius;*
- Northern lapwing *Vanellus vanellus;*
- European golden plover *Pluvialis apricaria;*
- Eurasian curlew *Numenius arquata**;* and
- Short-eared owl *Asio flammeus*.

Breeding Season Surveys

A precautionary approach was taken to the inclusion of Annex 1 species as primary target species during the breeding season with all Annex 1 raptor/owl species with any realistic potential to be present included as primary target species, although it was recognised that the likelihood of some of these species breeding in the vicinity of the sites was very low due to the lack of suitable breeding habitats. As such, the primary target species for VP surveys during the breeding season included the following bird species (* 2020 only, ** 2020 and 2021 only, ***2021 only[5]):

- Peregrine falcon;
- Hen harrier;
- Merlin;
- Kestrel *Falco tinnunculus****;*
- Northern lapwing**;
- European golden plover;
- Eurasian curlew;
- Black-headed gull *Chroicocephalus ridibundus***;
- Herring gull *Larus argentatus**; and
- Short-eared owl.

Although northern lapwing, Eurasian curlew, black-headed gull and herring gull are not listed under Annex I of the Birds Directive, they were red-listed in Ireland under the Birds of Conservation Concern (BoCC) 2014-2019 (Colhoun and Cummins 2013) as numbers of breeding pairs within the Irish landscape have suffered a serious decline in recent years. As such, Eurasian curlew was included as a primary target species in 2019, 2020 and 2021; and northern lapwing and black-headed gull were also included in 2020 and 2021. Herring gull was included as a primary target species in 2020, but not in 2021 owing to its removal from the BoCC red list in April 2021 (Gilbert *et al.*, 2021). Black-headed gull was also removed from the BoCC red list in April 2021 but was retained as a primary target species due to the presence of a breeding colony at Lough Ree. Kestrel was added to the red list in April 2021 and was therefore classed as a primary target species for breeding season surveys undertaken in 2021.

[4] *Further details are provided in the relevant baseline reports (Technical Appendices 7.1-7.6). In all cases data were collected for the relevant species as secondary target species (where not treated as primary target species) and sufficient data have been collected to enable potential impacts to be assessed.*

[5] *Further details are provided in the relevant baseline reports (Technical Appendices 7.1-7.6). In all cases data were collected for the relevant species as secondary target species (where not treated as primary target species) and sufficient data have been collected to enable potential impacts to be assessed.*

7.2.3.1.2 *Secondary Target Species*

Secondary target species were limited to species that may be affected by wind farms but either lack a higher level of legislative protection (not listed on Annex I of the Birds Directive) and/or are not included under the latest BoCC red-list.

Secondary target species included the following:

- Any other wildfowl and wader species not recorded as primary target species;
- Buzzard *Buteo buteo;*
- Sparrowhawk *Accipiter nisus*;
- Kestrel *Falco tinnunculus;*
- Raven *Corvus corax*;
- Grey heron *Ardea cinerea;*
- Cormorant *Phalacrocorax carbo;* and
- Gulls *Larus sp.* (where not recorded as primary target species).

7.2.3.2 Baseline Survey Methodologies

Surveys were carried out in accordance with the relevant NatureScot (NS) Guidance (SNH 2017). Further details are provided in Technical Appendices 7.1-7.6 with a summary provided below.

7.2.3.2.1 *Flight Activity Surveys*

Surveys at both the Northern and Southern Clusters commenced in October 2018 and continued until September 2021. As per current guidance a minimum of thirty-six hours of flight activity surveys were conducted from each of two VP locations at the Northern Cluster and each of four VP locations at the Southern Cluster during each non-breeding and breeding season.

The number of hours completed at each VP at the northern and southern clusters, in each season, is summarised in Table 7-2 and Table 7-3 for the northern and southern clusters respectively.

Table 7-2 Northern Cluster VP Survey Hours (Hrs:Mins)

VP	2018-19 (Oct-Mar)	2019 (Apr-Sept)	2019-20 (Oct-Mar)	2020 (Apr-Sept)	2020-21 (Oct-Mar)	2021 (Apr-Sept)
1	36:00	36:00	42:00	36:00	36:00	36:00
2	36:00	36:00	42:00	36:00	36:00	36:00

Table 7-3 Southern Cluster VP Survey Hours (Hrs:Mins)

VP	2018-19 (Oct-Mar)	2019 (Apr-Sept)	2019-20 (Oct-Mar)	2020 (Apr-Sept)	2020-21 (Oct-Mar)	2021 (Apr-Sept)
1	36:00	36:00	42:00	36:00	36:00	36:00
2	36:00	36:00	42:00	36:00	36:00	36:00
3	36:00	36:00	42:00	36:00	36:00	36:00
4	36:00	36:00	42:00	36:00	36:00	36:00

7.2.3.2.2 Breeding Wader Surveys

Surveys were undertaken in 2019, 2020 and 2021 within the southern cluster plus a 500 m buffer zone beyond the turbine cluster and infrastructure boundary as recommended by NatureScot (SNH, 2017) guidance, using the methodology described in O'Brien and Smith (1992) which is suitable for lowland grassland sites. Three survey visits were undertaken in each year in April, May and June.

As the habitat within the northern cluster is not suitable for breeding waders (consisting predominantly of improved agricultural grasslands used for cattle grazing), surveys were not considered necessary there.

Full details are provided in Technical Appendices 7.2, 7.4 and 7.6.

7.2.3.2.3 Breeding Raptor Surveys

The survey methodology for breeding raptors in 2019, 2020 and 2021 used a driven transect with regular stops, to carry out watches of potentially suitable habitat from appropriate viewpoints to identify potential nesting territories. Survey timings followed those in Hardey *et al.* (2013), as per current NatureScot guidelines. Surveys were repeated along the same route monthly from April to July inclusive in 2019 and 2020. A driven survey was used due to limitations to access to third party land within the 2 km buffer zone and the availability of a good road network in the vicinity of the site. Suitable breeding habitat for Annex 1 raptors within the sites and 2 km buffer was very limited and visibility from the survey route was sufficient to cover the vast majority of potentially suitable breeding habitat within the survey area. While they were not the main focus of the surveys, the regular stops/short vantage points were also used to record other, non-Annex 1, raptor species such as kestrel. While it is possible that nest locations for the more common raptor species within the 2 km buffer zone were not identified (as they weren't specifically searched for), the surveys were sufficient for determining probable breeding territory occupancy as evinced by displaying, courtship and territorial behaviour in suitable breeding habitat. Any such behaviour close to the sites themselves would also have been recorded during VP watches if present.

7.2.3.2.4 Swan and Goose Feeding Distribution Surveys

Whooper swan and Greenland white–fronted goose are features of interest of several SPAs within at least 15 km of the site boundary (see Table 7-4). As the survey area lies within the core foraging distance[6] of SPAs for these species, current NatureScot guidelines recommend that feeding distribution surveys should be undertaken, unless it can be established from existing data that the area is not utilised for feeding.

Feeding distribution surveys were carried out on at least a monthly basis each winter to establish whether swans and geese were using fields within 1 km of the EIAR Site Boundary. A buffer of 1 km around all turbines and site infrastructure combined across northern and southern clusters was used for these surveys which were undertaken by driven transect, stopping on a regular basis to check all fields for goose and swan feeding activity. This buffer was more than the current 500 m buffer recommended by NatureScot (SNH, 2017), which helped to identify whether swans or geese were feeding in areas between the two clusters. Monthly surveys were undertaken during October to March inclusive in 2018/19 and 2019/20, and surveys were undertaken fortnightly in 2020/21.

[6] *The core foraging range refers to the distance regularly travelled by a bird to forage. As per current NatureScot (SNH, 2016) guidance, this distance should be used when determining whether there is connectivity between the proposal and the qualifying interests of an SPA.*

7.2.3.2.5 Greenland White-fronted Goose Roost Surveys

Surveys for roosting Greenland white-fronted geese were undertaken monthly from December 2019 to March 2020 inclusive and were repeated on a monthly basis[7] from October 2020 to March 2021. These surveys were added to the scope following the provision of information by Birdwatch Ireland in late 2019, which revealed evidence of roosting Greenland white-fronted geese at some of the waterbodies in the vicinity of the site. The data provided, along with current survey data, indicated that surveys should focus on Lough Croan which lies approximately 1.5 km north of the northern cluster (see Technical Appendix 7-3 for further details).

Surveys of Lough Croan were carried out simultaneously from two vantage points on the local road north of Lough Croan. The watches were carried out at dusk and the following dawn each month for a duration of up to 2 hours depending on the levels of light. The dawn watches began at civil twilight i.e., 30 minutes before the time of sunrise and continued for up to 1.5 hours after sunrise. The dusk watches ended at civil twilight i.e., starting up to 1.5 hours before the time of sunset and continued for 30 minutes after sunset. All flight-lines of Greenland white-fronted geese to and from the turlough, in addition to the direction of flight and the number of birds, were recorded during watches.

7.2.3.2.6 European Golden Plover Nocturnal Foraging Surveys

Due to the presence of European golden plover during daytime surveys in winter 2018-19, additional surveys were carried out in winter 2019-20 to determine whether European golden plover activity at the Site was significantly different at night.

Pre-defined transects were walked at night on three occasions between January and March 2020. The purpose of the survey was to identify if European golden plover (or other waterbird species, e.g. Northern lapwing, uses the site for foraging at night. The habitats at the southern cluster were judged to be less suitable for golden plover than those at the northern cluster and the relatively rough topography and terrain present at the southern cluster was considered a health and safety risk to surveyors working in such terrain at night. Therefore, the transects were focused on the northern cluster where all proposed turbine locations and associated access tracks were walked after dark by two surveyors. A high-powered torch was used by one surveyor to slowly sweep across the landscape, while a second surveyor used binoculars to spot any birds visible in the torchlight. Any foraging European golden plover flushed while the surveyors were walking the transect route were also recorded. In the absence of survey data for the southern cluster a precautionary approach has been adopted which assumes that it is used in a similar way to the northern cluster by European golden plovers at night, despite the less suitable habitat.

Given the very small number of birds recorded (see Section 7.3.1.2.6) and the difficulties undertaking this survey (see above and Section 7.2.5) nocturnal surveys were not repeated in winter 2020-21.

7.2.4 Assessment Methods

The CIEEM Guidelines for Ecological Impact Assessment in the UK and Ireland (CIEEM, 2018) (henceforth referred to as the CIEEM guidelines) form the basis of the impact assessment presented in this Chapter. Reference has also been made to other relevant guidance as appropriate. Sources for other relevant guidance are listed below:

- Band, W., Madders, M. and Whitfield, D.P. (2007) Developing Field and Analytical Methods to Assess Avian Collision Risk at Wind Farms.
- Ruddock, M. and Whitfield, D.P. (2007). *A Review of Disturbance Distances in Selected Bird Species.*

[7] As the available evidence suggested that the nearest known roost site was > 1 km from the nearest wind farm infrastructure, monthly roost surveys (dusk and dawn) for geese were judged to be sufficient, as per current NatureScot (SNH, 2017) guidance.

- Scottish Natural Heritage (SNH) (2016). *Assessing Connectivity with Special Protection Areas* (SPAs).
- Scottish Natural Heritage (SNH) (2018). *Avoidance Rates for the onshore SNH Wind Farm Collision Risk Model.*
- Scottish Natural Heritage (SNH) (2017). *Recommended Bird Survey Methods to Inform Impact Assessment of Onshore Wind Farms.*
- Scottish Natural Heritage (SNH) (2018). *Assessing Significance of Impacts from Onshore Wind Farms on Birds Outwith Designated Areas.*
- Scottish Natural Heritage (SNH) (2018). *Assessing the Cumulative Impact of Onshore Wind Energy Developments.*

7.2.4.1 Sensitivity of Receptors

In accordance with the CIEEM guidelines, only ornithological receptors which are considered to be important (i.e., VORs) and potentially affected by the project should be subject to detailed assessment. It is not necessary to carry out detailed assessment of receptors that are sufficiently widespread, unthreatened and resilient to project impacts and would remain viable and sustainable.

Ornithological receptors should be considered within a defined geographical context and for this project the following geographic frame of reference is used:

- international;
- national (i.e. Ireland);
- regional/county (i.e. Roscommon); and
- local (i.e. the Site plus circa 5 km).

For designated sites, importance should reflect the geographical context of the designation. For example, an SPA would normally be considered internationally important while a Natural Heritage Area (NHA) or pNHA would normally be considered nationally important.

In assigning a level of value to a species, it is necessary to consider its distribution and status, including a consideration of trends based on available historical records. Reference has therefore been made to published lists and criteria where available. Examples of relevant lists and criteria include:

- species of European conservation importance (as listed on Annex I of the Birds Directive); and
- species red-listed[8] in Ireland under the relevant lists of Birds of Conservation Concern (BoCC), e.g. Gilbert *et al.* 2021.

Where appropriate, the value of species populations has been determined using the standard '1% criterion' method (e.g. Holt *et al.*, 2012). Using this, the presence of >1% of the international population of a species is considered internationally important; >1% of the national population is considered nationally important; etc.

7.2.4.2 Assessing Impacts and the Significance of an Effect

Both direct and indirect impacts are considered. Direct impacts are changes that are directly attributable to a defined action, e.g. the physical loss of habitat occupied by a bird species during the construction process. Indirect ecological impacts are attributable to an action, but which affect ecological resources through effects on an intermediary ecosystem, process or receptor, e.g. the creation

[8] *As per current NatureScot (SNH, 2017) guidance, care has been exercised when considering red-listed species for inclusion as a VORs. For example, it is generally considered that passerines are not significantly impacted by wind farms (SNH, 2017) and so red-listed passerines are not considered as VORs here.*

of roads which cause hydrological changes, which, in the absence of mitigation, could lead to the drying out of wetland habitats used by important bird species.

Disturbance impacts have been assessed with reference to the relevant literature (e.g. Ruddock and Whitfield 2007, Drewitt and Langston, 2006; Hötker *et al.*, 2006; Pearce-Higgins *et al.*, 2009), and the literature has also been used to recommend appropriate disturbance-free buffer zones considered likely to be required to help prevent nest failure due to disturbance during construction and operation.

The standard Band Collision Risk Model (CRM) (Band *et al.* 2007) was used to estimate collision risk based on recorded target species activity levels and flight behaviour, proposed turbine numbers and specifications, and the relevant species biometrics and flight characteristics. Modelling collision risk under the Band CRM is a two-stage process. Stage 1 estimates the number of birds that fly through the rotor swept disc. Stage 2 predicts the proportion of these birds that have the potential to be hit by a rotor blade. Combining both stages produces an estimate of collision mortality in the absence of any avoidance action/behaviour by birds. Avoidance rates are then applied to generate predicted rates of collision mortality. Further details of the CRM methodology are provided in Technical Appendix 7-7.

For the purposes of this assessment, in accordance with CIEEM guidelines, a 'significant effect' is an effect that either supports or undermines conservation objectives for VORs. Conservation objectives may be specific (e.g. for a designated site) or broad (e.g. national/local nature conservation policy). Effects can be considered significant at a wide range of scales from international to local. For example, a significant effect on a regionally important population of a species is likely to be of regional significance.

Consideration of conservation status is important for evaluating the effects of impacts on bird species and assessing their significance. Conservation status is determined by the sum of influences acting on the species concerned that may affect its abundance and distribution within a given geographical area.

7.2.4.3 Avoidance, Mitigation, Compensation and Enhancement

In accordance with CIEEM guidelines, a sequential process has been adopted to avoid, mitigate and, if necessary, compensate for ornithological impacts. This is referred to as the 'mitigation hierarchy'. Note that the term 'compensation' as used here does not refer to compensation for adverse effects on the integrity of European sites. Furthermore, no compensation measures are considered necessary in respect of ornithology for this project.

The differences between avoidance, mitigation, compensation and enhancement are defined here as follows:

- avoidance is used where an impact such as disturbance or displacement has been avoided through changes in scheme design;
- mitigation is used to refer to measures to reduce or remedy a specific negative impact in situ, e.g. timing restrictions during construction to avoid key periods for certain species;
- compensation describes measures taken to offset residual effects, i.e. where mitigation in situ is not possible, e.g. creation of new habitats to compensate for habitats lost or effectively lost due to displacement; and
- enhancement is the provision of new benefits for biodiversity that are additional to those provided as part of mitigation or compensation measures, although they can be complementary.

7.2.4.4 Potential Cumulative Effects

Cumulative effects result from effects arising from two or more developments and/or from different elements of the same project. Effects may be:

- additive (i.e. the sum of effects of different developments);
- antagonistic (i.e. the sum of effects are less than in a multiple independent additive model); or
- synergistic (i.e. the cumulative effect is greater than the sum of the multiple individual effects).

NatureScot (formerly SNH) has produced guidance on assessing cumulative effects on birds due to onshore wind energy developments (SNH 2018). While antagonistic or synergistic models may occur in real-life settings, the approach adopted in the guidance is based on a simpler additive model. The approach adopted here is based on the SNH (2018) guidance.

Cumulative effects have been assessed for all species for which detailed assessment has been undertaken in this EIA Report for which potential negative effects are likely. The potential for cumulative effects with other wind farms due to disturbance and collision mortality has been assessed. The cumulative assessment is based on consideration of residual effects, i.e. assuming that proposed mitigation measures for other wind farm projects are implemented.

With regard to the spatial extent of the cumulative assessment, current SNH (2018) guidance indicates that the default approach should be to assess cumulative effects at the Natural Heritage Zone (NHZ) scale, unless there is a reasonable alternative. As there are no NHZs in Ireland, the approach used is based on a 20km search distance recommended by IWEA (2012). With respect to designated sites, other developments, plans and projects which lie within core foraging distances of relevant designated features of the relevant SPAs are taken into account.

The significance of potential cumulative effects has been determined using the same method adopted in the assessment of effects for the Proposed Development considered on its own. Cumulative effects are therefore considered significant if they undermine conservation objectives for important ornithological receptors. Cumulative effects can be considered significant at a wide range of scales from international to local. For example, a significant cumulative effect on a regional population of a species is likely to be of regional significance.

7.2.5 Assumptions, Limitations and Confidence

The validity of ornithological survey data requires that they were obtained using accepted methodologies and that surveys were carried out in suitable conditions. The field survey methodologies outlined above and described in greater detail in Technical Appendices 7.1-7.6 were all carried out using survey standards recommended by NatureScot and were carried out during suitable times of the year. Three full years of surveys have been completed, which is in excess of the two full years recommended by current NatureScot (2017) guidance.

Although some surveys were completed in suboptimal conditions with regard to weather conditions (i.e., visibility during VP watches falling to between 1-3 km), in most cases all of the relevant 2 km viewing arc was visible and this is not considered to significantly affect the validity of the data collected. It is also noted that during such an extensive series of surveys it is inevitable that some surveys were completed in suboptimal conditions.

With regard to VP survey coverage, due to local topographical conditions a small area at the western end of the northern cluster and a very small area within the 500m buffer zone for the southern cluster were not within the 2km viewsheds from any of the VPs[9] (see figures showing the VP viewsheds within Technical Appendices 7.1-7.7). All turbine locations and the vast majority of the 500m buffer were visible from at least one VP however and the gaps in coverage are therefore not considered to represent

[9] *All vantage points were ground-truthed to ensure the least visible part of the collision risk volume could be seen per Band et al. (2007).*

a significant limitation. It is considered that the vantage point data are representative of the site as a whole and sufficient to inform a robust impact assessment of the Proposed Development.

Other survey limitations, mostly either relating to specific incidents on certain dates or lack of access to third party land within the survey buffer, are highlighted in the relevant baseline reports (Technical Appendices 7.1-7.6). None of these are considered to significantly affect the validity of the data collected.

With regard to assessment of collision mortality, it is noted that there are some small discrepancies between the total survey hours presented in the baseline survey reports and the survey hours used for CRM. There are two reasons for this:

1. Breeding and non-breeding seasons vary according to species (Technical Appendix 7-7), therefore the amount of survey effort per season used for CRM does not always correspond with the figures provided in the baseline reports (for example the non-breeding season for Eurasian wigeon begins on 1st September and ends on 14th April whereas the non-breeding season surveys reported in the relevant baseline reports cover the period October to March inclusive); and

2. A small amount of data reported in the baseline reports were unavailable for use in the CRM, due to IT issues. Only flights where the attribute data were available have been used in the CRM, although given the relatively small amount of data affected[10] this is not considered to have significantly affected the outcome of the assessment. It should also be noted that baseline data have been used from three breeding seasons and three non-breeding seasons, which exceeds the requirements of current NatureScot guidance (SNH, 2017).

CRM is based on a number of general assumptions, for example with regard to flight speeds and the distribution of flights (both spatially and within height bands), therefore this should be taken into account when interpreting the results.

With regard to nocturnal surveys for European golden plover, these were limited to the northern cluster site due to the health and safety concerns relating to undertaking surveys at night on the relatively rough topography and terrain present on the southern cluster site. However, the habitats in the southern cluster were considered less suitable for the plovers, but in order to infer a worst-case scenario similar numbers of plovers were assumed to be present at the southern cluster. The conclusions based on the results of these surveys are therefore applicable to both clusters .

None of the limitations outlined above are considered to significantly affect the validity of the data on which the assessment is based.

7.3 Baseline Conditions

7.3.1 Current Baseline

7.3.1.1 Designated Sites

Statutory designated sites designated for their ornithological interest (i.e. SPAs, NHAs and pNHAs) are shown in Figure 7-1. A brief description of each site designated in full or in part for its ornithological interest, within 15 km of the site, is provided in Table 7-4 (other sites designated for their non-avian

[10] The amount of affected data over two breeding seasons and three non-breeding seasons (where data were affected) is as follows. Northern cluster: VP 1 = 3.2% and VP 2 = 4.8%. Southern cluster: VPs 1 and 2 = 4.8% (each) and VPs 3 and 4 = 13% (each).

interest are covered in Chapter 6: Biodiversity (Flora and Fauna). Site synopses for each SPA, NHA and pNHA referred to in Table 7-4 are shown in Appendix 7-9.

The rationale for assessing designated sites within 15 km of the site is as follows.

In the absence of any specific European or Irish guidance in relation to establishing ecological connectivity to SPAs, NHAs or pNHAs, NatureScot (SNH, 2016) was consulted. This document provides guidance in relation to the identification of ecological connectivity between Proposed Development sites and SPAs. The guidance takes into consideration the distances species may travel beyond the boundary of relevant SPAs and provides information on dispersal and foraging ranges of bird species which are frequently encountered when considering plans and projects. It goes on to state that "*in most cases the core range should be used when determining whether there is connectivity between the proposal and the qualifying Interests*". Where SPAs are at greater distance from the site than the core foraging distances for their listed Special Conservation Interest (SCI) species, there is no likely ecological connectivity to the development and so the SPAs are outside the likely Zone of Impact.

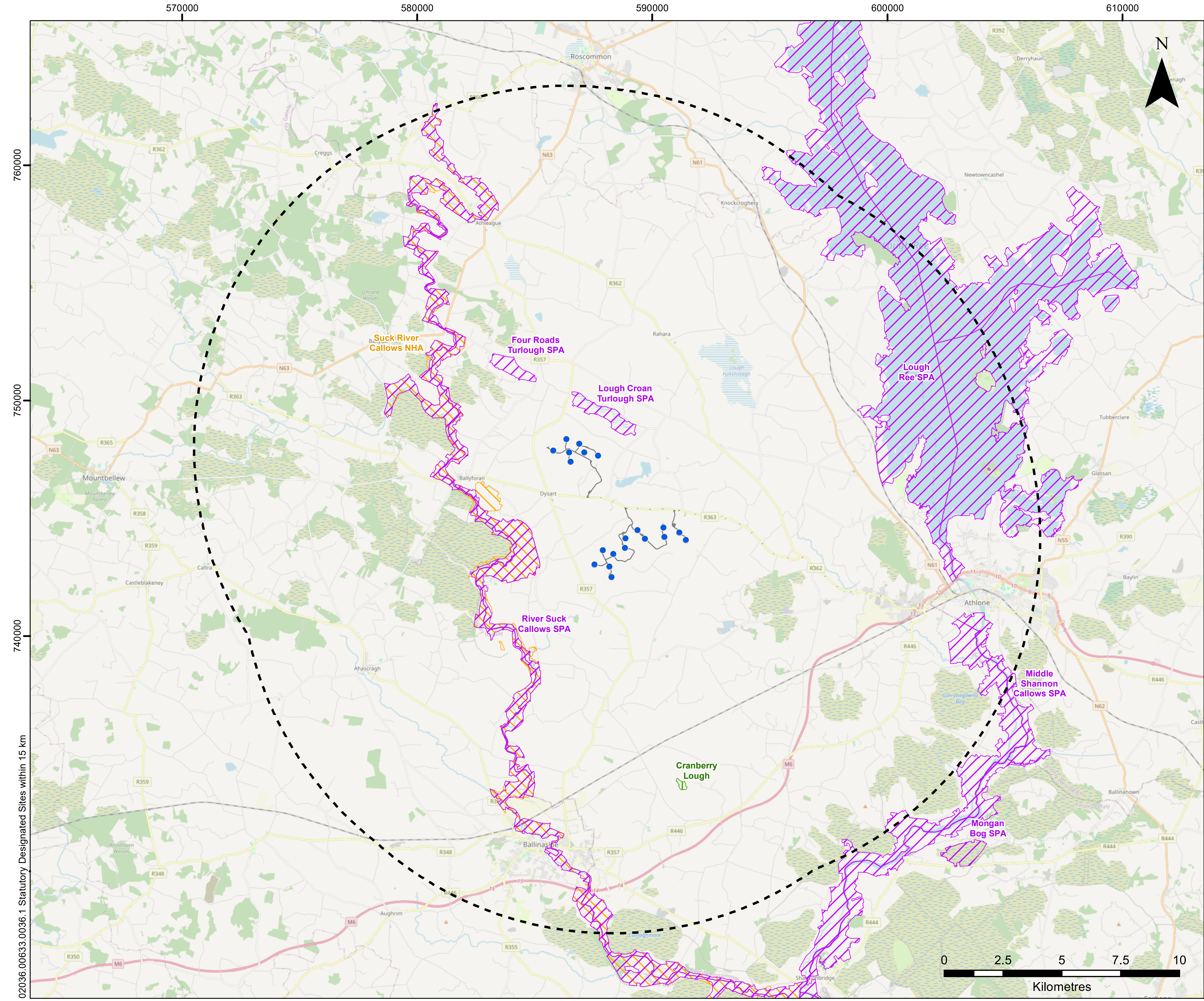
According to NatureScot guidance (SNH, 2016), the core foraging distances of wintering grey geese (greylag goose and pink-footed goose) from SPAs is 15-20 km. This represents the largest foraging range of all the species listed in this guidance document. It is acknowledged that information on core foraging ranges is not available for all SCI species. In such cases, the 15-20 km core foraging range for grey geese has been adopted as a precautionary approach.

Mongan Bog SPA (Site Code: 004017) is located 17 km from the site and is designated for Greenland white-fronted goose. As the core foraging range for this species is 5-8 km (SNH, 2016), this SPA is not ecologically connected to the site. The next closest SPA to the site is River Little Brosna Callows (Site Code: 004086), which is located c. 30 km from the site. This is well beyond the likely regular dispersal or foraging distance for any SCI species.

Thus, any SPAs beyond 15 km from the site have not been considered further within this Chapter.

This rationale for identifying ecological connectivity to SPAs has also been extended to NHAs and pNHAs and only those with ecological connectivity to the site have been included in Table 7-4.

It is noted that wetland sites designated for their non-avian interest could potentially support birds from the sites listed in Table 7-4. If wetland habitats within such sites were affected by the Proposed Development this could indirectly affect bird species of special conservation interest for the sites listed in Table 7-4. The possibility of any such effects has been investigated by reference to the assessment of potential effects on sites designated for their non-avian interests in Chapter 6: Biodiversity (Flora and Fauna).



NOTE

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LEGEND

- Turbine Location
- Site Infrastructure
- 15 km Site Buffer
- Special Protection Area (SPA)
- Natural Heritage Area (NHA)
- Proposed Natural Heritage Area (pNHA)

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SEVEN HILLS WIND FARM

ORNITHOLOGY

STATUTORY DESIGNATED SITES (SITES DESIGNATED FOR THEIR ORNITHOLOGICAL INTEREST) WITHIN 15KM

FIGURE 7-1

Scale	Date
1:150,000 @ A3	MAY 2022

Table 7-4 SPAs, NHAs and pNHAs within 15 km of Seven Hills Wind Farm Northern and Southern Clusters, and their Qualifying Interests[11]

Site Name	Site Code	Distance/ Direction from Site Boundary	Wintering Species/ Features of Special Conservation Interest	Breeding Season Species/ Features of Special Conservation Interest
Special Protection Areas (SPA)[12]				
Lough Croan Turlough SPA/pNHA	004139	1.5 km north	› Shoveler Anas clypeata › European golden plover › Greenland white-fronted goose › Wetland and waterbirds	› Shoveler › Wetland and waterbirds
River Suck Callows SPA	004097	1.7 km west	› Whooper swan › Eurasian wigeon › European golden plover › Northern lapwing › Greenland white-fronted goose › Wetland and waterbirds	› Wetland and waterbirds
Four Roads Turlough SPA/pNHA	004140	1.9 km north	› European golden plover › Greenland white-fronted goose › Wetland and waterbirds	› Wetland and waterbirds
Lough Ree SPA/pNHA	004064	8 km east	› Little grebe Tachybaptus ruficollis › Whooper swan › Eurasian wigeon › Teal Anas crecca › Mallard Anas platyrhynchos › Shoveler › Goldeneye Bucephala clangula › Coot Fulica atra › European golden plover › Northern lapwing › Wetland and waterbirds	› Tufted duck Aythya fuligula › Common 0scoter Melanitta nigra › Common tern Sterna hirundo › Wetland and waterbirds
Middle Shannon Callows SPA	004096	11.4 km southeast	› Whooper swan › Eurasian wigeon › European golden plover › Northern lapwing › Black-tailed godwit *Limosa limosa* › Black-headed gull	› Corncrake *Crex crex* › Northern lapwing › Black-tailed godwit › Wetland and waterbirds

[11] Site synopses are included in Technical Appendix 7-9.
[12] For brevity, NHAs or pNHAs that overlap with SPAs of the same name are not shown separately under the NHA or pNHA section.

Site Name	Site Code	Distance/ Direction from Site Boundary	Wintering Species/ Features of Special Conservation Interest	Breeding Season Species/ Features of Special Conservation Interest
			› Wetland and waterbirds	
Natural Heritage Area (NHA)				
Suck River Callows NHA	000222	2 km west	› Greenland white-fronted goose › Whooper swan › Eurasian wigeon › Lapwing › European golden plover › Mute swan *Cygnus olor* › Teal › Northern pintail *Anas acuta* › Curlew	› None
Proposed Natural Heritage Area (pNHA)				
Cranberry Lough	001630	8.5 km southeast	› Whooper swan	› Sedge warbler Acrocephalus schoenobaenus › Reed bunting Emberiza schoeniclus › Snipe › Curlew › Little grebe › Moorhen Gallinula chloropus

7.3.1.2 Field Surveys

7.3.1.2.1 *Pre-existing Survey Data*

Survey information relating to previous planning applications at Seven Hills in 2010 and 2012 was reviewed and summarised in Technical Appendices 7.1-7.6. In addition, the review included more recent documents which were produced after the submission of the planning applications. Winter bird surveys were undertaken at the northern and southern clusters during the winter seasons of 2008/09, 2009/10, 2011/12, 2014/15, 2016/17 and 2017/18. Previous breeding season data are limited to the period April to June 2009.

The winter surveys focused primarily on species such as whooper swan and Greenland white-fronted geese, while also providing counts for other water birds. The wintering bird surveys used a range of methods, including vantage point surveys and surveys of the wider surrounding area. Survey effort and methodology varied between years. Whooper swan was recorded in all years, mostly in small numbers and often irregularly. Greenland white-fronted goose was not recorded at the Wind Farm site, although it was recorded in the surrounding area (in 2013 and 2016 only, with no identifiable trend in numbers over the course of the surveys). Other species recorded in all historical surveys included European golden plover, northern lapwing, Eurasian curlew and Eurasian wigeon. The 2009 breeding surveys recorded species including Eurasian curlew, common snipe *Gallinago gallinago* and redshank *Tringa totanus*, although it is not clear whether all of these were recorded within the site or within the surrounding area.

Direct comparison between the previous data and survey data collected to inform this assessment from 2018 onwards is impossible due to differences in methods and survey areas used, plus a relative lack of information for some of the older surveys. However, to provide some context as to how the suite of birds recorded in the breeding and non-breeding season has changed, we have compared the number of species of waders, waterbirds and raptors recorded.

For the breeding season, of the 23 species recorded, 52% were present in 2009 as well as 2019 and/or 2020 and 2021. 35% were recorded in 2019 and/or 2020 and 2021 but not in 2009, and 13% were recorded in 2009 but not 2019 and/or 2020 and 2021 (European golden plover, Eurasian wigeon and cormorant).

For the non-breeding season, of the 38 species recorded across all years, 55% were present in the 2009-2018 surveys, as well as 2019 and/or 2020. 11% were recorded in 2019 and/or 2020 but not in 2009-2018, and 34% were recorded in 2009-2018 surveys but not 2019 and/or 2020 (Northern pintail, Northern shoveler, common pochard, tufted duck, dunlin, Bewick's swan, little grebe, moorhen, cormorant, gadwall, black-tailed godwit, ruff and common redshank).

The pre-existing data provide useful context. However, given their age and the differences in the methods used they have not been used to inform the impact assessment, which is instead based on the survey data collected specifically to inform this EIA, between winter 2018-19 and the breeding season in 2021.

7.3.1.2.2 *Flight Activity Surveys*

Full details of the flight activity survey results (including figures showing flight lines for primary target species) are provided in Technical Appendices 7.1-7.6. The following sections present seasonal summaries of 'at risk' flight activity within the northern and southern cluster Collision Risk Zones (CRZ), defined as the areas encompassed by the relevant Wind Farm Polygon (WP) (the area within 500m of the outermost turbine blade[13]). 'At risk' flights are defined as those crossing the relevant WP at Potential Collision Height (PCH), i.e. within each rotor-swept area (between 18m above ground level (AGL) and 180m AGL).

Northern Cluster Primary Target Species Flight Activity

Eleven primary target species were recorded during flight activity surveys at the northern cluster and of these, whooper swan, Greenland white-fronted goose, Eurasian wigeon, European golden plover, northern lapwing and black-headed gull are SCI species from nearby SPAs. In general, there were very few 'at risk' flight events for any primary target species; however, the total number of birds making 'at risk' flights was larger for species that often fly in flocks, such as whooper swan, Greenland white-fronted goose, European golden plover, northern lapwing and black-headed gull.

The majority of European golden plover, northern lapwing and black-headed gull activity was focused around Thomas Street Turlough, and as such were generally not associated with the proposed turbine locations.

Table 7-5 summarises the numbers of birds recorded passing through the northern cluster CRZ during baseline surveys undertaken during October 2018 to September 2021 inclusive and those potentially at risk of turbine collision.

[13] *Shown on Figure 1 of Technical Appendix 7-7 (Avian Collision Modelling Report)*

Table 7-5 Summary of 'At Risk' Flights of Primary Target Species by Season within Northern Cluster Site

Species	Season[14]	Total number of birds recorded in flight	Number in flight over WP	Number at PCH in WP	
				Birds	Flight events
Whooper swan	Non-breeding 2018/2019	21	21	21	2
	Non-breeding 2019/2020	16	0	0	0
	Non-breeding 2020/2021	58	13	13	2
Greenland white-fronted goose	Non-breeding 2018/2019	19	19	19	2
	Non-breeding 2019/2020	72	0	0	0
Eurasian wigeon	Non-breeding 2020/2021	35	0	0	0
Hen harrier	Breeding 2020	1	1	1	1
Peregrine falcon	Breeding 2019	1	1	1	1
	Non-breeding 2020/2021	1	0	0	0
	Breeding 2021	1	1	1	1
European golden plover	Non-breeding 2018/2019	92	40	40	1
	Non-breeding 2019/2020	140	92	92	3
	Non-breeding 2020/2021	107	17	17	1
Northern lapwing	Non-breeding 2019/ 2020	25	25	10	1
	Non-breeding 2020/2021	60	0	0	0
Black-headed gull	Breeding 2020	41	7	7	2
	Breeding 2021	51	27	27	8
Herring gull	Breeding 2020	19	0	0	0
Curlew	Breeding 2021	4	0	0	0
Kestrel	Breeding 2021	3	0	0	0

Northern Cluster Secondary Target Species Flight Activity

Table 7-6 summarises the secondary target species data for the northern cluster site.

[14] *For full definition of species-specific seasons, see Technical Appendix 7-7 (Avian Collision Modelling Report)*

Table 7-6 Summary of Flights of Secondary Target Species by Season within Northern Cluster Site

Species	Season	Total number of 5-minute periods in which species recorded	Total number of birds recorded
Mute swan	October 2019–March 2020	1	1
Eurasian wigeon	October 2019–March 2020	1	50
Mallard	October 2019–March 2020	2	6
Grey heron	April 2019-September 2019	1	1
	April 2020-September 2020	2	2
	April 2021-September 2021	1	1
Eurasian sparrowhawk	April 2019-September 2019	2	2
	April 2021-September 2021	3	3
Common buzzard	October 2018–March 2019[15]	3	3
	April 2019-September 2019	5	5
	October 2019–March 2020	3	5
	April 2020-September 2020	2	2
	October 2020–March 2021	13	16
	April 2021-September 2021	11	11
Kestrel	October 2018–March 2019	1	1

[15] *Buzzard was recorded as a primary target species in winter 2018-19 but relevant data have been included here for consistency with subsequent years. The same applies for kestrel.*

Species	Season	Total number of 5-minute periods in which species recorded	Total number of birds recorded
	April 2019-September 2019	2	2
	April 2020-September 2020	1	1
Northern lapwing	April 2019-September 2019	1	15
Common snipe	October 2020–March 2021	1	1
Eurasian curlew	October 2019–March 2020	1	1
Black-headed gull	October 2018–March 2019	6	24
	April 2019-September 2019	1	2
	October 2019–March 2020	36	1956
	October 2020–March 2021	43	334
Common gull *Larus canus*	April 2019-September 2019	1	4
	April 2021-September 2021	12	12
Lesser black-backed gull *Larus fuscus*	October 2018–March 2019	1	2
	April 2019-September 2019	9	15
	October 2019–March 2020	7	12
	April 2020-September 2020	17	32
	April 2021-September 2021	30	68
Herring gull	April 2019-September 2019	4	5

Species	Season	Total number of 5-minute periods in which species recorded	Total number of birds recorded
	April 2021-September 2021	5	7
Great black-backed gull *Larus marinus*	October 2018–March 2019	3	5
	April 2021-September 2021	5	5
Common raven	October 2018–March 2019	26	49
	April 2019-September 2019	30	54
	October 2019–March 2020	35	65
	April 2020-September 2020	25	39
	October 2020–March 2021	17	33
	April 2021-September 2021	29	47

Southern Cluster Primary Target Species Flight Activity

Ten primary target species were recorded during flight activity surveys at the southern cluster and of these, whooper swan, Greenland white-fronted goose, Eurasian wigeon, European golden plover, northern lapwing and black-headed gull are SCI species from nearby SPAs. In general, there were very few 'at risk' flight events for any primary target species, apart from for black-headed gull. None of the Greenland white-fronted goose flights recorded were 'at risk' flights.

The total number of birds making 'at risk' flights was larger for species that often fly in flocks, such as whooper swan, Eurasian wigeon, European golden plover, northern lapwing, Eurasian curlew and black-headed gull.

The majority of Eurasian wigeon, European golden plover, northern lapwing, Eurasian curlew and black-headed gull activity was focused around Feacle Turlough, and as such were generally not associated with the proposed turbine locations.

Table 7-7 summarises the numbers of birds recorded passing through the southern cluster CRZ during baseline surveys undertaken during October 2018 to September 2021 inclusive and those potentially at risk of turbine collision.

Table 7-7 Summary of 'At Risk' Flights of Primary Target Species by Season within Southern Cluster Site

Species	Season[14]	Total number of birds recorded in flight	Number in flight over WP	Number at PCH in WP	
				Birds	Flight events
Whooper swan	Non-breeding 2018/2019	33	30	30	5
	Non-breeding 2019/2020	31	31	31	5
	Non-breeding 2020/2021	35	35	35	8
Greenland white-fronted goose	Non-breeding 2020/2021	50	0	0	0
Eurasian wigeon	Non-breeding 2018/2019	37	37	37	2
	Non-breeding 2020/2021	291	291	158	3
Peregrine falcon	Non-breeding 2018/2019	5	4	4	4
	Breeding 2019	1	1	1	1
	Non-breeding 2020/2021	2	2	2	2
	Breeding 2021	2	2	2	2
European golden plover	Non-breeding 2018/2019	11	11	11	2
	Non-breeding 2019/2020	36	36	36	3
	Non-breeding 2020/2021	122	122	122	5
Northern lapwing	Non-breeding 2018/ 2019	126	101	98	6
	Non-breeding 2019/2020	69	69	69	6
	Breeding 2020	23	23	23	1
	Non-breeding 2020/2021	313	313	313	8
	Breeding 2021	45	45	45	4
Eurasian curlew	Non-breeding 2018/ 2019	212	212	212	14
	Breeding 2019	4	4	4	1
	Breeding 2021	3	2	3	2
Black-headed gull	Breeding 2020	44	36	36	16
	Breeding 2021	97	64	64	40
Herring gull	Breeding 2020	5	4	4	4
Kestrel	Breeding 2021	9	9	9	9

Southern Cluster Secondary Target Species Flight Activity

Table 7-8 summarises the secondary target species data for the southern cluster site.

Table 7-8 Summary of Flights of Secondary Target Species by Season within Southern Cluster Site

Species	Season	Total number of 5-minute periods in which species recorded	Total number of birds recorded
Mute swan	April 2019-September 2019	1	2
	October 2020–March 2021	1	2
Common shelduck *Tadorna tadorna*	April 2020-September 2020	3	5
Eurasian wigeon	October 2019–March 2020	2	61
Eurasian Teal	October 2018–March 2019[16]	3	36
	April 2019-September 2019	2	7
	October 2019–March 2020	3	7
Mallard	October 2018–March 2019	2	7
	April 2019-September 2019	7	45
	October 2019–March 2020	2	37
	April 2020-September 2020	8	17
	October 2020–March 2021	9	22
	April 2021-September 2021	22	123
Common scoter	April 2019-September 2019	1	1

[16] *Teal was recorded as a primary target species in winter 2018-19 but relevant data have been included here for consistency with subsequent years. The same applies for mallard, sparrowhawk, buzzard, kestrel and common snipe.*

Species	Season	Total number of 5-minute periods in which species recorded	Total number of birds recorded
Great cormorant	October 2019–March 2020	1	1
	April 2020-September 2020	1	3
	October 2020–March 2021	4	10
	April 2021-September 2021	1	1
Little egret *Egretta garzetta*	April 2019-September 2019	3	4
	April 2021-September 2021	2	3
Grey heron	April 2019-September 2019	6	6
	October 2019–March 2020	1	1
	April 2020-September 2020	7	7
	October 2020–March 2021	7	7
	April 2021-September 2021	12	19
Eurasian sparrowhawk	October 2018–March 2019	2	2
	April 2019-September 2019	3	3
	October 2019–March 2020	4	4
	April 2020-September 2020	1	1
	April 2021-September 2021	6	7
Common buzzard	October 2018–March 2019	2	2

Species	Season	Total number of 5-minute periods in which species recorded	Total number of birds recorded
	April 2019-September 2019	14	15
	October 2019–March 2020	3	4
	April 2020-September 2020	13	14
	October 2020–March 2021	26	37
	April 2021-September 2021	42	55
Kestrel	October 2018–March 2019	3	3
	April 2019-September 2019	13	13
	October 2019–March 2020	4	4
	April 2020-September 2020	9	9
	October 2020–March 2021	15	15
Common coot	April 2020-September 2020	1	1
	October 2020–March 2021	1	2
	April 2021-September 2021	2	6
Common snipe	October 2018–March 2019	5	8
	April 2019-September 2019	2	2
	October 2019–March 2020	1	1
Eurasian curlew	October 2019–March 2020	18	290

Species	Season	Total number of 5-minute periods in which species recorded	Total number of birds recorded
	October 2020–March 2021	11	267
Black-headed gull	October 2018–March 2019	37	602
	April 2019-September 2019	24	47
	October 2019–March 2020	37	339
	October 2020–March 2021	54	312
Common gull	October 2018–March 2019	2	8
	April 2021-September 2021	8	9
Lesser black-backed gull	October 2018–March 2019	4	7
	April 2019-September 2019	52	79
	October 2019–March 2020	1	2
	April 2020-September 2020	26	50
	October 2020–March 2021	8	10
	April 2021-September 2021	31	40
Herring gull	October 2018–March 2019	2	38
	April 2019-September 2019	9	8
	October 2019–March 2020	4	6
	October 2020–March 2021	2	2

Species	Season	Total number of 5-minute periods in which species recorded	Total number of birds recorded
	April 2021-September 2021	2	2
Great black-backed gull	October 2018–March 2019	1	1
Common raven	October 2018–March 2019	78	139
	April 2019-September 2019	95	309
	October 2019–March 2020	42	79
	April 2020-September 2020	55	135
	October 2020–March 2021	54	96
	April 2021-September 2021	81	137

7.3.1.2.3 Breeding Wader Surveys

Full results of the Breeding Wader Surveys in 2019, 2020 and 2021 are presented in Technical Appendices 7.2, 7.4 and 7.6. As stated previously, surveys were not considered necessary at the northern cluster, due to the lack of suitable habitat for breeding waders.

The results for the southern cluster are summarised below.

Southern Cluster Breeding Wader Survey Results

Surveys in 2019 indicated one possible breeding common snipe territory, due to a cluster of three records in the west of the site. The birds were present in suitable habitat, but otherwise there was no positive indication of breeding and it is more likely that these birds refer to passage migrants. No common snipe were recorded in 2020.

One northern lapwing was recorded outside of the 500 m survey buffer in 2019, but there was no indication of breeding behaviour. No northern lapwings were recorded in 2020.

No waders, breeding or otherwise were recorded in 2021 surveys.

7.3.1.2.4 Breeding Raptor Surveys

Full results of the Breeding Raptor Surveys in 2019, 2020 and 2021 are presented in Technical Appendices 7.2,7.4 and 7.6. The results of raptor surveys within 2 km are summarised below (note that the results for both clusters of the Proposed Development have been combined due to the survey buffers being merged together).

Northern and Southern Clusters Breeding Raptor Survey Results

In 2019 there were two probable buzzard territories to the north and north-west of the northern cluster site within the 2 km survey buffer. In addition, kestrel and sparrowhawk were observed. No peregrine falcons were recorded during the raptor surveys, although two individuals were recorded during VP surveys in the 2019 breeding season (single records of an adult male and female noted in July and August respectively, which is late in the peregrine falcon breeding season).

Similar results were noted in 2020, with two probable buzzard territories noted to the north and north-east of the northern cluster site within the 2 km survey buffer. In addition, kestrel and sparrowhawk were observed. No peregrine falcons were recorded during any surveys in the 2020 breeding season. One female hen harrier was observed during a VP survey at the northern cluster site in April which is considered to have been a bird passing through the area.

In 2021, a probable buzzard territory was recorded to the north-east of the northern cluster site within the 2 km survey buffer. Kestrel and sparrowhawk were observed, but there was no evidence of breeding. Peregrine falcon was confirmed breeding at a site within 2 km in May 2021, the details of the nesting site remain confidential at this stage to reduce the risk of persecution should nest details enter the public domain. Two chicks were recorded but no further sightings of juvenile peregrines were made, so it was not clear whether the chicks fledged successfully.

7.3.1.2.5 *Swan and Goose Feeding Distribution Surveys*

Full results of the Swan and Goose Feeding Distribution Surveys are presented in Technical Appendices 7.1, 7.3 and 7.5. The yearly summaries are presented below:

2018/ 2019

There were no whooper swans recorded within 1 km of the Wind Farm site (as measured from all proposed turbine and site infrastructure locations from both clusters combined) during the October, November, December and February feeding and distribution surveys.

In January 2019, a peak count of 154 whooper swans was recorded on the feeding and distribution survey, east of the northern cluster site and outside the 1km survey buffer. Whooper swans were observed feeding in fields at two other locations during the January survey, including 105 swans observed within the 1km buffer northwest of the southern cluster site and 21 swans feeding within the southern cluster survey buffer to the southeast.

During the March survey, a flock of 12 whooper swans was recorded feeding in an improved agricultural grassland field south of the northern cluster site. 14 whooper swans were also recorded at the south-eastern corner of Lough Croan Turlough, north of the northern cluster.

There were no Greenland white-fronted geese recorded within 1 km of either site throughout the entire season of feeding and distribution surveys.

2019/ 2020

Two main whooper swan foraging areas were regularly used in 2019/ 2020:

1. approximately 1 km from each of the two clusters, namely at Lough Croan to the north of the northern cluster (ranging in numbers from 2-5 birds during December, January and February, with a flock of 32 in March); and

2. the Ballyglass River to the north of the southern cluster (8-20 birds).

There were no Greenland white-fronted geese recorded within 1 km of the sites during the October 2019 to March 2020 feeding distribution surveys.

2020/2021

Higher numbers of whooper swans were recorded in 2020/2021, with birds using similar foraging areas as in 2019/2020. Combined totals of whooper swans ranged between 64 in October and a peak of 189 in March.

Greenland white-fronted geese were recorded in February only, with three separate flocks observed grazing during the same survey period in the fields surrounding Lough Croan, just outside the 1 km survey buffer (5, 124 and 50 birds).

In addition, three greylag geese *Anser anser* were recorded in February and March around Lough Croan.

7.3.1.2.6 Greenland White-fronted Goose Roost Surveys

Full results of the Greenland White-fronted Goose Roost Surveys at Lough Croan are presented in Technical Appendices 7.3 and 7.5. The yearly summaries are presented below:

2019/2020

Greenland white-fronted geese were recorded at Lough Croan in December 2019 and February 2020 only, with no sightings of geese during January or the two March surveys.

A total of five flocks were observed at the lough in December, with four of these flocks ranging in size from 9 -17. There was one larger flock of 120 observed arriving from the west during the dusk survey. There were two flocks recorded during February surveys (40 and 14).

Observations indicated that birds did not overfly either the northern or southern cluster or fly through the area between the two clusters, which lie to the south of Lough Croan (all records were of birds flying east or west into or away from Lough Croan or flying north from Lough Croan).

2020/2021

Greenland white-fronted geese were recorded at Lough Croan in January, February and March 2021 only, with no sightings of geese during the October - December surveys.

During the January dusk survey, a flock of 55 geese flew in from the west just after sunset and landed in the east of the lough. At dawn on the following morning a total of three of the nine flocks recorded (n=36, n=40 and n=80) were observed flying in from the west just after sunrise and landing on a field immediately south of the lough. A further three flocks (n=11, n=50 and n=50) moved a short distance from the eastern section of the turlough to the fields to the south of the central section of the turlough, joining three other flocks which had arrived from the west. This formed a large flock of approximately 267 Greenland white-fronted geese. A short time later, this group of geese began to disperse.

In the February dusk survey, a flock of 70 geese was observed leaving the lough to the west just after sunset.

In March, a flock of 50 geese was observed leaving the lough at dawn, heading in a north-westerly direction.

As in 2019/20, birds did not overfly either of the clusters, which lie to the south of Lough Croan (i.e., all flights were of birds heading east-west into or away from Lough Croan or north from Lough Croan).

7.3.1.2.7 *European Golden Plover Nocturnal Foraging Surveys*

Full results of the European Golden Plover Nocturnal Foraging Surveys are presented in Technical Appendix 7-3. Surveys were undertaken at the northern cluster site monthly between January and March 2020. There was a total of four records of European golden plover noted during these surveys, one record in January and three in March, with only small numbers recorded (maximum of 5 birds in March). It is assumed that a similar number of birds may also have been present in the southern cluster, despite the less suitable habitat.

7.3.2 Evaluation of Ornithological Receptors

Applying the criteria outlined in the 'Sensitivity of Receptor' section (Section 7.2.4.1), an evaluation of the importance of the relevant study areas for target species recorded during the baseline surveys is provided in Table 7-9. The target species with a value of 'local' or above are the ones taken forward as VORs for detailed assessment.

Table 7-9 Evaluation of Target Species Populations within the study area

Value	VORs	Species Information, Status & Baseline	Justification for Evaluation

International	Greenland white-fronted goose	- Annex I;
		- BoCCI 4: Amber List (qualifying criteria: >50% of the non-breeding population found at ≤ 10 sites; and Irish population represents 23% of European non-breeding population);
		- All Ireland wintering population: 10,418 (Spring Count, Greenland white-fronted goose international census 2019/20, WWT 2020);
		- River Suck Callows SPA population (wintering):
		  o Reference population at designation (1996): 386
		  o Mean population 2014/15 – 2017/18: 28 (I-WeBS);
		- Lough Croan Turlough SPA population (wintering):
		  o Reference population at designation (2010): 164
		  o Mean population 2008/09 – 2017/18: 41 (data for I-WeBS site Southern Roscommon Lakes);
		- Four Roads Turlough SPA population (wintering):
		  o Reference population at designation (2010): 93
		  o Mean population 2008/09 – 2017/18: 41 (data for I-WeBS site Southern Roscommon Lakes);
		- Baseline surveys:
		  o Swan and goose feeding distribution surveys: only recorded in one monthly survey (179 in February 2021).
		  o Greenland white-fronted goose roost surveys: irregularly recorded at Lough Croan, but with a peak of 267 in January 2021.
		  o Northern cluster flight activity surveys: two flocks in winter 2018/19 (5 & 14); one flock of 72 in winter 2019/20; none in winter 2020/21.
			Qualifying species at three SPAs within 15 km (River Suck Callows, Lough Croan Turlough, Four Roads Turlough) and also for Suck River Callows NHA. Peak counts during baseline surveys represent >1% of the criteria for international importance stated by I-WeBS (=190) and also a high proportion of the local SPA populations, although use of the study area has been irregular. Birds recorded over site likely to be part of nearby SPA populations (i.e., River Suck Callows and Lough Croan Turlough). On the basis of the above, the population within the study area is considered to be internationally important.

Value	VORs	Species Information, Status & Baseline	Justification for Evaluation
		○ Southern flight activity surveys: none in winter 2018/19; none in winter 2019/20; one flock of 50 in winter 2020/21.	
National	Whooper swan	› Annex I; › BoCCI 4: Amber List (qualifying criteria: Irish population represents 45% of European non-breeding population); › All Ireland wintering population: 19,111; ROI wintering population: 14,467 (2020, BirdWatchIreland); › Middle Shannon Callows SPA population (wintering): ○ Reference population at designation (1996): 287 ○ Mean population 2010/11 – 2017/18: 102 (data for I-WeBS site Shannon Callows) › River Suck Callows SPA population (wintering): ○ Reference population at designation (1996): 124 ○ Mean population 2014/15 – 2017/18: 200 (I-WeBS); › Lough Ree SPA population (wintering): ○ Reference population at designation (1995): 89 ○ Mean population 2013/14 – 2017/18: 4 (I-WeBS); › Baseline surveys: ○ Swan and goose feeding distribution surveys: max. 189 (March 2021). ○ Northern cluster flight activity surveys: maximum combined total of 58 (winter 2020/21). ○ Southern cluster flight activity surveys: maximum combined total of 35 (winter 2020/21).	Qualifying species at three SPAs within 15 km (Middle Shannon Callows, River Suck Callows, Lough Ree) and also for Suck River Callows NHA and Cranberry Lough pNHA. Peak counts during baseline surveys represent <1% of the criteria for international importance stated by I-WeBS (=340) but are a high proportion of the local SPA populations. Timings of peak counts (in March) indicate that these include passage birds rather than exclusively birds from local SPAs. On the basis of the above, the population within the study area is considered to be nationally important.

Value	VORs	Species Information, Status & Baseline	Justification for Evaluation

Regional/County	Black-headed gull	• BoCCI 4: Amber List (qualifying criteria: moderate breeding range decline of 58% over short time period and 55% over longer time period);
		• ROI wintering population: 14,994 (I-WeBS 2016/17);
		• ROI breeding population: 7,810 AON[17] 2015-18 (JNCC 2021);
		• Middle Shannon Callows SPA population (wintering):
		  ○ Reference population at designation (1996): 1,061
		  ○ Mean population 2010/11 – 2017/18: 292 (data for I-WeBS site Shannon Callows);
		• Baseline surveys:
		  ○ northern cluster flight activity surveys: combined total of 24 birds (secondary species data), winter 2018/19; 2 birds (secondary species data) breeding season 2019; combined total of 1,956 (max. flock size 500) (secondary species data), winter 2019/20; 13 flights, combined total of 41 (max. flock size 10) (primary target species data) breeding season 2020; combined total of 334 (max. flock size 60) (secondary species data) winter 2020/21; combined total of 51 birds (max. flock size 12) (primary target species data) breeding season 2021.
		  ○ Southern cluster flight activity surveys: combined total of 602 (max. flock 150) (secondary species data), winter 2018/19; combined total of 21 (max. of 2 birds) (secondary species data), breeding season 2019; combined total of 339 (max. of 42 birds) (secondary species data), winter 2019-20; 19 flights, combined total of 44, (max. flock size 8), (primary target species data)
			Qualifying species at one SPA within 15 km (Middle Shannon Callows). Important breeding colony at Lough Ree (100 individuals) but the species is not a qualifying feature of this SPA.
			The maximum flock size recorded during baseline surveys (c.500) represents >1% of the ROI wintering population (I-WeBS) although numbers within the study area were generally considerably less than this. Birds at Seven Hills are unlikely to contain a high proportion of individuals from Middle Shannon Callows SPA, given the intervening distance, as this species is common and widespread in the non-breeding season.
			The black-headed gull population within the study area is therefore considered to be of no more than regional importance in the non-breeding season.
			Use of the study area has been focussed around turloughs, away from the Proposed Development areas.

[17] *AON= Apparently Occupied Nests*

Value	VORs	Species Information, Status & Baseline	Justification for Evaluation
		breeding season 2020; combined total of 312 (max. flock size 60) (secondary species data) winter 2020/21; combined total of 97 birds (max. flock size 8) (primary target species data) breeding season 2021.	

Regional/County	Eurasian curlew	- BoCCI 4: Red List (qualifying criteria: of global conservation concern; severe decline in breeding population of 86% over short and 98% over longer time period; severe decline in winter population of 65% over short time period; severe decline in breeding range of 73% over short time period and 78% over longer time period);
		- ROI wintering population: 14,994 (Fitzgerald et al. 2021);
		- Baseline surveys:
		  o Northern cluster flight activity surveys: total of 1 (secondary species data) (winter 2019/20); combined total of 4 birds (max. flock size 4) (primary target species data) breeding season 2021.
		  o Southern cluster flight activity surveys: 15 flights with a combined total of 216 (max. flock size 38) (primary target species data) (winter 2018/19); 4 flights with a combined total of 4 (breeding season 2019) (primary target species data); combined total of 290 (max. flock size 56) (winter 2019/20) (secondary species data); combined total of 267 (max. flock size 120) (secondary species data) (winter 2020-21); combined total of 3 birds (max. flock size 2) (primary target species data) breeding season 2021. Most activity focussed around Feacle Lough Turlough.
			Peak counts during baseline surveys represent <1% of criteria for both international (=7,600) and national (=350) importance (I-WeBS).
			Peak counts during baseline surveys represents <1% of ROI wintering population (I-WeBS). The Eurasian curlew population within the study area is therefore considered of no more than regional importance.

Regional/County	Eurasian wigeon	- BoCCI 4: Amber List (qualifying criteria: moderate decline in winter population of 38% over short time period and 44% over	Qualifying species at three SPAs within 15 km (River Suck Callows, Lough Ree, Middle Shannon Callows) and also for Suck River Callows NHA. Peak counts during baseline

Value	VORs	Species Information, Status & Baseline	Justification for Evaluation

		longer time period; rare breeder; localised non-breeding population);
		- All Ireland wintering population: 41,504 (Fitzgerald et al. 2021);
		- River Suck Callows SPA population (wintering):
		  - Reference population at designation (1996): 1,203
		  - Mean population 2014/15 – 2017/18: 1,311 (I-WeBS);
		- Lough Ree SPA population (wintering):
		  - Reference population at designation (1995): 1,475
		  - Mean population 2013/14 – 2017/18: 17 (I-WeBS);
		- Middle Shannon Callows SPA population (wintering):
		  - Reference population at designation (1996): 2,972
		  - Mean population 2010/11 – 2017/18: 405 (data for I-WeBS site Shannon Callows)
		- Baseline surveys:
		  - Northern cluster flight activity surveys: one record (as secondary target species) of flock of 40-50 (winter 2019/20). One record (as primary target species) of flock of 35 (winter 2020/21).
		  - Southern cluster flight activity surveys: two records (as secondary target species), max. flock size 57. Seven records (as primary target species) with combined total of 291 (max. flock size 120) (winter 2020/21).
			surveys represent <1% of criteria for both international (=14,000) and national (=560) importance (I-WeBS).
			A maximum flock size of 120 Eurasian wigeon is not significant within the context of the ROI wintering population (0.29% of the 2016/17 survey total) but is likely to contain some birds from the closest SPA (River Suck Callows). The Eurasian wigeon population within the study area is therefore considered to be of regional importance.
			Site use has been irregular and focussed at Feacle Lough Turlough.

Local	European golden plover	- Annex I; - BoCCI 4: Red List (qualifying criteria: severe decline in breeding population of 84% over longer time period);	Qualifying species at five SPAs within 15 km (River Suck Callows, Lough Croan Turlough, Four Roads Turlough, Lough Ree, Middle Shannon Callows) and for Suck River Callows NHA. Peak counts during baseline surveys

Value	VORs	Species Information, Status & Baseline	Justification for Evaluation
		› ROI wintering population: 70,726 (I-WeBS 2016/7), 35,760 (2014), 56,841 (2008) (International Wader Study Group); › River Suck Callows SPA population (wintering): o Reference population at designation (1996): 2,241 o Mean population 2014/15 - 2017/18: 835 (I-WeBS); › Lough Croan Turlough SPA population (wintering): o Reference population at designation (2010): 2,025 o Mean population 2008/09 - 2017/18: 3,625 (data for I-WeBS site Southern Roscommon Lakes); › Four Roads Turlough SPA population (wintering): o Reference population at designation (2010): 3,717 o Mean population 2008/09 - 2017/18: 3,625 (data for I-WeBS site Southern Roscommon Lakes); › Lough Ree SPA population (wintering): o Reference population at designation (1995): 2,035 o Mean population 2013/14 - 2017/18: 1,127 (I-WeBS); › Middle Shannon Callows SPA population (wintering): o Reference population at designation (1996): 4,254 o Mean population 2010/11 - 2017/18: 576 (data for I-WeBS site Shannon Callows); › Baseline surveys: o Northern cluster flight activity surveys: 2 flights (max. flock size 49) (winter 2018/19); 5 flights with a combined total of 140 (max. flock size 50) (winter 2019/20); 4 flights with a combined total of 107 (winter 2020/21).	represent <1% of criteria for both international (=9,300) and national (=920) importance (I-WeBS). A maximum flock size of 50 is not significant within the context of the ROI wintering population (0.14% of the 2014 survey total). Although some of these birds may be associated with local SPAs (River Suck Callows, Lough Croan Turlough and Four Roads Turlough in particular), in the context of the combined populations of these SPAs (c. 8,000 birds) this number is not considered significant. The European golden plover population within the study area is therefore considered to be of no more than local importance.

Value	VORs	Species Information, Status & Baseline	Justification for Evaluation
		○ Southern cluster flight activity surveys: 2 flights (combined total of 11) (winter 2018/19); 3 flights (combined total of 36) (winter 2019/20); 5 flights with a combined total of 122 (max. total of 40) (winter 2020/21). ○ European golden plover nocturnal foraging surveys: max. of 5 birds.	
Local	Kestrel	› BoCCI 4: Red List (qualifying criteria: severe decline in breeding population of 53% over short time period); › ROI 2017 national survey recorded 84 territorial pairs (Wilson-Parr & O'Brien, 2018) but this is likely to represent a massive underestimate as the Countryside Bird Survey 2011-2016 estimates an ROI population of 13,500 individuals; › Baseline surveys: ○ No breeding birds recorded. ○ Northern cluster flight activity surveys: 0 flights in 2019 breeding season, 1 flight in 2020 breeding season and 0 flights in 2018/19, 2019/20 and 2020/21 non-breeding seasons; combined total of birds (max. flock size 1) (primary target species data) breeding season 2021. ○ Southern cluster flight activity surveys: 2 flights in non-breeding season 2018/19, 10 flights in breeding season 2019, 4 flights in non-breeding season 2019/20, 9 flights in breeding season 2020 and 15 flights in non-breeding season 2020/21; combined total of 9 birds (max. flock size 1) (primary target species data) breeding season 2021.	No more than one bird was observed in any sighting and although not specifically targeted in breeding raptor surveys no evidence indicative of breeding was recorded and it is likely only non-breeding birds are present within the southern cluster site. The study area population (based on assumption that a couple of birds are likely to be present in the area) is around 0.01% of the ROI population (based on an ROI population of 13,500 individuals). Flight activity was at a relatively low level throughout all years. The kestrel population within the study area is therefore considered to be of no more than local importance.
Local	Northern lapwing	› BoCCI 4: Red List (qualifying criteria: of global conservation concern; severe decline in breeding population of 74% over short time period and 95% over longer time period; severe decline in	Qualifying species at three SPAs within 15 km (River Suck Callows, Lough Ree, Middle Shannon Callows) and also Suck River Callows NHA. Peak counts during baseline

Value	VORs	Species Information, Status & Baseline	Justification for Evaluation
		winter population of 67% over short time period and 58% over longer time period); › ROI wintering population: peak of 42,514 (I-WeBS 2016/17); › River Suck Callows SPA population (wintering): o Reference population at designation (1996): 3,640 o Mean population 2014/15 – 2017/18: 1,431 (I-WeBS); › Lough Ree SPA population (wintering): o Reference population at designation (1995): 3,870; o Mean population 2013/14 – 2017/18: 608 (I-WeBS); › Middle Shannon Callows SPA population (wintering): o Reference population at designation (1996): 11,578 o Mean population 2010/11 – 2017/18: 597 (data for I-WeBS site Shannon Callows); › Baseline surveys: o Northern cluster flight activity surveys: 11 flights with combined total of 126 (max. flock size of 26) (winter 2018/19); 1 flock of 10 birds (winter 2019/20); 3 flights with combined total of 60 (max. flock size 40) (winter 2020/21). o Southern cluster flight activity surveys: 6 flights with a combined total of 69 birds (max. flock size 35) (winter 2019/20); 8 flights with combined total of 313 (max. flock size 50) (winter 2020/21); combined total of 60 birds (max. flock size 34) (primary target species data) breeding season 2021. Most recorded activity focussed around Feacle Lough Turlough.	surveys represent <1% of criteria for both international (=72,300) and national (=850) importance (I-WeBS). A maximum flock size of 50 is not significant within the context of the ROI wintering population (0.11% of the 2017 I-WeBS survey peak). Although some of these birds may be associated with local SPAs (River Suck Callows in particular), in the context of these SPA populations of several hundreds or thousands this number is not considered significant. The northern lapwing population within the study area is therefore considered to be of no more than local importance.
Regional/County	Peregrine falcon	› Annex I;	The study area population (based on 2021 data) is 0.2% of the ROI population but may be of regional importance.

Value	VORs	Species Information, Status & Baseline	Justification for Evaluation
		› BoCCI 4: Green List; › ROI 2017 national survey recorded 425 territorial pairs (Wilson-Parr & O'Brien 2018); › Baseline surveys: o 1 breeding pair within 2 km in 2021. o Northern cluster flight activity surveys: 1 flight in 2019 breeding season,1 flight in 2020/21 non-breeding season and 1 flight in 2021 breeding season. o Southern cluster flight activity surveys: 5 flights in non-breeding season 2018/19, 1 flight in breeding season 2019,2 flights in non-breeding season 2020/21 and 2 flights in breeding season 2021.	Flight activity was at a low level throughout all years.
Less than Local	All other species	› See Technical Appendices 7-1-7-6 for baseline survey results.	All other species are either relatively common or widespread and/or were recorded only infrequently/in small numbers and are therefore not considered important at a local or higher level.

7.4 Future Baseline

In the absence of the Proposed Development, and assuming the continuation of the current land use in the area, the bird populations are likely to continue to be present in similar abundances and distributions, subject to ongoing changes in the population of some species across the wider landscape.

7.5 Assessment of Effects

7.5.1 Effects Assessed in Full

This assessment concentrates on the effects of construction, operation and decommissioning of the Proposed Development upon VORs. The assessment of effects is based on the information outlined in Chapter 4: Description. The following potential effects have been assessed:

- habitat loss or damage (permanent and temporary) due to construction of Wind Farm infrastructure, including the underground Grid Connection;
- inadvertent destruction of nests during construction;
- disturbance to birds during construction due to vehicular traffic, operating plant and the presence of construction workers;
- disturbance to birds due to the operation of the wind turbines (including barrier effects), vehicular traffic and the presence of people during operation; and
- mortality of birds caused by collisions with turbine blades and other infrastructure.

Effects have been assessed in detail for the following VORs (see Table 7-9 for justification):

Breeding season:

- Peregrine falcon.

Non-breeding season:

- Whooper swan;
- Greenland white-fronted goose;
- Eurasian wigeon;
- Peregrine falcon;
- European golden plover;
- Northern lapwing;
- Eurasian curlew; and
- Black-headed gull.

Breeding and non-breeding season:

- Kestrel.

This list includes all species which are potentially vulnerable to likely significant effects from the Proposed Development, which are also:

- species listed on Annex I of the Birds Directive; and/or
- species for which the study area is considered to be important at a local level or above.

7.5.2 Embedded Mitigation and Good Practice Measures

Good practice measures, as outlined below, would be employed to reduce the possibility of damage and destruction (and disturbance in the case of sensitive species such as breeding raptors and waders), to occupied bird nests during the construction phase. These measures are 'embedded' as part of the Proposed Development and potential effects are therefore assessed on the basis that these measures will be implemented.

Full details of construction mitigation measures would be provided in a Construction Environmental Management Plan (CEMP). A draft CEMP is included as Technical Appendix 4-9.

7.5.2.1 Timing of Works, Pre-Commencement Surveys and Implementation of Disturbance-Free Buffer Zones

Avoidance of damage to, or destruction of nests, or disturbance to sensitive species whilst nesting can be achieved through careful timing of construction activities; for example, restricting activities in sensitive areas as far as practicable in the early part of the breeding season until the location and breeding status of nesting birds has been established. Clearance of uncultivated vegetation, i.e. trees and hedgerows, will be undertaken outside the main breeding bird season, from March to August inclusive. If other site clearance and construction activities are required to take place during the main breeding bird season, pre-commencement survey work would be undertaken to ensure that nest destruction and disturbance to sensitive species (i.e., breeding raptors and waders) are avoided. Where applicable, construction would not take place within specified disturbance-free buffer zones for certain sensitive species whilst those species are actively nesting.

Disturbance-free buffer zones around nest sites of sensitive species would be applied as set out below and would be monitored closely. Although not recorded during the 2019, 2020 or 2021 breeding surveys the possibility of breeding waders being present in future cannot be discounted (based on pre-2018 data and should the agricultural regime become less intensive and therefore more amenable to breeding waders) and therefore measures would be put in place, if wader species were recorded during pre-commencement surveys.

For breeding waders, disturbance-free buffer zones are generally only required until chicks have hatched and are capable of walking away from any sources of disturbance. As very little suitable breeding wader habitat is present near both the northern and southern clusters, it is possible that the buffer zones may be required until the chicks are fully fledged as little displacement habitat is available nearby. This would be determined following pre-commencement surveys.

Based on survey data and the relevant literature (e.g. Ruddock and Whitfield 2007), the following disturbance-free buffer zones are considered likely to be required to help prevent nest failure due to disturbance during construction. It should be noted that these distances represent a guide only and these may vary according to topography and other factors at each nest site. Peregrine falcon was the only confirmed breeding species identified as a VOR but buffer zones for breeding waders have also been included in the possible event wader species are recorded in pre-commencement surveys.

- Peregrine falcon – 500-750m
- Northern lapwing – 300m
- Eurasian curlew – 300m
- Common snipe – 300m

A suitably qualified Project Ecologist would be employed for the duration of the construction period, although this may not necessarily be a full-time role throughout. The role of the Project Ecologist would include the tasks outlined in Chapter 6: Biodiversity (Flora and Fauna) but with specific roles with regard to the bird interest of the site:

- Prior to the start of construction and/or the breeding bird season, contractors would be made aware of the ornithological sensitivities within the site (particularly with regard to the potential presence of sensitive breeding species); and
- Undertake surveys for nesting birds throughout the construction period that is within the nesting season and set up and monitor appropriate exclusion areas whilst nests of relevant species are in use.

7.5.3 Construction Effects

Construction effects considered include:

- Nest Damage or Destruction;
- Habitat Loss (including indirect effects on wetland habitats); and
- Disturbance / Displacement.

Potential effects, assuming that the good practice mitigation measures outlined above are implemented, are addressed for each VOR below.

7.5.3.1 Nest Damage or Destruction

Damage or destruction to active nests could contravene Section 22 of the Wildlife Acts 1976 to 2021. However, the good practice measures previously outlined would avoid the likelihood of damage, destruction or disturbance to occupied bird nests during the construction phase. As such, no significant effects, and no contravention of the relevant legislation, are likely for any species due to nest damage or destruction.

7.5.3.2 Habitat Loss

Construction of turbine bases, access tracks and other structures would lead to the direct loss of 29.6 ha of primarily agricultural habitat in total. Based on the results of the surveys between October 2018 and March 2021 none of this habitat is of particular importance for wintering wildfowl or waders due to the fact that:

- most[18] foraging whooper swans were recorded beyond the 500 m buffer of the northern and southern clusters and none were recorded within the site;
- Greenland white-fronted goose activity was focussed around Lough Croan and beyond (i.e., beyond the 1 km buffer of the northern and southern clusters);
- Other wildfowl and wader species (including Eurasian wigeon, European golden plover, Northern lapwing, Eurasian curlew and black-headed gull) activity was focussed around the Feacle Turlough and Thomas Street Turloughs, outside the site. These turloughs are located 730 m and 948 m from the nearest proposed turbine locations, respectively.

Similarly, none of the habitats present within the site are of particular importance to wintering kestrel, with similar habitats widely available in the wider area.

No significant effects are therefore likely for any VORs during the winter period as a result of habitat loss.

[18] *Over three winter seasons of survey, 805 (76%) whooper swans were recorded foraging outside the 500 m buffer compared with 258 within. Across all three winters the maximum peak counts occurred outside the 500 m buffer (154 at Cuilleenirwan Lough in 2018/19, 32 at Lough Croan in 2019/20 and 57 north of Dysart in 2020/21). None of these records were of birds foraging within the developable area and so no impacts of habitat loss are possible.*

Habitat loss could affect VORs breeding within the site, although the only VOR which could be affected, based on 2019-2021 data is peregrine falcon. The habitats within the site are not suitable for nesting peregrine falcon, which mostly nest on cliffs and crags, but the site may form part of the foraging range of the pair nesting within the wider survey area. Whilst peregrine falcon may suffer some loss of available habitat for foraging, effects are not likely to be significant given the size of this species foraging range (up to 6 km, Hardey *et al.* 2013*)*, its infrequent use of the site (based on activity survey data obtained to date) and the wide availability of alternative foraging habitat within the surrounding area. No significant effects are therefore likely for peregrine falcon in respect of habitat loss.

Kestrel were not recorded breeding within the site and although they may forage within the site none of the habitats present within the proposed site are of particular importance to foraging kestrel so no significant effects are likely for breeding kestrel in respect of habitat loss.

While Thomas Street and Feacle Turloughs are outside the proposed site, there could be potential indirect effects on wildfowl and wader species (including Eurasian wigeon, European golden plover, Northern lapwing, Eurasian curlew and black-headed gull) via potential dewatering of these turloughs, which could result in habitat loss to these species if it occurred. However, as shown in Section 9.4.2.8 in Chapter 9: Water and Hydrology, with embedded mitigation in place no significant effects will occur on these turloughs, precluding any indirect effects of habitat loss for wildfowl and waders using these turloughs.

As the Grid Connection route will be buried underground within or adjacent to existing regional roads, there is no potential for habitat loss for VORs.

7.5.3.2.1 *Indirect Effects on Wetland Habitats within Designated Sites*

If the construction of the Proposed Development led to dewatering of groundwater-dependent habitats within nearby designated sites for birds with a hydrogeological pathway to the northern and southern turbine clusters (Lough Croan Turlough SPA and Four Roads Turlough SPA) it could indirectly result in habitat loss for qualifying bird species. The same is also true for wetland sites not designated for bird species, but where there is a hydrogeological pathway to either the northern or southern turbine cluster, and which could be used by SCI bird species from nearby SPAs. This applies to Ballynamona Bog and Corklip Lough SAC and Feacle Turlough pNHA (see Chapter 6: Biodiversity (Flora and Fauna)). However, Section 9.4.2.9.1 in Chapter 9: Water and Hydrology concludes that with embedded mitigation in place there will be no significant effects on the water bodies within any of these designated sites, and so there can be no significant indirect effects on any wildfowl or wader species as a result.

7.5.3.3 Disturbance / Displacement

During the construction stage of the Proposed Development, the potential effects of associated noise and visual disturbance could lead to the temporary displacement or disruption of foraging and roosting breeding and non-breeding birds. The level of impact would depend on the timing of potentially disturbing activities, the extent of displacement (both spatially and temporally) and the availability of suitable habitats in the surrounding area for displaced birds to occupy. Significant disturbance / displacement effects are unlikely to occur along the Grid Connection route, with underground cables buried within or adjacent to a busy, existing regional road. Any disturbance or displacement from construction activities while the cable is being buried within the road is unlikely to be significantly greater than that from typical traffic levels. It is noted also that the route does not pass through or adjacent to any sites designated for their ornithological interest.

Potential effects are likely to be greatest during the breeding season (predominantly between March and August, depending on the species under consideration, but here only relevant to peregrine falcon as kestrel were not recorded breeding within the study area). Behavioural sensitivity to the effects would vary between species. Disturbance to foraging and roosting wintering wildfowl and waders is considered less likely due to the distances involved between the Proposed Development and habitats regularly used by these birds (see habitat loss, Section 7.5.3.2) and no significant effects are likely. As mentioned in Section 7.5.3.2, the closest wetland sites for wildfowl and waders are Feacle Turlough and Thomas Street Turlough, which are located 730 m and 948 m from the nearest proposed turbine locations, respectively. Lough Croan is also a winter roost for Greenland white-fronted geese but is located beyond the 1 km survey buffer of the northern and southern cluster layouts. These intervening distances make it very unlikely disturbance or displacement will impact waterfowl and waders.

Non-breeding kestrel have large foraging ranges and there is widely available alternative foraging habitat within the study area, so it is very unlikely disturbance or displacement will significantly impact this species.

The potential effects associated with construction activities are only likely to occur for as long as the construction phase continues and are thus generally short-term in nature. The exception to this would be if a negative effect on the breeding success of a receptor were such that the local population becomes extinct and replacement through recruitment or re-colonisation does not occur.

Based on the above, disturbance/displacement effects during construction are only likely to affect VORs breeding within the relevant parts of the study area (i.e. peregrine falcon only) with no significant disturbance / displacement likely for all other VORs.

Construction disturbance can be readily mitigated by avoiding sensitive areas through the implementation of appropriately defined buffer zones and by timing construction activities to avoid periods where sensitive species are present (if and where possible), such as the breeding season. A range of good practice measures have therefore been proposed to mitigate for potential construction disturbance effects.

7.5.3.3.1 *Peregrine Falcon*

An advised upper limit of 750m for disturbance to nesting peregrine falcons was found in a literature review by Ruddock and Whitfield (2007). The peregrine falcon nest site within the study area lies within the range of 580-700m from two of the proposed turbine locations. Survey data indicate that this nest site isn't used every year[19]. There is no other suitable nesting habitat for peregrine falcon within closer proximity to the Proposed Development.

In the event of peregrine falcon nesting within 500-750m of construction activities, the implementation of good practice measures would serve to minimise the risk of short-term disturbance, by avoiding construction activity around any active nest sites (by up to 750m depending on topography, which is considered the worst case scenario). Some disturbance to foraging birds is possible but the area affected is likely to be very small in the context of a pair's foraging range.

Following the implementation of the proposed good practice measures, disturbance/displacement of nesting peregrine falcon during construction would be negligible and not significant.

7.5.4 Operational Effects

Operational effects considered include:

- Disturbance / Displacement and Barrier Effects; and
- Collision with Wind Turbines.

Note that no operational effects are likely for the Grid Connection, which will be underground and located beneath or adjacent to a regional road. The remaining project elements are considered in further detail below.

[19] *The nest was not active in the summers of 2019 and 2020.*

7.5.4.1 Disturbance / Displacement and Barrier Effects

The operation of wind turbines and associated human activities for maintenance purposes both have the potential to cause disturbance and displace birds from the site. Disturbance effects during the operational phase may be less than during the construction phase, as species may become habituated to wind turbines and disturbance due to human activities would be considerably reduced.

Studies have shown that, in general, species are not disturbed beyond 500m to 800m from wind turbines (e.g. Drewitt and Langston, 2006 and references therein; Hötker *et al*., 2006; Pearce-Higgins *et al*., 2009) and, in some cases, birds do not appear to have been disturbed at all (e.g. Devereux *et al*., 2008; Whitfield *et al*., 2010; Douglas *et al*., 2011; Fielding and Haworth, 2013).

Individual turbines, or the Wind Farm as a whole, may also present a barrier to the movement of birds, restricting or displacing birds from much larger areas. The effect this would have on a population, if affected, could be subtle, and may be difficult to predict. If birds regularly have to fly over or around obstacles or are forced into suboptimal habitats, this may result in greater energy expenditure. By implication, this will reduce the efficiency with which they accumulate reserves, potentially affecting their survival or breeding success. However, logically, barrier effects can only be possible if there is clear evidence birds are regularly flying through a site, or regularly using the habitats within the site, which are optimal for foraging, breeding or roosting.

Disturbance/ displacement and barrier effects during operation may affect species in the breeding season or roosting and foraging species outside of the breeding season, within the relevant parts of the study area, i.e. close to the proposed wind turbines. Disturbance relating to the substation and access tracks is less likely to be significant during operation. As such, the assessment concentrates on two important wildfowl species (whooper swan and Greenland white-fronted goose) and breeding peregrine falcon. Whilst other important, wide-ranging species may suffer some disturbance from wind turbines whilst foraging, effects are not likely to be significant given the large size of their respective foraging ranges and the wide availability of more optimal, alternative foraging habitats located outside the site (see Section 7.5.3.2). Other species (such as Eurasian wigeon, European golden plover, northern lapwing, Eurasian curlew, black-headed gull and kestrel) are therefore not considered in further detail here.

7.5.4.1.1 *Whooper swan and Greenland white-fronted goose*

A review of wind farm impacts on swans and geese (Rees 2012) considered data published on the effects of offshore and onshore windfarms on swans and geese and found that available information is patchy. Key knowledge gaps within the scientific community more generally include whether wind farm installation has a consistently negative effect on the number of birds returning to a wintering area; whether flight avoidance behaviour varies with weather conditions, wind farm size, habituation, and the alignment of the turbines; provision of robust avoidance rate measures; and the extent to which serial wind farm development has a cumulative impact on specific swan and goose populations. The review by Hötker *et al.* (2006) found that seven of 127 wind farm studies (not all relating to swans or geese) assessed and found evidence for turbines having a barrier effect on goose movements during migration or whilst commuting more locally (e.g. between feeding and roosting sites). Single observations and extensive investigations were combined, and a barrier effect was assumed in quantitative studies if at least 5% of the individuals or flocks showed a measurable reaction by changing their flight direction to go around or over a wind farm (Hötker *et al.* 2006). These observations were made during daylight as there was insufficient information at the time (e.g. through radar studies) on the birds' flight lines at night, when migration can occur.

Radar studies (at offshore sites) have shown avoidance behaviour (i.e., changes in flight lines) for swans or geese (e.g., Fijn et al. 2007, 2012). Avoidance behaviour was observed at a range of a few hundred metres to 2-3 km. Swans and geese are considered sensitive to these developments because they frequent open landscapes (Hötker et al. 2006). The review by Hötker et al. (2006) indicated that the mean minimal distances (disturbance area) to wind farms ranged from 150 m for swans to 373 m for geese. Other studies considered by Rees (2012) recorded displacement distances of 200–560 m for swans and 30–600 m for geese at terrestrial wind farms.

At Seven Hills, most[20] foraging whooper swans were recorded beyond the 500 m buffer of the Northern and Southern Clusters and all Greenland white-fronted goose activity was focussed around Lough Croan and beyond (i.e., beyond the 1 km buffer of the Northern and Southern Clusters).

Whilst acknowledging that there are knowledge gaps with regard to disturbance/ displacement and barrier effects in the scientific community generally, considering the distances involved and the limited number of flights recorded through the sites, it is likely that any disturbance/displacement or barrier effects on whooper swan and Greenland white-fronted goose during the operation of the Seven Hills Wind Farm will not be significant.

7.5.4.1.2 *Peregrine Falcon*

There will be negligible and not significant disturbance/displacement and barrier effect impacts for foraging peregrine. This is because the species has a large home range (up to 6 km, Hardey *et al.* 2013), its use of the site is infrequent and there is wide availability of displacement habitats in the wider landscape (see Section 7.5.3.2). Of greater importance are the potential impacts on nesting peregrine. As stated previously there is an advised upper limit of 750m for disturbance to nesting peregrine falcons (Ruddock and Whitfield 2007). However, as well as successfully breeding in active quarries and urban areas in the UK and Ireland, SLR is aware of post-construction monitoring of at least two Scottish wind farms where successful breeding by peregrine falcon has occurred within 500 m of turbines. The peregrine falcon nest site within the study area lies over this distance (580-700m from two of the proposed turbine locations) at a site which is regularly disturbed by human activity (i.e., within a working quarry).

In addition, peregrine falcons have nested successfully using a nest box fixed to a wind turbine in Germany[21]. Birds nesting in working quarries appear to be more tolerant of disturbance although their reactions can depend on whether disturbance occurs inside or outside quarry-working hours (Ruddock and Whitfield 2007).

For this reason, given the intervening distance and the location of the nest site within a working quarry showing that peregrine falcon is a species which can become inured to the effects of at least some human disturbance, it is likely that any disturbance/displacement impacts on peregrine falcon during the operation of the Seven Hills Wind Farm will be negligible and not significant.

7.5.4.2 Collision with Wind Turbines

Collision of a bird with turbine rotors is almost certain to result in the death of the bird. In low density populations (e.g. raptors) this could have a greater negative effect on the local population than in higher density populations (e.g. passerines) because a higher proportion of the local population would be affected in a low density population. Larger birds such as raptors also live longer and have much slower reproductive rates than passerines, which can also increase the significance of the impact of collisions on the relevant population. The frequency and likelihood of a collision occurring depends on a number of factors which include aspects of the size and behaviour of the bird (including their use of a site), the nature of the surrounding environment, and the structure and layout of the wind turbines.

Collision risk is perceived to be higher for birds that spend much of the time in the air, such as foraging raptors and those that have regular flight paths between feeding and breeding/roosting grounds (e.g.

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[20] *Over three winter seasons of survey, 805 (76%) whooper swans were recorded foraging outside the 500 m buffer compared to 258 (24%) within.*
[21] *https://renews.biz/32727/raptors-revel-in-enercon-nest/*

wildfowl). The risk of bird collisions at wind farms is greatest in areas where large concentrations of birds are present (such as on major migration routes), and in poor flying conditions, such as rain, fog, strong winds that affect birds' ability to control flight manoeuvres, or on dark nights when visibility is reduced (Langston and Pullan, 2003; Drewitt and Langston, 2006 and references therein). Birds may also be more susceptible if the wind farm is located in an area of high prey density. For diurnal foraging raptors, the proximity of structures on which to perch can increase the likelihood of collision with wind turbines (e.g. Percival, 2005 and references therein).

It should be noted that operational disturbance and collision risk effects are mutually exclusive in a spatial sense; i.e. a bird that avoids the wind farm area due to disturbance cannot be at risk of collision with the turbine rotors at the same time. However, they are not mutually exclusive in a temporal sense; i.e. a bird may initially avoid the wind farm but habituate to it, and would then be at risk of collision.

Passerines nesting within a wind farm site would be expected to be regularly flying between wind turbines and could therefore be expected to be most at risk of collision. However, passerines tend to fly below Potential Collision Height (PCH) and evidence suggests that passerines collide with wind turbines relatively infrequently. Moreover, most of the species concerned are of low or negligible conservation value or have relatively large populations and high reproductive rates. Collision is therefore mainly considered in relation to species of high sensitivity, e.g. target raptor species and species not particularly maneuverable in flight, such as geese and swans.

Species with sufficient data (minimum of five flights and/or minimum of 10 birds per season) to undertake CRM are considered at risk of collision with the proposed wind turbines at the site. VORs that were subject to CRM are as follows:

- Whooper swan;
- Greenland white-fronted goose;
- Eurasian wigeon;
- Peregrine falcon;
- Kestrel;
- European golden plover;
- Northern lapwing;
- Eurasian curlew; and
- Black-headed gull.

For all other species, the number of flights within the Collision Risk Zone (CRZ), i.e. flights through the Wind Farm Polygon (WP) at PCH, was so low that CRM was not warranted and collision risk is considered negligible.

Kestrel was not included as a primary target species at the time of all non-breeding (2018/19, 2019/20 and 2020/21) and most breeding season (2019 and 2020) surveys and therefore has not been subject to detailed CRM for those years. For those years, it has been included for qualitative collision risk appraisal based on secondary target species data collected during VP watches. For the 2021 breeding season, it was included as a primary target species where it has been subjected to detailed CRM.

Due to the lack of regular flight lines across the viewsheds a random (bird occupancy method) CRM was considered suitable and used for all VORs subject to modelling.

The results of the CRM are described below for each of the species modelled, along with an assessment of whether predicted collision rates are likely to be significant. Further information about predicted collision rates is provided in the avian CRM report (Technical Appendix 7-7).

7.5.4.2.1 Rationale for prediction of effect

Without application of methods such as Population Viability Analysis (PVA) it is not known to what extent the populations of target species can sustain additional levels of mortality. It has been assumed, (as recommended by Percival 2003), that any impact not increasing adult mortality by more than 1% of the existing background mortality rate can be considered to be insignificant. It should be noted that this method is highly precautionary when applying to non-breeding populations, as it uses the highest survival rates (i.e., for adult birds) for context. Where survival rates are high, a smaller number of collisions with turbines are needed for the excess mortality to be >1% of the background levels, i.e., the threshold for a potentially significant effect. Using adult survival rates (which are higher than juvenile survival rates), makes it more likely to identify a potentially significant effect of turbine collisions on the avian population under consideration.

7.5.4.2.2 *Whooper swan*

Three whooper swan collisions have been reported at European wind farms, none of which were in Great Britain (GB) or Ireland (Dürr 2019). Whilst it is acknowledged that there may be other, unpublished reports of collisions of this species, whooper swan collisions nevertheless appear to be an uncommon event.

The whooper swan flight activity survey data for Seven Hills northern and southern clusters are shown on drawings within the baseline survey reports (Technical Appendices 7.1-7.6). Flights were predominantly associated with two turloughs (Feacle Turlough and Thomas Street Turlough)[22].

Collision risk analysis has been carried out on flight activity data from each cluster using data from the 2018/19, 2019/20 and 2020/21 non-breeding seasons. Based on these data, four whooper swan flights (involving 34 birds) were recorded at PCH within the CRZ during surveys at the northern cluster and 18 whooper swan flights (involving 96 birds) were recorded at PCH within the southern cluster CRZ.

Assuming a 99.5% avoidance rate, there was a mean annual collision rate of 0.095 (approximately one collision every 10-11 years) predicted for the northern cluster and a mean annual collision rate of 0.133 (approximately one collision every 7-8 years) for the southern cluster. This amounts to a combined annual collision rate of 0.228 (one collision every 4-5 years).

The predicted annual mortality (0.228 individuals per year) has been assessed in the context of the estimated ROI wintering population in January 2020 (14,467 individuals; BirdWatch Ireland 2020). In order to determine whether the predicted annual mortality is significant in terms of the nearby SPA populations the modelling results have also been assessed in the context of the one SPA for which whooper swan is a qualifying species that is located within the core foraging range for whooper swan (5 km, SNH 2016), i.e., the River Suck Callows SPA (124 individuals, 1995; 200 individuals, 2014/15 – 2017/18).

The following is based on the precautionary assumption that all birds recorded flying through the CRZ form part of the relevant SPA population. In the context of background annual adult mortality of 19.9% (BTO Birdfacts), which amounts to 2,879 birds in the context of the ROI population of 14,467 birds, the additional annual mortality of 0.228 birds represents an increase of <0.01% on background mortality. With regard to River Suck Callows SPA, the additional annual mortality of 0.228 birds represents an increase of 0.6-0.9% on background mortality (based on 124 – 200 individuals). This is in the context of an overall increasing whooper swan population (BirdWatch Ireland 2021). Therefore, it is considered that the predicted collision rate of 0.228 birds per year would not result in a significant decline in the SPA population of whooper swan and is not significant.

7.5.4.2.3 *Greenland white-fronted goose*

[22] *CRM is undertaken for all flights within 500m of the outermost turbine blades as a precautionary approach (to take into account spatial errors in mapping). Although both turloughs are more than 500m from the closest turbine, Feacle Turlough is located within a line drawn 500m from the outermost turbine blades (see Figure 1 in Technical Appendix 7-7) and hence a number of flights associated with the turlough have been included in the CRM.*

No Greenland white-fronted goose collisions have been recorded at European wind farms, but there have been six greater white-fronted goose collisions reported. None of these were in the GB or Ireland (Dürr 2019). Although there may be other, unpublished reports of collisions of this species, white-fronted goose collisions nevertheless appear to be an uncommon event.

The Greenland white-fronted goose flight activity survey data for Seven Hills northern and southern clusters are shown on drawings within the baseline survey reports (Technical Appendices 7.1-7.6). Flight activity across the site was fairly low, with most activity focused outside the 500 m buffer.

Collision risk analysis has been carried out on flight activity data from surveys in 2018/19, 2019/20 and 2020/21. Sufficient data for modelling were available for the northern cluster in the 2018/19 non-breeding season only. During this period, there were two Greenland white-fronted goose flights (involving 19 birds) recorded at PCH within the CRZ.

Assuming a 99.8% avoidance rate, there was a mean annual collision rate of 0.054 (approximately one collision every 18-19 years) predicted for the northern cluster.

In order to determine whether the predicted annual mortality is significant in terms of the nearby SPA populations the modelling results have been assessed in the context of the reference populations of the SPAs for which Greenland white-fronted goose is a qualifying species with the lowest Greenland white-fronted goose reference population that is located within the core foraging range for the species (5 – 8 km, SNH 2016) (Four Roads Turlough SPA, (93 individuals, 2010)). If more recent data are taken into account the SPA within the core foraging range with the lowest population is the River Suck Callows SPA (28 individuals, based on I-WeBS data from 2014/15 - 2017/18).

It is likely that, even if actually realised, the predicted collision rate of 0.054 birds per year would not result in a population decline of Greenland white-fronted goose in Four Roads Turlough SPA or River Suck Callows SPA (even based on the precautionary assumption that all birds flying through the CRZ are SPA birds). In the context of background annual adult mortality of 28% (BTO Birdfacts), which amounts to 26 birds in the context of the 2010 Four Roads Turlough SPA population of 93 birds and 7.8 birds in the context of the 2014/15 – 2017/18 River Suck Callows SPA population of 28 birds, the additional annual mortality of 0.054 birds is not significant for Greenland white-fronted goose (increase of 0.2-0.7% on background mortality).

7.5.4.2.4 Eurasian wigeon

Six Eurasian wigeon collisions have been reported at European wind farms, none of which were in the GB or Ireland (Dürr 2019). Although there may be other, unpublished reports of collisions of this species, Eurasian wigeon collisions nevertheless appear to be an uncommon event.

The Eurasian wigeon flight activity survey data for Seven Hills northern and southern clusters are shown on drawings within the baseline survey reports (Technical Appendices 7.1-7.6). Flights were predominantly associated with Feacle Turlough, and as such were generally not associated with the proposed turbine locations but were within the 500m buffer used for CRM for the southern cluster only. It is therefore likely that collision risk estimates, which include these flights, have been overestimated.

Collision risk analysis has been carried out on flight activity data from the southern cluster using data from the 2018/19 and 2020/21 non-breeding seasons. Based on these data, five Eurasian wigeon flights (involving 195 birds) were recorded at PCH within the CRZ.

Assuming a 98% avoidance rate, there was a mean annual collision rate of 0.794 (approximately one collision every 1-2 years) predicted for the southern cluster.

In order to determine whether the predicted annual mortality is significant in terms of the nearby SPA populations the modelling results (0.794 individuals per year) have been assessed in the context of the reference population of the SPA within 15 km with the lowest Eurasian wigeon reference population (River Suck Callows SPA, (1,203 individuals, 1995)). If more recent data are taken into account the SPA within 15 km with the lowest population is the Middle Suck Callows SPA (405 individuals, based on I-WeBS data from 2010/11 - 2017/18)[23].

It is likely that, even if actually realised, the predicted collision rate of 0.794 birds per year would not result in a population decline of Eurasian wigeon in the River Suck Callows SPA or Middle Suck Callows SPA (even based on the precautionary assumption that all birds flying through the CRZ are SPA birds). In the context of background annual adult mortality of 47% (BTO Birdfacts), which amounts to 565 birds in the context of the 1995 River Suck Callows SPA population of 1,203 birds or 190 birds in the context of the 2010/11 – 2017/18 Middle Suck Callows SPA population of 405 birds, the additional annual mortality of 0.794 birds is not significant for Eurasian wigeon (increase of 0.1-0.4% on background mortality).

7.5.4.2.5 ***Peregrine falcon***

Thirty collisions have been reported at European wind farms, one of which was in GB and Ireland (in the UK) (Dürr 2019). Although there may be other, unpublished reports of collisions of this species, peregrine falcon collisions nevertheless appear to be an uncommon event.

The peregrine falcon flight activity survey data for Seven Hills northern and southern clusters are shown on drawings within the baseline survey reports (Technical Appendices 7.1-7.6).

Collision risk analysis has been carried out on flight activity data from each cluster using data from all seasons from winter 2018 to summer 2021. Based on these data, two peregrine falcon flights (involving single birds in the breeding season) were recorded at PCH within the northern cluster CRZ and nine flights involving a single bird on each occasion (three of which were in the breeding season) were recorded at PCH within the southern cluster CRZ.

Assuming a 98% avoidance rate, there was a mean annual collision rate of 0.017, based on non-breeding season data (approximately one collision every 59-60 years), predicted for the southern cluster. There was insufficient breeding season activity to warrant CRM.

The predicted annual mortality (0.017 individuals per year) has been assessed in the context of the estimated ROI breeding population in 2016-17 (425 territorial pairs/ 850 individuals Wilson-Parr, R. & O'Brien, I. (Eds) (2019)).

It is likely that, even if actually realised, the predicted collision rate of 0.017 birds per year would not result in a population decline of breeding peregrine falcon (based on the precautionary assumption that all birds are breeding birds). In the context of background annual adult mortality of 19% (BTO Birdfacts), which amounts to 162 birds in the context of the ROI population of 850 birds, the additional annual mortality of 0.017 birds is not significant for peregrine falcon (increase of 0.01% on background mortality). Such a small increase in background mortality is also unlikely to be significant at a regional or even local level.

7.5.4.2.6 ***European golden plover***

[23] The 2013/14 – 2017/18 population for Lough Ree is lower (17) but is so low as to make comparisons meaningless and it is extremely unlikely that the birds recorded flying through the CRZ relate to birds from that population due to the very small number of birds involved and the fact that Lough Ree is 8 km from the site and that birds are more likely to favour areas immediately surrounding the SPA for foraging.

39 European golden plover collisions have been reported at European wind farms, none of which were in the GB or Ireland (Dürr 2019). Although there may be other, unpublished reports of collisions of this species, European golden plover collisions nevertheless appear to be an uncommon event.

The European golden plover flight activity survey data for Seven Hills northern and southern clusters are shown on drawings within the baseline survey reports (Technical Appendices 7.1-7.6). Flights were predominantly associated with two turloughs (Feacle Turlough and Thomas Street Turlough), and as such were generally not associated with the proposed turbine locations although some of these flights were within the 500m buffer for both the northern and southern clusters. It is therefore likely that collision risk estimates, which include these flights, have been overestimated.

Collision risk analysis has been carried out on flight activity data from each cluster using data from the 2018/19, 2019/20 and 2020/21 non-breeding seasons. Based on these data, five European golden plover flights (involving 149 birds) were recorded at PCH within the CRZ during surveys at the northern cluster and ten European golden plover flights (involving 169 birds) were recorded at PCH within CRZ surveys at the southern cluster.

Assuming a 98% avoidance rate, there was a mean annual collision rate of 0.432 (approximately one collision every 2-3 years) predicted for the northern cluster and a mean annual collision rate of 0.847 (approximately one collision every 1-2 years for the southern cluster. This amounts to a combined annual collision rate of 1.279.

In order to determine whether the predicted annual mortality is significant in terms of the nearby SPA populations the modelling results (1.279 individuals per year) have been assessed in the context of the reference population of the nearest SPA where European golden plover is a designated feature (Lough Croan Turlough SPA, (2,025 individuals, 2010)). If more recent data are taken into account the SPA within 15 km with the lowest population is the Middle Suck Callows SPA (576 individuals, based on I-WeBS data from 2010/11 - 2017/18).

It is likely that, even if actually realised, the predicted collision rate of 1.279 birds per year would not result in a population decline of European golden plover in Lough Croan Turlough SPA or Middle Suck Callows SPA (even based on the precautionary assumption that all birds flying through the CRZ are SPA birds). In the context of background annual adult mortality of 27% (BTO Birdfacts), which amounts to 547 birds in the context of the 2010 Lough Croan Turlough SPA population of 2,025 birds and 144 birds in the context of the 2010/11 – 2017/18 Middle Suck Callows SPA population of 576 birds, the additional annual mortality of 1.279 birds is not significant for European golden plover (increase of 0.2-0.9% on background mortality).

7.5.4.2.7 *Northern lapwing*

27 northern lapwing collisions have been reported at European wind farms, none of which were in the GB or Ireland (Dürr 2019). Although there may be other, unpublished reports of collisions of this species, northern lapwing collisions nevertheless appear to be an uncommon event.

The northern lapwing flight activity survey data for Seven Hills northern and southern clusters are shown on drawings within the baseline survey reports (Technical Appendices 7.1-7.6). Flights were predominantly associated with Turloughs (in particular Feacle Turlough south of the southern cluster), and as such were generally not associated with the proposed turbine locations but were within the 500m buffer at the southern cluster. It is therefore likely that collision risk estimates, which include these flights, have been overestimated.

Collision risk analysis has been carried out on flight activity data from each cluster using data from the 2018/19, 2019/20 and 2020/21 non-breeding seasons and the 2020 and 2021 breeding seasons. Based on these data, one northern lapwing flight (involving 10 birds) was recorded at PCH within the CRZ during surveys at the northern cluster and 25 northern lapwing flights (involving 548 birds) were recorded at PCH within the southern cluster CRZ.

Assuming a 98% avoidance rate, there was a mean annual collision rate of 0.160 (approximately one collision every 6-7 years) predicted for the northern cluster and a mean annual collision rate of 1.509 based on non-breeding season data for the southern cluster and a mean annual collision rate of 0.855 based on breeding season data for the southern cluster (approximately one collision every 1.2 years). This amounts to a combined annual collision rate of 1.66 (non-breeding season) and 0.855 (breeding season).

In order to determine whether the predicted annual mortality is significant in terms of the nearby SPA populations the predicted annual non-breeding season mortality (1.66 individuals per year) has been assessed in the context of the reference population of the SPA within 15 km with the lowest northern lapwing reference population, designated for the non-breeding season population[24] (River Suck Callows SPA, (3,640 individuals, 1995)). If more recent data are taken into account the SPA within 15 km with the lowest population is the Middle Suck Callows SPA (597 individuals, based on I-WeBS data from 2010/11 - 2017/18).

It is likely that, even if actually realised, the predicted collision rate of 1.66 birds per year would not result in a population decline of northern lapwing in River Suck Callows SPA or Middle Suck Callows SPA (even based on the precautionary assumption that all birds flying through the CRZ are SPA birds). In the context of background annual adult mortality of 30% (BTO Birdfacts), which amounts to 1,074 birds in the context of the 1995 River Suck Callows SPA population of 3,640 birds and 179 birds in the context of the 2010/11 – 2017/18 Middle Suck Callows SPA population of 597 birds, the additional annual mortality of 1.66 birds is not significant for northern lapwing (increase of 0.2-0.9-% on background mortality).

7.5.4.2.8 *Eurasian curlew*

Twelve Eurasian curlew collisions have been reported at European wind farms, none of which were in the GB or Ireland (Dürr 2019). Although there may be other, unpublished reports of collisions of this species, Eurasian curlew collisions nevertheless appear to be an uncommon event.

The Eurasian curlew flight activity survey data for Seven Hills northern and southern clusters are shown on drawings within the baseline survey reports (Technical Appendices 7.1-7.6). The majority of flights were associated with Feacle Turlough (south of the southern cluster), and as such were generally not associated with the proposed turbine locations but were within the 500m buffer at the southern cluster. It is therefore likely that collision risk estimates, which include these flights, have been overestimated, as the birds are unlikely to use the areas where turbines are proposed with most of the flight activity predictably associated with this turlough.

Collision risk analysis has been carried out on flight activity data from the southern cluster (there were insufficient data at the northern cluster) using data from the 2018/19 non-breeding season. Based on these data, 14 Eurasian curlew flights (involving 212 birds) were recorded at PCH within the CRZ during surveys at the southern cluster.

Assuming a 98% avoidance rate, there was an annual collision rate of 1.171 (approximately one collision every 10 months) predicted for the southern cluster based on non-breeding season data.

The predicted annual non-breeding season mortality (1.171 individuals per year) has been assessed in the context of the estimated ROI wintering population in 2016/17 (14,994 individuals; I-WeBS) and nearby sites for which I-WeBS data are available (Feacle Turlough, River Suck Callows and Southern Roscommon Lakes (recent 5-year mean peaks of 55, 158 and 96 individuals respectively, totaling 309 individuals), which are assumed to represent the regional/county population.

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[24] *Therefore, no assessment for breeding northern lapwing is required.*

It is likely that, even if actually realised, the predicted collision rate of 1.171 birds per year would not result in a population decline of Eurasian curlew in the national context (0.08% increase on background mortality). With regard to regional populations, the River Suck I-WeBS site most recent 5-year mean peak is 158. In the context of background annual adult mortality of 10% (BTO Birdfacts), which amounts to 31 birds in the context of the regional wintering population of 309 birds, the additional annual mortality of 1.171 birds is potentially significant for Eurasian curlew (increase of 3.8% on background mortality) in the context of the regional population. However, it should be re-iterated that collision risk is likely to have been over-estimated due to the majority of flights being associated with Feacle Turlough, rather than the southern cluster turbine locations. The assumed regional population figure is also likely to represent an under-estimate as it excludes birds present outside sites included in I-WeBS counts.

7.5.4.2.9 Black-headed gull

667 black-headed gull collisions have been reported at European wind farms, including 12 in GB and Ireland (Dürr 2019), therefore it seems that black-headed gull collisions are relatively common events.

The black-headed gull flight activity survey data for Seven Hills northern and southern clusters are shown on drawings within the baseline survey reports (Technical Appendices 7.1-7.6). Flights were predominantly associated with the two Turloughs (Feacle Turlough and Thomas Street Turlough), and as such were generally not associated with the turbine locations, but many were within the 500m buffer at both clusters. It is therefore likely that collision risk estimates, which include these flights, have been overestimated.

Collision risk analysis has been carried out on flight activity data from the southern cluster (there were insufficient data at the northern cluster) using data from the 2020 and 2021 breeding season only[25]. Based on these data, 56 black-headed gull flights (involving 95 birds) were recorded at PCH within the CRZ.

With regard to non-breeding season secondary species data, the location of black-headed gull activity was recorded in 2019/20 & 2020/21, and the majority of birds were recorded off site (i.e., in the 500 m buffer or beyond). Although relatively large flocks were recorded, all of these were associated with either Thomas Street Turlough, Feacle Turlough or in flooded fields off site. In addition, where recorded, the majority of flights were below potential collision risk height (e.g., in 2019/20 only five out of 63 flights were at potential collision risk height). Collision risk is therefore considered unlikely to be significant in the context of a ROI non-breeding population of 14,994 birds.

Assuming a 98% avoidance rate, there was a mean annual collision rate of 0.697 based on breeding season data (approximately one collision every 1.4 years) predicted for the southern cluster.

The predicted annual breeding season mortality (0.697 individuals per year) has been assessed in the context of the estimated ROI breeding population 2015-18 (15,620 individuals; JNCC) and the regional breeding population[26] (100 individuals, 1995).

In the context of background annual adult mortality of 10% (BTO Birdfacts), the predicted collision rate of 0.697 birds per year would not result in a population decline of breeding black-headed gull in the ROI (0.04% increase on background mortality[27] based on the precautionary assumption that all birds are breeding birds). In the context of a regional breeding population of 100 birds, the additional annual

[25] There were similar numbers of birds and flight lines recorded at the two clusters in 2019 and 2020, suggesting the collision risk estimates based on the 2020 data are also broadly representative of 2019. For example, at the southern cluster there were 47 birds and 24 flight lines in 2019 and 44 birds and 19 flight lines in 2020. There were two birds and one flight line in 2019 and 41 birds and 13 flight lines in 2020 at the northern cluster.
[26] Lough Ree. Note that black-headed gull is not a designated feature of Lough Ree SPA, but is the only site within 15 km for which breeding season data are available
[27] A 1% increase in background mortality is considered significant (Percival, 2003)

mortality of 0.697 birds is potentially significant for black-headed gull (increase of 6.97% on background mortality, based on the precautionary assumption that all birds colliding with turbines are breeding birds and form part of the regional breeding population, which is unlikely).

However, it should be noted that Seven Hills is likely to be outside of the core foraging range for the Lough Ree colony. The exact location of the colony is unknown, but the edge of Lough Ree is 8 km from the site. There is a general lack of information on foraging distances of black-headed gull from inland colonies, but one study in the Mediterranean found that the core foraging range was 0 – 7 km (Fasola & Bogliani 1990). On that basis, the predicted mortality is considered unlikely to affect the Lough Ree colony as it is located further from Seven Hills than the core foraging range for this species and birds are much more likely to use similar habitat much closer to the colony (which is widespread). It should also be re-iterated that the estimated collision risk is likely to have been over-estimated due to the majority of flight activity being associated with Feacle Turlough, rather than around the southern cluster turbine locations. Feacle Turlough is located c. 730 m southeast of the nearest turbine.

7.5.4.2.10 *Kestrel*

614 kestrel collisions have been reported at European wind farms (Dürr 2021), therefore it seems that kestrel collisions are relatively common events.

Kestrel was not recorded as a primary target species in most survey years and so a qualitative appraisal of collision risk has been undertaken using secondary target species data for all years and seasons, except for the 2021 breeding season.

Kestrel was only recorded twice during VP watches in winter 2018/19, there were four records in winter 2019/20 and 15 records in winter 2020/21. Most records were for the southern cluster and where the location or height was recorded, all kestrel flights were recorded outside the collision risk zone. During the breeding season, there were ten kestrel records in 2019 and nine in 2020. As in the winter, most records were for the southern cluster and where the location or height was recorded, all flights were recorded outside the collision risk zone. In the 2021 breeding season, there were 9 flights of 9 individuals recorded at PCH within the CRZ.

Assuming a 95% avoidance rate, there was a mean annual collision rate of 0.637 (approximately 1 collision every 1.6 years) based on the breeding 2021 season data for the southern cluster. In the context of background mortality of 31% (BTO Birdfacts), the predicted collision rate of 0.637 birds per year is not significant for breeding kestrel in the ROI (0.02% increase on background mortality[28] based on a ROI breeding population of 13,500 birds).

Population data for kestrel at a regional level were not available and a quantitative assessment against background mortality rates at a regional or local level is not possible. However, given that no kestrels were recorded within the CRZ in the 2019 or 2020 breeding seasons and that a majority of the flight lines recorded in 2021 were on the margins of the WP, generally well away from any proposed turbine locations, it is likely that the 2021 predicted collision rate is an overestimate.

On the basis of the above, despite the relative frequency of kestrel collisions with turbines elsewhere in Europe, any mortality is considered unlikely to affect the regional breeding population and is therefore not likely to be significant.

7.5.4.3 Effects on Designated Site Bird Populations

Table 7-10 summarises the likely effects on the relevant qualifying features (i.e., those recorded during baseline surveys) of the European designated sites within the relevant species' core foraging range of Seven Hills. Where core foraging ranges were not available the distance used is a precautionary 20 km.

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[28] A 1% increase in background mortality is considered significant (Percival, 2003)

As shown in Section 7.3.1.1, no other SPAs beyond 15 km distance from the Site need to be considered. The rationale for the potential significance of effect is given in Section 7.5.4.2.1.

For brevity, only those impacts that are assessed as likely to occur, i.e. collision, have been included in Table 7-10. Impacts relating to nest damage/destruction, disturbance/ displacement, habitat loss and barrier effects are considered very unlikely to occur for any qualifying species for the relevant sites. This is because:

- None of the breeding species for which the sites within 15 km are designated are likely to use the habitats within the Site and therefore nest damage/destruction is not likely to occur;
- None of the habitat that will be directly lost is of particular importance for non-breeding wildfowl and waders therefore direct habitat loss for non-breeding species for which the sites within 15km are designated is not likely to occur;
- No adverse effects on any sites containing groundwater-dependent habitats are likely (see Chapter 9: Water and Hydrology) and therefore indirect habitat loss within the designated sites (or for other water bodies outside the relevant designated sites that may be used by SPA birds, e.g. Feacle Turlough or Thomas Street Turlough as mentioned in Section 7.3.1.1) is not likely to occur; and
- The abundance of alternative foraging habitats in the surrounding landscape and the relatively low number of flights through the northern and southern turbine clusters by species for which the sites within 15 km are designated mean that barrier effects are not likely to occur.

The nationally designated sites Lough Croan pNHA, Four Roads Turlough pNHA and Lough Ree pNHA are excluded from Table 7-10 on the basis that they overlap with SPAs of the same name and a summary of likely effects is already provided in the table for the relevant SPA. The Suck River Callows NHA is also included in Table 7-10 but considered as one with the River Suck Callows SPA on account of the reference population data for the site being the same as the reference data for the River Suck Callows SPA (and an assessment is therefore already included in the table for the relevant SPA).

Cranberry Lough pNHA is located 8.5 km from the site and is therefore beyond the core foraging range for whooper swan (5 km) and well beyond the core foraging range for any of the listed interest features during the breeding season, for which that site is proposed to be designated, none of which are likely to regularly forage more than a few hundred metres from their nest sites. Cranberry Lough pNHA is therefore also excluded from Table 7-10 on the basis that it lies beyond the core foraging range of the relevant species.

Table 7-10 Summary of Impacts[29] on Qualifying Features of Designated Sites within 15 km (Excluding Qualifying Features for SPAs which lie beyond the Core Foraging Range for the Relevant Species)

Designated Site	Distance from Seven Hills (km)	Qualifying Feature	Core Foraging Range (km)	Effect Assessed	Qualifying Feature Population[30]	Impact on Qualifying Feature	Significance of Impact
Lough Croan Turlough SPA	1.5	European golden plover	15	Collision with wind turbines	2,025 (at time of designation in 2010) 3,625 (Southern Roscommon Lakes population 2008/09 – 2017/18)	0.1-0.2% increase on background mortality	Not significant
	1.5	Greenland white-fronted goose	5-8	Collision with wind turbines	164 (at time of designation in 2010)	0.1-0.4% increase on background mortality	Not significant

[29] *Only those impacts that are assessed as likely to occur have been included in this table for brevity. Thus, nest damage/destruction, disturbance, displacement, habitat loss and barrier effects are not shown in this table as they are very unlikely to occur for the named Qualifying Features.*
[30] *Unless otherwise stated population figures provided are those given on the relevant Natura 2000 standard data form, i.e. the population at the time of designation. For qualifying features for which collision has been assessed in detail, more recent population figures are also provided where available.*

Designated Site	Distance from Seven Hills (km)	Qualifying Feature	Core Foraging Range (km)	Effect Assessed	Qualifying Feature Population[30]	Impact on Qualifying Feature	Significance of Impact
					41 (Southern Roscommon Lakes population 2008/09 – 2017/18)		
River Suck Callows SPA	1.7	Whooper swan	<5	Collision with wind turbines	124 (at time of designation in 1995) 200 (2014/15 – 2017/18)	0.6-0.9% increase on background mortality	Not significant
	1.7	Eurasian wigeon	15	Collision with wind turbines	1,203 (at time of designation in 1996) 1,311 (2014/15 – 2017/18)	0.1% increase on background mortality	Not significant
	1.7	European golden plover	15	Collision with wind turbines	2,241 (at time of designation in 1996)	0.1-0.6% increase on background mortality	Not significant

Designated Site	Distance from Seven Hills (km)	Qualifying Feature	Core Foraging Range (km)	Effect Assessed	Qualifying Feature Population[30]	Impact on Qualifying Feature	Significance of Impact
					835 (2014/15 – 2017/18)		
	1.7	Northern lapwing	15	Collision with wind turbines	3,640 (at time of designation in 1996) 1,431 (2014/15 – 2017/18)	0.1-0.4% increase on background mortality	Not significant
	1.7	Greenland white-fronted goose	5-8	Collision with wind turbines	386 (at time of designation in 1996) 28 (2014/15 – 2017/18)	0.1-0.7% increase on background mortality	Not significant
Four Roads Turlough SPA	1.9	European golden plover	15	Collision with wind turbines	3,717 (at time of designation in 2010) 3,625 (Southern Roscommon	0.1% increase on background mortality	Not significant

Designated Site	Distance from Seven Hills (km)	Qualifying Feature	Core Foraging Range (km)	Effect Assessed	Qualifying Feature Population[30]	Impact on Qualifying Feature	Significance of Impact
					Lakes population 2008/09 – 2017/18)		
	1.9	Greenland white-fronted goose	5-8	Collision with wind turbines	93 (at time of designation in 2010) 41 (Southern Roscommon Lakes population 2008/09 – 2017/18)	0.2-0.4% increase on background mortality	Not significant
Lough Ree SPA	8.0	Whooper swan	<5	Not assessed (beyond core foraging range)	89 (at time of designation in 1995) 4 (2013/14 – 2017/18)	Likely negligible	Not significant
	8.0	Eurasian wigeon	15	Collision with wind turbines	1,475 (at time of designation in 1995)	0.1% increase on background mortality	Not significant

Designated Site	Distance from Seven Hills (km)	Qualifying Feature	Core Foraging Range (km)	Effect Assessed	Qualifying Feature Population[30]	Impact on Qualifying Feature	Significance of Impact
					17 (2013/14 – 2017/18)	(comparison with 2013/14 – 2017/18 data not applicable)	
	8.0	Eurasian teal	15	Not assessed (so few observations that collision risk modelling not possible, indicating negligible levels of collision risk; see Section 7.5.4.2))	912	Likely negligible	Not significant
	8.0	Mallard	15	Not assessed (so few observations that collision risk modelling not possible, indicating negligible levels of collision risk; see Section 7.5.4.2)	675	Likely negligible	Not significant
	8.0	Common coot	15	Not assessed (so few observations that collision risk modelling not possible, indicating negligible levels of collision risk; see Section 7.5.4.2)	250	Likely Negligible	Not significant

Designated Site	Distance from Seven Hills (km)	Qualifying Feature	Core Foraging Range (km)	Effect Assessed	Qualifying Feature Population[30]	Impact on Qualifying Feature	Significance of Impact
	8.0	European golden plover	15	Collision with wind turbines	2,035 (at time of designation in 1995) 1,127 (2013/14 – 2017/18)	0.1-0.4% increase on background mortality	Not significant
	8.0	Northern lapwing	15	Collision with wind turbines	3,870 (at time of designation in 1995) 608 (2013/14 – 2017/18)	0.1-0.9% increase on background mortality	Not significant
	8.0	Common scoter	15	Not assessed (so few observations that collision risk modelling not possible indicating negligible levels of collision risk; see Section 7.5.4.2)	60	Likely Negligible	Not significant
	11.4	Whooper swan	<5	Not assessed (beyond core foraging range)	287 (at time of	Likely negligible	Not significant

Designated Site	Distance from Seven Hills (km)	Qualifying Feature	Core Foraging Range (km)	Effect Assessed	Qualifying Feature Population[30]	Impact on Qualifying Feature	Significance of Impact
Middle Shannon Callows SPA					designation in 1995) 102 (2010/11 – 2017/18)		
	11.4	Eurasian wigeon	15	Collision with wind turbines	2,972 (at time of designation in 1995) 405 (2010/11 – 2017/18)	0.1-0.4% increase on background mortality	Not significant
	11.4	European golden plover	15	Collision with wind turbines	4,254 (at time of designation in 1995) 576 (2010/11 – 2017/18)	0.1-0.8% increase on background mortality	Not significant
	11.4	Northern lapwing	15	Collision with wind turbines	11,578 (at time of designation in 1995) 597 (2010/11 – 2017/18)	0.04-0.9% increase on background mortality	Not significant

Designated Site	Distance from Seven Hills (km)	Qualifying Feature	Core Foraging Range (km)	Effect Assessed	Qualifying Feature Population[30]	Impact on Qualifying Feature	Significance of Impact
	11.4	Black-headed gull	15	Not assessed for non-breeding birds for which this SPA is designated (see Section 7.2.3.1).	1,061	Likely negligible	Not significant

7.5.4.4 Mitigation

No additional mitigation, additional to the embedded mitigation measures set out in Section 7.5.2, is considered necessary. This is because the embedded mitigation measures set out are sufficiently comprehensive to avoid significant effects during construction and the likely effects on nearby designated sites and local bird populations during operation are not significant.

7.5.4.5 Residual Effects

During construction, following the employment of the proposed good practice measures, it is likely that there will be no significant residual effects on peregrine falcon even if nesting occurs within the study area during the construction period.

During operation, the likely potential impact of collision mortality on Eurasian curlew and black-headed gull would be of potentially regional/county significance, although this is based on a number of precautionary assumptions for both species and the true level of mortality is considered likely to be lower.

The likely potential impact of collision mortality on the other species assessed (including the qualifying features of designated sites within core foraging ranges up to 15 km) would not be significant, based on the results of the CRM, although some mortality is likely to occur. Post consent monitoring will be undertaken to identify any unforeseen significant adverse effects in order to be able to undertake appropriate remedial action, if required (see Section 7.7).

All other potential impacts on the species assessed, including nest damage or destruction, habitat loss (direct and indirect), disturbance/displacement and barrier effects would be non-significant.

7.5.5 Decommissioning Effects

Potential effects associated with decommissioning of the Proposed Development are assumed to be similar to, albeit somewhat reduced to those identified for construction phase (i.e. potentially disturbance/ displacement but not habitat loss). As there are no significant adverse construction effects likely for any VOR, decommissioning effects are not considered separately for each species.

Due to the length of the operational period (30 years) the future composition of the bird community at the site is not known and the confidence in any prediction would be uncertain. In the absence of mitigation, decommissioning could cause short term effects through disturbance. Good practice measures, similar to those employed during the construction phase, including surveys prior to decommissioning, to inform an up-to-date assessment of potential effects on important bird species, would be implemented during decommissioning. Following the implementation of these measures no significant effects are anticipated.

7.5.6 Cumulative Effects Assessment

Potential cumulative effects on VORs have been considered in relation to operational, consented and wind farms for which applications have been submitted within 20 km of Seven Hills. Online searches for relevant information were made using relevant local authority (Roscommon County Council) and ABP websites.

There are three wind farm developments located in proximity to the proposed wind farm:

- Skrine Wind Farm, which lies approximately 8.5 km north of the site and consists of two constructed turbines;

- Derrane Wind Farm, which is located approximately 20 km north of the site and consists of two turbines not yet constructed; and
- Kilcash Wind Farm, which is located approximately 10.3 km north of the site and consists of one turbine; the application is currently under consideration by the Council.

No documents relevant to ornithology for Skrine Wind Farm or Derrane Wind Farm were available in an online search suggesting it was not assessed given the small size of the schemes and therefore no quantitative assessment of cumulative effects for these projects is possible. However, given the separation distances, and given that both wind farms contain only two turbines each, significant cumulative effects are very unlikely. This is because the further away two wind farms are from each other, the lower the likelihood that bird populations will be affected by both wind farms. Similarly, the fewer turbines that are present in each wind farm, the lower the additive cumulative collision risk.

For Kilcash Wind Farm, according to the NIS written in November 2021 by EirEco, bird surveys carried out to inform the planning application for Kilcash Wind Farm recorded the following target species: European golden plover, Northern lapwing, whooper swan, mute swan, buzzard, sparrowhawk, kestrel, peregrine falcon, gull species, mallard, cormorant, swallow *Hirundo rustica* and house martin *Delichon urbica*.

Given the separation distance between Kilcash Wind Farm and the site, any cumulative negative effects of habitat loss or disturbance to VOR bird species are very unlikely to be significant. Similarly, Kilcash Wind Farm is located within a separate WFD (Water Framework Directive) sub-catchment and there is no hydrogeological link between the two proposed wind farms meaning cumulative effects resulting from indirect habitat loss are unlikely. Given that Kilcash Wind Farm consists of a single turbine and given the intervening distance, there is no realistic potential for significant cumulative negative effects due to barrier effects or operational displacement upon VORs. In terms of collision risk, collision risk modelling was not undertaken for Kilcash and therefore a quantitative assessment of cumulative collision risk is not possible, although the lack of collision risk modelling for Kilcash suggests that collision risk was considered to be negligible for all species. However, given the separation distance, and given that Kilcash is only a single turbine, significant cumulative effects resulting from collision are very unlikely. This is because the further away two wind farms are from each other, the lower the likelihood that bird populations will be affected by both wind farms. Similarly, the fewer turbines that are present in each wind farm, the lower the additive cumulative collision risk.

Other (non- wind farm) projects with the potential to have cumulative negative effects on VORs include the operational Cam Roadstone Quarry, which is located to the south of the R363 and is approximately 100 m from the site. It is assumed that works at the quarry will continue throughout the construction and operation of the proposed Wind Farm. The only cumulative effect that may occur is possible disturbance to VORs from noise and human/vehicular presence, particularly during construction of the Wind Farm. Given that the quarry has been operational for several years, it is likely any VORs have habituated to the quarry's presence. Therefore, following the implementation of the proposed embedded measures during construction there is not likely to be any significant cumulative negative effects on VORs as a result of the construction and operation of the proposed Wind Farm.

Other projects within the local area are limited to minor proposals such as one-off dwelling houses and are not considered to have the potential for significant cumulative negative effects on VORs.

It was also concluded there were no significant negative cumulative effects on groundwater-dependent habitats in Chapter 9: Water and Hydrology, which precludes the possibility of cumulative negative effects on VORs that use such habitats.

As there are no effects predicted on VORs as a result of the proposed Grid Connection, no significant negative cumulative effects from the Grid Connection on VORs can occur.

7.6 Statement of Significance

7.6.1 Proposed Development

Following the implementation of good practice measures no significant negative effects on important ornithological receptors are likely during the construction or decommissioning phases of the Proposed Development.

During operation, collision risk mortality is likely to affect the following VORs: whooper swan, Greenland white-fronted goose, Eurasian wigeon, peregrine falcon, European golden plover, northern lapwing, Eurasian curlew and black-headed gull.

The likely potential impact of collision mortality on Eurasian curlew and black-headed gull would be of potential regional/county significance, although this is based on a number of precautionary assumptions and the true level of mortality is considered likely to be lower.

The likely potential impact of collision mortality on the other species assessed (including the qualifying features for all designated sites within at least 15 km) would not be significant. These species include: whooper swan, Greenland white-fronted goose, Eurasian wigeon, peregrine falcon, European golden plover, northern lapwing, common scoter, common coot, mallard and Eurasian teal.

All other potential impacts on the species assessed, including nest damage or destruction, habitat loss (direct and indirect), disturbance/displacement and barrier effects would be non-existent or non-significant.

7.6.2 Cumulative Effects

No significant cumulative negative effects on important ornithological receptors are likely.

7.7 Further Survey Requirements and Monitoring

Prior to and throughout construction (if this occurs within the breeding bird season), surveys will be undertaken for nesting birds in order to prevent disturbance and/ or contravention of wildlife legislation.

Based on current best-practice guidelines (SNH, 2009), it is proposed that a targeted range of flight activity surveys and collision monitoring (carcass searching) should be undertaken during the non-breeding season in years 1, 2 and 3 post construction, in order to monitor the rate of avian turbine collisions and identify any significant unforeseen adverse effects. Thereafter, if the rate of turbine strikes is as low as predicted, the monitoring should no longer be required. If monitoring indicates potentially significant levels of collision mortality for VORs potential mitigation measures would be developed and implemented and further monitoring would also be considered. Further details of proposed monitoring methods and survey effort, and possible mitigation measures (if required), would be provided to and agreed with the planning authority prior to Wind Farm operation commencing.

The applicant welcomes a condition, set by the Planning Authority, covering the agreement and implementation of a bird monitoring plan.

7.8 Conclusion

With the implementation of the good practice measures and project design as outlined in this chapter, no significant residual individual or cumulative effects are likely for VORs from any phase of the Proposed Development.