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CONSULTANTS IN ENGINEERING, ENVIRONMENTAL SCIENCE & PLANNING

ENVIRONMENTAL IMPACT ASSESSMENT REPORT (EIAR) FOR THE PROPOSED COUMNAGAPPUL WIND FARM, CO. WATERFORD

Volume 2 – MAIN EIAR CHAPTER

10 - ORNITHOLOGY

Prepared for:

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10. ORNITHOLOGY

10.1 Introduction

This chapter has been prepared to examine the potential effects that the Proposed Development (described in Chapter 2) may have on the avifauna of the study area. This assessment considers the potential effects with regard to each phase of the development: construction phase, operational phase, and decommissioning phase. Appropriate mitigation measures are described to avoid, or reduce potential significant negative effect(s).

A detailed description of the project assessed in this EIAR is provided in Chapter 2 and is comprised of the following main elements:

- The wind farm site (referred to in this EIAR as '**the Site**')
- The grid connection route (referred to in this EIAR as the '**GCR**')
- The turbine delivery route (referred to in this EIAR as the '**TDR**')

Collectively these three elements are referred to as the **Proposed Development**.

The Site includes the wind turbines, internal access tracks, hard standings, the permanent meteorological mast, onsite substation, internal electrical and communications cabling, temporary construction compound, drainage infrastructure and all associated works related to the construction of the wind farm.

The GCR includes the underground grid connection cable route from the on-site substation to the 110 kV substation at Dungarvan, Co. Waterford.

The TDR includes all aspects of the route from the port of Belview in Co. Kilkenny to the site entrance including proposed temporary accommodation works to facilitate the delivery of wind turbine components.

Bird surveys of the study area following SNH (2017) guidance were carried out during the winters of 2019/2020, 2020/2021 and 2021/2022, as well as summers of 2019, 2020, 2021 and 2022 by Malachy Walsh and Partners, see Appendix 10.1 and 10.2, Volume III for full details.

10.2 Methodology

10.2.1 Statement of Authority

The lead author of this chapter is David Daly (FT Ecologist, BSc. Ecology; MSc. Species Identification and Survey Skills). The chapter was reviewed by Rita Mansfield (FT Ecologist, BSc Applied Ecology [Hons]; H.Dip Environmental Protection and Pollution Control (Hons)). David Daly is a Project Ecologist with Fehily Timoney and Company. He holds a Bachelor of Science (BSc) in Ecology from University College Cork, and a Master of Science (MSc) in Species Identification and Survey Skills from University of Reading. David's work focused on the survey and assessment of proposed wind and solar energy development sites, and he has carried out comprehensive ecological work on numerous sites. He has carried out numerous mammal surveys including bat, badger, otter, and general mammal surveys, and acted as ecological clerk of works on a cable route construction project. Ben is the Author of the Biodiversity chapter and completed many of the ecological surveys for the Coumnagappul Project, including habitat surveys, botanical surveys, invasive species surveys, mammal surveys and static bat detectors surveys (deployment of detectors). Rita is an experienced Project Manager and Principal Ecologist at FT. She specialises in statutory consent and environmental assessment for large scale public infrastructure projects in the energy, water (including flood relief schemes) and transport sectors. Rita provides technical advisory services through all stages of project delivery from feasibility assessment, impact assessment, CPO, design, expert witness, contract administration and construction.

Monica Kane (MSc. BSc.), former Ecology Sector Manager and senior ecologist with Malachy Walsh and Partners (MWP), was the Project Manager for the Coumnagappul Wind Farm Project from the beginning of the project in early 2019 until her departure from MWP in December 2021. Ken Fitzgerald, the current Ecology Sector Manager, has been overseeing the project in the intervening period. Bird surveys were designed and supervised by John N. Murphy, the Project Ornithologist, in conjunction with Monica Kane. John oversaw all bird surveys from the outset of the project in early 2019 up until his departure from MWP in March 2021. During that time John carried out surveys, managed all survey work and had some involvement in the reporting Field surveyors were John N. Murphy, Eric Dempsey, Michael O'Clery, Austin Cooney, Éinne Ó Cathasaigh and Ger McGrath. This report has been prepared by Fiona McKenna (BSc.) an ecologist with MWP. Individual surveyor profiles outlining surveyor competencies, expertise and previous experience are included in Appendix 10.1. The Collision Risk Modelling Report has been prepared by Úna Williams (BSc. MSc.), Ecologist and Environmental Scientist, at Malachy Walsh and Partners (MWP) Engineering and Environmental Consultants (see Appendix 10.1).

10.2.2 Relevant Guidance

The methodology for this appraisal has been devised in accordance with the following relevant guidance published by the Environmental Protection Agency (EPA) 'Guidelines on the information to be contained in Environmental Impact Assessment Reports' (EPA, 2022) and 'Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment' (DoHPLG, 2018) and the Chartered Institute of Ecology and Environmental Management (CIEEM) 'Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine (Version 1.1)' (CIEEM, 2018 and revisions).

Additional guidance available from the EU such as 'Guidance document on wind energy developments and EU nature legislation' (2020) and 'Guidance on Integrating Climate Change and Biodiversity into Environmental Impact Assessment' (2013) has also been applied. The Heritage Council publication 'Best Practice Guidance for Habitat Survey and Mapping' (Smith et al., 2011) is also referenced.

Relevant guidance published by the National Roads Authority (NRA) such as '*Guidelines for Assessment of Ecological Impacts of National Road Schemes*' (2009a) has been applied.

Relevant guidance from Scottish Natural Heritage (SNH) in relation to birds such as SNH Recommended bird survey methods to inform impact assessment of onshore windfarms (2017), 'Survey Methods for use in assessing the impacts of onshore wind farms on bird communities (2005 & 2010)' and 'Assessing the cumulative impact of onshore wind energy developments (2012)' have also been applied.

Documentation available from Waterford County Council (WCC) such as the 'Waterford County Development Plan: 2011-2017 and Waterford County Development Plan 2022-2028 has been reviewed and utilised where relevant.

10.2.3 Legislative Context

All wild birds are protected under the Wildlife (Amendment) Act, 2000.

The conservation of birds and their habitats in Ireland has been expanded by EU law, most notably by the EU Habitats Directive (Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Flora and Fauna) (as amended) (the 'Habitats Directive') together with the Birds Directive (Council Directive 2009/147/EC on the Conservation of Wild Birds) (as amended) (the 'Birds Directive') are, which provide bird protection legislation.

Species listed in Annex I and migratory species are subject to special conservation measures to protect their habitat, through the establishment of Special Protection Areas (SPAs), under the Birds Directive. The Habitats Directive (and Birds Directive were transposed into Irish law inter alia by the European Communities (Birds and Natural Habitats) Regulations 2011 (S.I. No. 477 of 2011), as amended and the Planning and Development Act 2000 as amended.

10.2.4 Consultation

For a full list of consultations and responses, please see Chapter 5 - EIA Scoping and Consultation.

10.2.5 Desktop Study

A desk study was carried out to collate and review available information, datasets and documentation sources pertaining to the site's natural environment. Records available on the NPWS and the National Biodiversity Data Centre websites were reviewed, in addition to records of rare/sensitive species within the 10km grid squares overlapped by a 2 km buffer surrounding the study area obtained by request from NPWS (received 28th March 2023).

Other data sources include Ireland's Wetlands and their Waterbirds: Status and Distribution (Crowe 2005), the Atlas of Wintering Birds in Britain and Ireland (Lack, 1986), the Atlas of Breeding Birds in Britain and Ireland (Sharrock, 1976) and the Breeding and Winter Birds of Britain and Ireland Bird Atlas 2007-11 (Balmer et al., 2013).

Other sources included:

- OSI Aerial photography and 1:50000 mapping;
- NPWS website (mapviewer) grid square S10 flora and fauna records, accessed 16th January 2023;
- National Biodiversity Data Centre (NBDC) website and data obtained on 16th January 2023;
- Teagasc Soil area maps;

- Geological Survey Ireland (GSI) area maps, and;
- EPA website datasets (soil, surface water quality, ground water quality, designated sites).

10.2.6 Field Study

The details, dates and weather conditions are provided in Appendix 1.

Limitations:

It is acknowledged that the timing of the red grouse surveys undertaken in 2020 and 2022 resulted in the start of the red grouse breeding season (April to early May) to be missed. Due to these survey limitations, a precautionary approach should be taken with regard to the 2020 and 2022 survey findings.

10.2.6.1 Target Species

The following criteria has been utilised to select target species for the current study. Scottish Natural Heritage (SNH) guidance (SNH, 2017) on the assessment of the effects of wind farms on ornithological interests suggests that there are four important species lists from which target species can be drawn, as follows:

- Species listed on Annex 1 of the Birds Directive (EC, 2009)
- Red-listed birds of Conservation Concern
- Schedule 1 of the Wildlife and Countryside Act 1981 (not applicable in Ireland) and;
- Regularly occurring migratory species.

In addition to the above, consideration was given to species identified locally as being of conservation concern, regionally or those particularly susceptible to impact from wind farm development. Note that not all species on the above lists would be categorised as target species, e.g. most passerine species and general lowland farmland birds are not considered to be particularly susceptible to impacts from wind farms (SNH, 2017).

In the Irish context, it has been suggested that target species should be taken from species of conservation concern in Ireland (BOCCI) (Gilbert et al., 2021), those likely to occur within the vicinity of the Proposed Development, and those most at risk from particular impacts such as disturbance and displacement (Nairn, R. and Partridge, K., 2013).

'Birds of Conservation Concern in Ireland' (BoCCI) are classified into three separate lists: red, amber, and green. Red-listed species are of high conservation concern, Amber-listed species are of medium conservation concern and Green-listed species are considered to be of no conservation concern (Gilbert et al., 2021).

To date four BoCCI lists have been published with the current list by Gilbert et al., (2021) superseding the three former lists by Colhoun and Cummins (2013), Lynas et al., (2007), and Newton et al., (1999). The conservation status of bird species found in this study was assessed using the most recent (2021) BoCCI List (Gilbert et al., 2021).

Additionally, a review of the bird species listed on Annex I of the EU Birds Directive (2009/147/EC) was undertaken in assessing the conservation status of birds. Annex I species are afforded additional protection through the designation of Special Protection Areas (SPAs) throughout EU countries in addition to existing National legislation.

10.2.6.2 Overview of methods of surveys

Initial walkovers of the Site were carried out to enable the identification of suitable survey locations.

Field surveys were undertaken to gather detailed information on bird distribution and flight activity in order to predict the potential effects of a wind farm development on birds.

The field surveys comprised two main elements; vantage point (VP) watches and targeted distribution and abundance surveys which comprised:

- VP watches undertaken over 3.5 years at five VPs (winter 19/20, winter 20/21, winter 21/22, summer 2019, summer 2020, summer 2021, and summer 2022).
- Transect surveys (winter 19/20, winter 20/21, winter 21/22, summer 2019, summer 2020, summer 2021, and summer 2022);
- Hinterland surveys (summer 2020).
- Nocturnal surveys – for woodcock, nightjar and owls (summer 2020)
- Merlin, red grouse and golden plover surveys (summer 2020)

For full survey methodologies, see Appendix 10.1.

10.2.7 Avifauna Receptor Evaluation

Avifauna resources were initially evaluated as to whether or not they constitute key receptors for the assessment following NRA guidance. For the purposes of impact assessment, a receptor 'importance value' or sensitivity, following published guidance as in Percival (2007), SNH (2017) and literature review of published information on birds and wind farms (Pearce-Higgins J. L., 2009; Pearce-Higgins J. S., 2012; Drewitt A. L., 2006; Drewitt and Langston, 2008 and Masden, 2009) is to be calculated. Where provided receptor values from Percival (2007) are below those recommended in guidance within the Irish context (NRA, 2009a); then the evaluation has been increased in line with the recommended Irish evaluation as a precautionary principle. **Error! Reference source not found.** illustrates the combined receptor evaluation criteria used to assign sensitivity levels to key receptors:

Sensitivity of key receptor	Percival 2007 criteria	NRA Resource Evaluation	NRA Criteria	Combined Criteria
Very High	Species is cited interest of SPA. Species present in Internationally important numbers.	International Importance	Resident or regularly occurring populations (assessed to be important at the national level) of the following: Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive	Species is cited Special Conservation Interest of SPA. Species present in Internationally important numbers. Resident or regularly occurring populations (assessed to be important at the national level) of the following: Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive

Sensitivity of key receptor	Percival 2007 criteria	NRA Resource Evaluation	NRA Criteria	Combined Criteria
High	Other non-cited species which contribute to integrity of SPA. Ecologically sensitive species (<300 breeding pairs in UK) and less common birds of prey. Species listed on Annex 1 of the EU Birds Directive. Regularly occurring relevant migratory species which are rare or vulnerable	National Importance	Resident or regularly occurring populations (assessed to be important at the national level) of the following: Species protected under the Wildlife Acts; and/or Species listed on the relevant Red Data list	Other non-cited / not a Special Conservation Interest species which contribute to integrity of SPA. Ecologically sensitive species (<300 breeding pairs nationally) and less common birds of prey. Species listed on Annex 1 of the EU Birds Directive. Regularly occurring relevant migratory species which are rare or vulnerable Resident or regularly occurring populations (assessed to be important at the national level) of the following: Species protected under the Wildlife Acts; and/or Species listed on the relevant Red Data list (in this case BOCCI Red list).
Medium	Species present in regionally important numbers (>1% of regional population). Species occurring within SPA's but not crucial to the integrity of the site. Species listed as priority species in the UK BAP subject to special conservation measures	County Importance	Resident or regularly occurring populations (assessed to be important at the County level) of the following: Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive; County important populations of species. Sites containing habitats and species that are rare or are undergoing a decline in quality or extent at a national level.	Species present in regionally important numbers (>1% of regional population). Species occurring within SPA's but not crucial to the integrity of the site. Resident or regularly occurring populations (assessed to be important at the County level) of the following: Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive; County important populations of species. Species that are rare or are undergoing a decline in quality or extent at a national level.
Low	Species covered above which are present very infrequently or in very low numbers. Any other species of conservation interest not covered above, e.g. species listed on	Local Importance (High Value)	Locally important populations of priority species or habitats or natural heritage features identified in the Local BAP, if this has been prepared;	Locally important populations of priority species identified in the Local BAP, if this has been prepared.

Sensitivity of key receptor	Percival 2007 criteria	NRA Resource Evaluation	NRA Criteria	Combined Criteria
	the red or amber lists of the BoCC.		Resident or regularly occurring populations (assessed to be important at the Local level) of the following: Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive; Species protected under the Wildlife Acts; and/or Species listed on the relevant Red Data list.	Resident or regularly occurring populations (assessed to be important at the Local level) of the following: Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive; Species protected under the Wildlife Acts; and/or Species listed on the relevant Red Data list. Amber listed species.
Negligible	Species that remain common and widespread	Local Importance (Low Value)	n/a	Species that remain common and widespread.

10.2.8 Assessing Effect Significance

Once the value of the identified ecological receptors (features and resources) was determined, the next step was to assess the potential effect or impact of the project on the identified key ecological receptors, following the EPA evaluation criteria utilised in this appraisal of the Environmental Factor, Biodiversity. This criteria is included in the Draft Guidelines on the Information to be contained in Environmental Impact Assessment Reports (EPA 2022).

The characterisation of effects reflects the ecological structure and function upon which the key ecological receptors depend. Detailed assessment of effects takes into account the magnitude of effects affecting populations.

This EIAR uses the EPA classification of effects in order to describe the quality, significance, duration and type of effect. Effects on avifauna are to be assessed following published guidance by Percival (2003). Once key avian receptors have been selected and assigned an evaluation of importance or sensitivity, the significance of potential effects are rated as a product of both the magnitude of the predicted effect and the sensitivity of the key receptor affected. The magnitude of effect is based on probability of the likely effect occurring.

The criteria has been developed by Percival (2003) to determine the magnitude of potential effects on a species. Methodology for assessing sites outside of European Sites (i.e. SPAs) state 'the test of significance of an impact will be whether the wind farm impact is causing a significant change to the population its range or distribution' (Percival, 2003). It is important to consider availability of alternative habitat elsewhere during this assessment (Percival, 2003).

10.2.9 Assessing Effect Type and Magnitude

Assessment of effects considers construction, operational and decommissioning effects with reference to the potential for direct, indirect, and cumulative effects. The assessment also takes account of any residual effects that may persist following the implementation of any mitigation or best practice design. The characterisation of effects reflects the ecological structure and function upon which the key ecological receptors depend. Detailed assessment of effects considers the magnitude of effects affecting populations.

This EIAR uses the EPA classification of effects in order to describe the quality, significance, duration, and type of effect. Effects on avifauna have been assessed following published guidance by Percival (2003). Once key avian receptors have been selected and assigned an evaluation of importance or sensitivity, the significance of potential effects are rated as a product of both the magnitude of the predicted effect and the sensitivity if the key receptor affected. The magnitude of effect is based on probability of the likely effect occurring.

The criteria outlined in **Error! Reference source not found.** below has been developed by Percival (2003) to determine the magnitude of potential effects on a species. Methodology for assessing sites outside of European Sites (i.e. SPAs) state 'the test of significance of an impact will be whether the wind farm impact is causing a significant change to the population its range or distribution' (Percival, 2003). It is important to consider availability of alternative habitat elsewhere during this assessment (Percival, 2003).

Table 10-1: Determination of Magnitude Effects (Percival, 2003)

Magnitude	Description
Very High	Total loss or very major alteration to key elements/ features of the baseline conditions such that the post development character/ composition/ attributes will be fundamentally changed and may be lost from the site altogether. *Guide: < 20% of population / habitat remains*
High	Major loss or major alteration to key elements/ features of the baseline (pre-development) conditions such that post development character/ composition/ attributes will be fundamentally changed. *Guide: 20-80% of population/ habitat lost*
Medium	Loss or alteration to one or more key elements/features of the baseline conditions such that post development character/composition/attributes of baseline will be partially changed. *Guide: 5-20% of population/ habitat lost*
Low	Minor shift away from baseline conditions. Change arising from the loss/alteration will be discernible but underlying character/composition/attributes of baseline condition will be similar to pre-development circumstances/patterns. *Guide: 1-5% of population/ habitat lost*
Negligible	Very slight change from baseline condition. Change barely distinguishable, approximating to the "no change" situation. *Guide: < 1% population/ habitat lost*

The significance of potential effects is assessed by cross tabulating the magnitude of effects and bird sensitivity to predict significance of each potential effect. Population status, distribution, and trends of potentially affected species such as migratory winter birds should be taken into consideration when undertaking the assessment. Significant ratings are interpreted as follows, very low and low should not normally be of concern however normal design care should be undertaken to minimise effects, medium represents a potentially significant effect that requires careful individual assessment, while very high and high represents a highly significant effect on bird populations. A significance matrix table, combining magnitude and sensitivity to assess overall significance is presented below in **Error! Reference source not found.**.

Table 10-2: 110 Significance matrix: combining magnitude and sensitivity to assess significance (Percival, 2003)

Significance Magnitude	Sensitivity				
	Very High	High	Medium	Low	Very High
Very High	Very High	Very High	Very High	High	Medium
High	High	Very High	Very High	Medium	Low
Medium	Medium	Very High	High	Low	Very Low
Low	Low	Medium	Low	Low	Very Low
Negligible	Negligible	Low	Very Low	Very Low	Very Low

10.3 Description of the Existing Environment

The ecology of the existing environment is described within this section.

10.3.1 Site Description

The redline boundary extends to 211ha, and comprises a mixture of farmland, forestry, and upland heath. Much of the lands are in private, third-party ownership.

For further information, please refer to the Chapter 9 - Biodiversity and Chapter 2 - Development Description.

10.3.2 Desktop Study

10.3.2.1 Defining the Zone of Influence

The potential zone of influence (ZoI) for the Site a is defined by an initial search area of 15 km which was selected on the basis of national guidance which relates to plans (DEHLG, 2010) (adopted here on a precautionary basis to provide a wide initial search radius), in addition to any sites further afield with potential ecological links (i.e. hydrological links or mobile species). The ZoI is then refined further based on the potential impacts associated with the Site and the conservation interests of individual sites. All sites identified in the initial search are detailed here.

The potential ZoI for the GCR and TDR is defined by a 500m buffer around the TDR Nodes and GCR alignment. The 500m buffer is informed by the limited scale of works required at TDR Nodes (vegetation clearance/trimming and placement of temporary load bearing surfaces are the most invasive works required) and the limited works footprint associated with the GCR. The 500m buffer has also been selected as this distance encompasses the buffering distances required for the most sensitive group (wetland and waterbirds) associated with designated sites.

The 500m buffer has been applied at all TDR Nodes and the GCR to maintain a consistent approach. Any sites outside the 500m buffer with potential hydrological links or other ecological links such as mobile species are also within the potential ZoI of the TDR and GCR. The ZoI is then refined further based on the potential impacts associated with works at particular TDR Nodes and the conservation interests of individual sites. All sites identified in the initial search are detailed here.

10.3.2.2 Sites of International Importance

Note only Special Protection Areas (relating to birds) are addressed in this chapter. Special Areas of Conservation (relating to habitats, plants, mammals, and all other non-avian taxa of note) are covered in the Chapter 9 (Biodiversity). The same logic applies to sites of national importance.

Sites of International Importance

Special Protection Areas (SPAs) are designated under the The Birds Directive. There are three SPAs within the potential Zone of Influence (ZoI) of the Proposed Development. Based on the information provided in SNH 2016 on the core foraging ranges available for the SCIs listed in Table 3 of Appendix 10.1, connectivity between the SPA sites and the Proposed Development is unlikely. However, the maximum foraging range for the SCIs of Dungarvan Harbour SPA and Mid-Waterford Coast SPA overlaps the Site, namely golden plover and peregrine. Therefore, an Appropriate Assessment (AA) Screening Report and Natura Impact Statement (NIS) have been completed in order to appraise the likely significant effects of the proposed development either alone or in combination with other plans or projects on European Sites (SACs and SPAs); and accompanies this planning application.

Sites of National Importance

Sites of National Importance in Ireland are termed Natural Heritage Areas (NHA) and proposed Natural Heritage Areas (pNHA).

While the Wildlife (Amendment) Act 2000 has been passed into law, pNHAs will not have legal protection until the consultative process with landowners has been completed; this process is currently ongoing. For the purposes of this assessment however pNHAs have be treated as fully designated sites. There are no NHAs and three pNHAs, where birds are a feature of interest, present within the potential Zone of Influence (ZoI) of the Proposed Development.

Figure 9.2 and Figure 9.3, Volume IV show the location of the designated sites in relation to the proposed turbine locations.

Table 10-3: Summary of SPAs and pNHA within ZoI of the project

Designated Site	Site code	Features of Interest (Birds)	Distance to site (km)	Connectivity?
Dungarvan Harbour SPA	004032	Great Crested Grebe (*Podiceps cristatus*) [A005] Light-bellied Brent Goose (*Branta bernicla hrota*) [A046] Shelduck (*Tadorna tadorna*) [A048] Red-breasted Merganser (*Mergus serrator*) [A069] Oystercatcher (*Haematopus ostralegus*) [A130] Golden Plover (*Pluvialis apricaria*) [A140] Grey Plover (*Pluvialis squatarola*) [A141] Lapwing (*Vanellus vanellus*) [A142] Knot (*Calidris canutus*) [A143] Dunlin (*Calidris alpina*) [A149] Black-tailed Godwit (*Limosa limosa*) [A156] Bar-tailed Godwit (*Limosa lapponica*) [A157] Curlew (*Numenius arquata*) [A160] Redshank (*Tringa totanus*) [A162] Turnstone (*Arenaria interpres*) [A169] Wetland and Waterbirds [A999]	12.74 km	Yes – 8.9 km downstream of the Ssite via the Colligan River. The Site is outside the maximum foraging range for Golden Plover (11 km), but it has been included, taking the precautionary approach, due to presence onsite during surveys.
Mid-Waterford Coast SPA	004193	Cormorant *(Phalacrocorax carbo) [*A017*]* Peregrine *(Falco peregrinus) [*A103*]* Herring Gull *(Larus argentatus) [*A184*]* Chough *(Pyrrhocorax pyrrhocorax) [A346]*	>15 Km (15.17 km)	Yes – inside the max foraging range for QI species - Peregrine (up to 18 km) (SNH 2016) .

Designated Site	Site code	Features of Interest (Birds)	Distance to site (km)	Connectivity?
Dungarvan Harbour pNHA	000663	Wetland and waterbirds. See SCIs for Dungarvan SPA above	12.79	See Dungarvan SPA above
Kilsheelin Lake pNHA	001701	Waterbirds	12.9	No – no hydrological connectivity and outside core & maximum foraging range for birds
Marlfield Lake pNHA	001981	Wetland and waterbirds (mallard, teal, wigeon, shoveler, tufted duck, gadwall, pochard, mute swan, grey heron, coot, moorhen, little grebe, black-headed gull, cormorant)	13.6	No – no hydrological connectivity and outside core & maximum foraging range for notable birds

Other Designated Sites

Nature Reserves

There are no nature reserves within 10km of the proposed development.

Ramsar Sites

There is one Ramsar site within the potential ZoI of the Proposed Development, Dungarvan Harbour 16km to the southeast of the Site. This overlaps the Dungarvan Harbour SPA, see *Sites of International Importance* above.

10.3.2.3 Avifauna

A desktop study (dated 28th March 2023) was undertaken to locate any records of rare or protected avian species that have previously been recorded in the site and the surrounding area. Examination of NPWS and NBDC records indicates that there is a combined total of 105 species, regardless of conservation status or date, recorded in the 10 km grid squares (S20 and S21) which overlaps the study area and are listed in Table 714, below. Of these species, seven (chough, kingfisher, nightjar, red kite, spotted crake, teal and yellowhammer) are considered to be historical records, as they have not been documented in the grid square in the last fifteen years. A total of 16 that are on the current Birds of Conservation Concern in Ireland (BoCCI) red list (curlew, golden plover, grey wagtail, kestrel, lapwing, meadow pipit, nightjar, red grouse , red kite, redwing, ring ouzel, snipe, stock pigeon, swift, woodcock, and yellowhammer) and 22 are on the BoCCI amber list (black-headed gull, chough, cormorant, goldcrest, greenfinch, hen harrier, herring gull, house martin, house sparrow, kingfisher, linnet, mallard, merlin, sand martin, skylark, spotted crake, spotted flycatcher, starling, swallow, teal, wheatear and willow warbler). Six of the species (golden plover, hen harrier, little egret, merlin, nightjar and peregrine) are further listed on Annex I of the EU Birds Directive (EC, 2009). Four are species which are not rare (Red or Amber listed) or protected under Annex I (Habitats Directive) but have been included as they are indicator/keystone species and/or may be sensitive to wind farm development; namely buzzard, grey heron, moorhen and sparrowhawk.

Pheasant is the only invasive species recorded in the 10km grid square.

10.3.3 Field Surveys

Species of conservation concern that are known to be potentially vulnerable to wind farm developments will be discussed in more detail in this section. Species have been selected for detailed discussion on the basis of conservation status, vulnerability to wind farm developments and if species sightings have been confirmed on or near the proposed wind farm site, which will indicate potential links between species recorded at the proposed site and the surrounding environment.

10.3.3.1 Target Species Observation (Flight Activity Surveys)

As per SNH guidance (2017) the Site, for the purposes of flight activity surveys (vantage point surveys) is defined not by the planning boundary for the Proposed Development but by a 500m radius circle (buffer) around the proposed wind turbine locations. The proposed turbine locations form the centre point of each of these 500m radius buffers. This study area is called the 'flight activity survey area' and is unique to this survey type. Any target species passing within this 500m buffer from proposed turbine locations (flight activity survey area) is considered within the Site under the SNH (2017) guidance.

During the winter 2019/2020 season, eight target species were recorded within the flight activity survey area. Of these, three species were red-listed (kestrel, golden plover, snipe), two species were amber-listed (merlin, lesser black-backed gull), and three were green-listed (peregrine falcon, buzzard, sparrowhawk). Merlin, peregrine falcon and golden plover are also listed under Annex I of the EU Birds Directive.

During the winter 2020/2021 season, eight target species were recorded within the flight activity survey area. Of these, three species were red-listed (kestrel, golden plover, snipe), two species were amber-listed (hen harrier, merlin) and three were green-listed (peregrine falcon, buzzard, sparrowhawk). Hen harrier, merlin, peregrine falcon and golden plover are also listed under Annex I of the EU Birds Directive

During the winter 2021/2022 season, eight target species were recorded within the flight activity survey area. Of these, three species were red-listed (kestrel, golden plover, snipe), two species were amber-listed (hen harrier, merlin) and three were green-listed (peregrine falcon, buzzard, sparrowhawk). Hen harrier, merlin, peregrine falcon and golden plover are also listed under Annex I of the EU Birds Directive.

During the summer 2019 season, nine target species were recorded within the flight activity survey area. Of these, two species were red-listed (kestrel, snipe), three species were amber-listed (hen harrier, merlin, lesser black-backed gull), and four were green-listed (buzzard, sparrowhawk, grey heron, long-eared owl). Hen harrier and merlin are also listed under Annex I of the EU Birds Directive.

During the summer 2020 season, 12 target species were recorded within the flight activity survey area. Of these, three species were red-listed (kestrel, golden plover, snipe), five species were amber-listed (hen harrier, merlin, herring gull, lesser black-backed gull, ringed plover), and four were green-listed (peregrine falcon, buzzard, sparrowhawk, great black-backed gull). Hen harrier, merlin, peregrine falcon and golden plover are also listed under Annex I of the EU Birds Directive.

During the summer 2021 season, eight target species were recorded within the flight activity survey area. Of these, three species were red-listed (kestrel, snipe, red grouse), four species were amber-listed (hen harrier, herring gull, lesser black-backed gull, mallard), and one was green-listed (buzzard). Hen harrier is also listed under Annex I of the EU Birds Directive.

During the summer 2022 season, four target species were recorded within the flight activity survey area. Of these, two species were red-listed (kestrel, golden plover), one species was amber-listed (hen harrier), and one was green-listed (buzzard). Hen harrier and golden plover are also listed under Annex I of the EU Birds Directive.

10.3.3.2 Non-target Species Recorded During VP Surveys

Non-target species were also recorded during vantage point survey periods, as a summary of additional species, noted during each survey. In total, 16 non-target species were recorded during the surveys.

Of these 16 species, four species were red-listed (grey wagtail, meadow pipit, stock dove, swift), while the remaining 12 species were amber-listed (goldcrest, house martin, house sparrow, linnet, sand martin, skylark, spotted flycatcher, starling, swallow, tree sparrow, wheatear and willow warbler). See Table 9 of Appendix 10.1 for full details.

10.3.3.3 Hinterland Surveys

During the Hinterland survey carried out during summer 2020, birds of prey were active in the site, whilst there were no large assemblages of waders recorded. During the first hinterland survey buzzard were recorded in-flight three times and kestrel once. During the second hinterland survey sparrowhawk was recorded in-flight once and buzzard twice. See Appendix 10.1 for full details.

10.3.3.4 Winter and Breeding Surveys

Transect surveys for all species were recorded during surveys of the Site over three winters and three summers. This survey captured the baseline of avian species using the site as well as their abundance and includes seasonal visitors of the winter (i.e., redwing) and summer months (i.e., cuckoo, and swallow). Over the entire survey period, a total of 56 bird species were recorded. Of the 56 species, two are Annex I listed (hen harrier and peregrine falcon), five are red-listed (grey wagtail, kestrel, meadow pipit, redwing and stock dove) and 13 are amber-listed (goldcrest, greenfinch, hen harrier, herring gull, house martin, house sparrow, lesser black-backed gull, linnet, skylark, starling, swallow, wheatear and willow warbler). The remaining 38 species are green-listed.

10.3.3.5 Nocturnal Surveys

There were no nightjar, woodcock or owls recorded during the nocturnal surveys carried out in summer 2020. Other species observed during these surveys consisted of snipe. On both nights of surveying, snipe was observed displaying.

10.4 Avifauna Evaluation

The basis of impact assessment should be a determination of which ornithological resources within the zone of influence of the proposed development are of sufficient value to be material in decision making and therefore, included in the assessment (NRA, 2009a and CIEEM 2019). Outlined below are the key receptors selected for assessment and the rationale for same based on NRA guidance (NRA, 2009a); the overall importance or sensitivity evaluation for each key receptor, taken from guidance such as Percival 2007 is also illustrated. All other ecological receptors are dealt with in Chapter 9 Biodiversity.

Table 10-4: key receptors selected for assessment

Species	BoCCI	Annex I (Y/N)	NRA Evaluation	Receptor Evaluation for Impact Assessment (Sensitivity)	Key Receptor	Rationale
Buzzard	Green	No	Local Importance (Higher Value)	Low	Yes	Recorded on various surveys throughout. A total of 2,360 seconds were logged in PCH in the flight activity survey area.
Goldcrest	Amber	No	County Importance	Medium	Yes	Recorded as a non-target species during vantage point surveys and during both summer and winter transects.
Golden Plover	Red	Yes	International Importance	Very High	Yes	Recorded on vantage point surveys in the flight activity survey area, with 76,270 seconds logged in the rotor sweep zone.
Great Black-backed Gull	Green	No	Local Importance (Higher Value)	Low	Yes	Recorded on four occasions (all summer 2020). A total of 25 seconds of observation time occurred in the rotor sweep zone.
Greenfinch	Amber	No	County Importance	Medium	Yes	Recorded during summer transect surveys.
Green-listed non-passerine sp.	Green	No	Local Importance (Low Value)	Low	No	Recorded on various surveys throughout. Not recorded as key receptors because of the common and widespread status of green-listed non-passerine species in both a local and national context.
Grey Heron	Green	No	Local Importance (Higher Value)	Low	No	Recorded on one occasion during vantage point surveys (summer 2019), with two seconds spent in the flight activity survey area, none of which were in the rotor sweep zone. Not included as a key receptor because of a paucity of records and time spent in the flight activity survey area, combined with the species' green-listed status.
Grey Wagtail	Red	No	National Importance	High	Yes	Recorded as a non-target species during vantage point surveys and during both summer and winter transects.

Species	BoCCI	Annex I (Y/N)	NRA Evaluation	Receptor Evaluation for Impact Assessment (Sensitivity)	Key Receptor	Rationale
Hen Harrier	Amber	Yes	International Importance	Very High	Yes	Recorded during both summer and winter season vantage point surveys, on a total of 17 occasions. A total of 130 seconds of flight time occurred within the flight activity survey area in the rotor sweep zone. Also recorded during winter transect surveys (2021/2022) and walkover and hinterland surveys (summer 2020).
Herring Gull	Amber	No	County Importance	Medium	Yes	Recorded on five occasions during summer season vantage point surveys. A total of 150 seconds were logged in the flight activity survey area in the rotor sweep zone.
House Martin	Amber	No	County Importance	Medium	Yes	Recorded as a non-target species during vantage point surveys and during summer transects.
House Sparrow	Amber	No	County Importance	Medium	Yes	Recorded as a non-target species during vantage point surveys and during summer transects.
Kestrel	Red	No	National Importance	High	Yes	Recorded from all VPs during summer vantage point surveys as well as from all VPs during winter vantage point surveys. A total of 4,151 seconds was logged in the flight activity survey area in the rotor sweep zone. Recorded across five seasons from transect surveys, in both winter and summer. Also recorded during hinterland surveys (summer 2020).
Lesser Black-backed Gull	Amber	No	County Importance	Medium	Yes	Recorded on 15 occasions, from all VPs except VP5, during both winter and summer vantage point surveys. A total of 521 seconds were recorded in the flight activity survey area in the rotor sweep zone.
Linnet	Amber	No	County Importance	Medium	Yes	Recorded as a non-target species during vantage point surveys and during both summer and winter transects.
Long-eared Owl	Green	No	Local Importance (Higher Value)	Low	No	Incidental recorded on one occasion during vantage point surveys (summer 2019), where a juvenile was heard but not seen, calling from a conifer plantation to the south of VP3. Not included as a key receptor because of a paucity of records and absence of time spent in the flight activity survey area, combined with the species' green-listed status.

Species	BoCCI	Annex I (Y/N)	NRA Evaluation	Receptor Evaluation for Impact Assessment (Sensitivity)	Key Receptor	Rationale
Mallard	Amber	No	County Importance	Medium	Yes	Recorded on two occasions from vantage point surveys (both in summer 2021).
Meadow Pipit	Red	No	National Importance	High	Yes	Recorded as a non-target species during vantage point surveys and during both summer and winter transects.
Merlin	Amber	Yes	International Importance	Very High	Yes	Recorded during both summer and winter season vantage point surveys, on a total of eight occasions. A total of 180 seconds of flight time occurred within the flight activity survey area in the rotor sweep zone.
Peregrine	Green	Yes	International Importance	Very High	Yes	Recorded on seven occasions from during winter vantage point surveys as well as an additional record during summer vantage point surveys. A total of 110 seconds were logged in the flight activity survey area in the rotor sweep zone. Also recorded during the winter 2021/2022 transect survey.
Redwing	Red	No	National Importance	High	Yes	Recorded during winter transects.
Red Grouse	Red	No	National Importance	High	Yes	Recorded on two occasions during vantage point surveys (both summer 2021), with two seconds spent in the flight activity survey area, none of which were in the rotor sweep zone. Although unlikely, and not noted during other surveys, heath habitat (largely degraded through burning and overgrazing) on site could host breeding/foraging grouse.
Ringed Plover	Amber	No	County Importance	Medium	Yes	Recorded once during summer vantage point surveys from VP4 on the 16th August 2020. Limited occurrence.
Sand Martin	Amber	No	County Importance	Medium	Yes	Recorded as a non-target species during summer vantage point surveys.
Skylark	Amber	No	County Importance	Medium	Yes	Recorded as a non-target species during vantage point surveys and summer transects.

Species	BoCCI	Annex I (Y/N)	NRA Evaluation	Receptor Evaluation for Impact Assessment (Sensitivity)	Key Receptor	Rationale
Snipe	Red	No	National Importance	High	Yes	Recorded during both summer and winter season vantage point surveys, on a total of 16 occasions. A total of 43 seconds of flight time occurred within the flight activity survey area were in the rotor sweep zone. Also recorded during nocturnal surveys (summer 2020).
Sparrowhawk	Green	No	Local Importance (Higher Value)	Low	Yes	Recorded on various surveys throughout. A total of 275 seconds were logged in the flight activity survey area in the rotor swept zone.
Spotted Flycatcher	Amber	No	County Importance	Medium	Yes	Recorded as a non-target species summer during vantage point surveys.
Starling	Amber	No	County Importance	Medium	Yes	Recorded as a non-target species during vantage point surveys and both summer and winter transects.
Stock Dove	Red	No	National Importance	High	Yes	Recorded as a non-target species during vantage point surveys and during both summer and winter transects.
Swallow	Amber	No	County Importance	Medium	Yes	Recorded as a non-target species during vantage point surveys and summer transects.
Swift	Red	No	National Importance	High	Yes	Recorded as a non-target species during summer vantage point surveys.
Tree Sparrow	Amber	No	County Importance	Medium	Yes	Recorded as a non-target species during winter vantage point surveys.
Wheatear	Amber	No	County Importance	Medium	Yes	Recorded as a non-target species during vantage point surveys and summer transects.
Willow Warbler	Amber	No	County Importance	Medium	Yes	Recorded as a non-target species during winter vantage point surveys and summer transects.

Seven species (chough, kingfisher, nightjar, red kite, spotted crake, teal and yellowhammer), ranging from medium sensitivity to very high sensitivity, are considered to be historical records, as they have not been documented in the grid square in the last fifteen years and were not observed during the three and half years of surveys and consequently are therefore not listed as key receptors.

Additionally, black-headed gull (medium sensitivity, last recorded 2011), cormorant (medium sensitivity, last recorded in 2011), curlew (high sensitivity, last recorded in 2011), lapwing (high sensitivity, last recorded in 2011), little egret (very high sensitivity, last recorded in 2011), ring ouzel (high sensitivity, last recorded in 2011) and woodcock (high sensitivity, last recorded in 2011) were recorded in the desktop study only, either in modern times (within the last fifteen years) or historically (more than fifteen years ago) within the 10km grid square X (encompassing the study area) and were not observed during three and half years of surveys and consequently are therefore not listed as key receptors.

10.5 Do Nothing Scenario

If the proposed development does not proceed, the 'do nothing' scenario is that the existing environment and key receptors identified in 1.3 are likely to remain as described previously. This assumes the continuation of existing agricultural activities at the Site but excludes forestry operations (thinning, harvesting and replanting). Agricultural practices such as intensive farming, overgrazing and burning would continue.

If forestry management activities proceed, the plantation woodlands onsite will undergo changes as they are harvested and subsequently replanted. Although key ecological receptors can fluctuate in abundance and may be found in different locations during different stages of said forestry operations (e.g. post-felling, plantation habitats can be replaced by scrub habitats, which may cause animals that use wooded habitats to move to different locations in the forestry), overall, the habitats and species found at the project will likely remain as they are currently.

10.6 Potential Effects on Avifauna

The effects of infrastructure such as wind farms on birds are highly variable and depend on a wide range of factors including the specification of the development, the topography of the surrounding land, the habitat affected and the numbers and species of birds present (Drewitt, A., and Langston, R., 2006). Developments such as wind farms in general have many effects on birds, including potential direct habitat loss and fragmentation, displacement due to disturbance, death, and injury due to collisions and disruption of local or migratory movements, with a consequent increase in energy expenditure (Drewitt, A., and Langston, R., 2008). However, the principal concerns in terms of adverse effects on birds are (1) disturbance / displacement, (2) collision, (3) habitat loss/change and (4) barriers to movement (Langston, R., 2010). Of these, only two are applicable during construction: 1) disturbance and / or displacement and 2) habitat loss/alteration. Habitat loss is the primary potential direct impact during constructions and although disturbance and / or displacement could be viewed as effective habitat loss, it is essentially indirect (SNH, 2017) and therefore covered under Indirect Impacts.

With regard to impacts on bird species, it is considered that the main potential sources of impacts on avian fauna is the construction of the Site, particularly the construction of turbines and the associated road network, as well as the operational phase of the turbines.

The potential likely significant impact of wind turbines on birds may be considered as:

- Possible loss or deterioration of habitats; and
- Disturbance or displacement of birds.
- Direct collisions with turbines

Consideration of the survey data against Table 10-4 indicates that four 'Very High' sensitivity species have been recorded within the project study area:

- Golden plover (red-listed, annex I);
- Hen harrier (amber-listed, annex I);
- Merlin (amber-listed, annex I);
- Peregrine (green-listed, annex I);

Consideration of the survey data against Table 10-4 indicates that eight 'High' sensitivity species have been recorded within the project study area or have the potential to occur (red grouse).

- Grey wagtail (red-listed);
- Kestrel (red-listed);
- Meadow pipit (red-listed);
- Red grouse (red-listed);
- Redwing (red-listed);
- Snipe (red-listed);
- Stock dove (red-listed);
- Swift (red-listed).

'Medium' sensitivity species recorded in the study area are also considered in this assessment, amounting to the following 16 species:

- Goldcrest (amber-listed);
- Greenfinch (amber-listed);
- Herring gull (amber-listed);
- House martin (amber-listed);
- House sparrow (amber-listed);
- Lesser black-backed gull (amber-listed);
- Linnet (amber-listed);
- Mallard (amber-listed);
- Ringed Plover (amber-listed);
- Sand martin (amber-listed);
- Skylark (amber-listed);
- Spotted flycatcher (amber-listed);
- Starling (amber-listed);
- Swallow (amber-listed);
- Tree sparrow (amber-listed);
- Wheatear (amber-listed);
- Willow warbler (amber-listed).

Seven 'Low' sensitivity species are considered in this assessment:

- Buzzard (green-listed);
- Great black-backed gull (green-listed);
- Sparrowhawk (green-listed).

10.6.1 Potential Construction Effects

Habitat loss associated with the TDR is detailed in Section 9.3.5.3 of Chapter 9 and is limited to laying of temporary hardcore along road verges and grassed areas, trimming of vegetation, hedgerow cutting and tree felling. The habitats at TDR Nodes are largely made up of buildings and artificial surfaces, with adjacent vegetated habitats including hedgerows, treelines, ornamental non-native shrub, amenity grassland, dry meadows and grassy verges, stone walls and other stonework and drainage ditches. Where minimal hedgerow/vegetation trimming, trimming or cutting of ornamental/non-native shrub, and temporary placement of hardcore is required, a Short-term Imperceptible Reversible Local effect will occur. Where tree felling is required, Long-term Moderate Reversible Local scale effects to treelines and hedgerows may occur, see Chapter 9 for assessment of effect significance. Felling affecting treelines and hedgerows is required at TDR Nodes 12, 14, 15, 16, 17, 18, 23 and 25.

The habitat loss within the Site associated with the GCR is encompassed within the footprint of proposed access tracks. The section along public roads may result in the temporary loss of limited sections of dry meadows and grassy verges along road edges. Any potential effects on hedgerows and/or treelines will be limited to branch trimming and will not decrease the overall length of these habitats. As the works will progress relatively quickly along a linear corridor, any fugitive noise will be highly localised, temporary and are not expected to be of sufficient magnitude to create any disturbance or displacement impacts outside of areas contiguous or adjacent to the corridor. These adjacent habitats are widespread in the surrounding area therefore any resident species can easily move in response to any temporary disturbance.

10.6.1.1 Direct Effects: Habitat Loss or Alteration

Habitat loss can be direct through land take of breeding or foraging habitats for key species or indirect such as effective habitat loss through avoidance or disturbance due to the above factors. For direct effects during construction, land take of potential breeding or foraging habitat is the primary effect. This may constitute land stripping or vegetation removal affecting ground nesting birds, hedgerow removal or trimming if this takes place during the breeding season and loss of nesting or roosting sites such as trees. Some species (for example sand martin) may also be affected through material extraction requirements for construction purposes.

Effects on avifauna were assessed following guidance in Percival (2007). As outlined previously, key avian receptors have been assigned an evaluation of importance (or sensitivity) for assessment. Following this, the significance of potential effects are rated as a product of both the magnitude of the predicted effect and the importance value (sensitivity) of the key receptor affected, based on the probability of the likely effect occurring.

The construction of the Site tracks, turbine foundations and hardstandings, the substation compound, temporary site compound and excavation of the on-site borrow pit will result in some habitat damage and loss. Tree felling will be required as part of the project, to facilitate the access roads (5.4Ha forestry will need to be clear-felled). This forestry to be clear-felled is mostly consisting of Sitka Spruce and is expected to take 1 month to clear. For further details on predicted habitat losses please see Chapter 8 Biodiversity.

For the purpose of the consideration of the potential effects on birds, species have been grouped into four categories namely passerines, birds of prey, game birds and waders/waterfowl.

A passerine is any bird of the order Passeriformes, which includes more than half of all bird species. A notable feature of passerines is the arrangement of their toes (three pointing forward and one back) which facilitates perching. The group are sometimes known as perching birds or, less accurately, as songbirds. Pigeon/dove belong to the order Columbidae comprised of birds with stout bodies, short necks, and slender bills which primarily feed on seed, fruits, and plants. Bird of prey are raptors that actively hunt other bird species. Gamebirds are birds that traditionally could be hunted, and terrestrial species often include pheasants and grouse, of which red grouse is an example. Waders are shorebirds with the majority of species eating small invertebrates picked out of mud or exposed soil. Waterfowl are swimming gamebird and are comprised of duck, geese, and swan.

Passerines/ Non-target Species

The loss of habitat due to the construction of the project has the potential to affect some passerines. Habitat loss is inevitable in the development of any wind farm, especially when the development of turbine foundations and hard stands, access roads and other associated construction is considered. This can result in reduced feeding and nesting opportunities for birds. However, direct habitat loss by the development of wind farms tends to be relatively small (Drewitt and Langston 2006).

The proposed Site will result in the long-term removal of wet heath (5.94 ha), dry siliceous heath (7.25 ha o), conifer plantation (5.4. ha), improved agricultural land (0.11 ha), dense bracken (1.73 ha), dense bracken/ scrub mosaic (0.10 ha) and exposed siliceous rocks (0.56 ha). Additional works along the TDR will result in the removal of trees as well as the trimming of branches along the corridor of the route.

Goldcrest (Percival sensitivity: Medium), greenfinch (Percival sensitivity: Medium), linnet (Percival sensitivity: Medium), spotted flycatcher (Percival sensitivity: Medium), tree sparrow (Percival: Medium) and willow warbler (Percival sensitivity: Medium), typically use woodland, and treelines on and bordering the site of which there will be a combined loss of 5.4 Ha. These species have a Percival effect of Low (1-5% population/ habitat lost).

Linnet, greenfinch and tree sparrow are seed-eaters, and although they do require trees and shrubs for breeding, they also need open spaces, with seed, for foraging. Both species would use a number of habitats on site, and to understand predicted effects the summed loss of these habitats have been assessed, rather than looking at each habitat type as a separate entity. Combined losses of habitats suited to greenfinch and linnet amount to 19.51 Ha which are classed as a Low Percival effect significance (1-5% of population/ habitat lost). Similar habitat is present at a number of TDR Nodes but is less suitable due to high levels of disturbance, however open habitats with seed sources, as well as scrub and tree cover exists commonly in the surround landscape. The resultant loss for these species is deemed to be a Long-term Not Significant Effect and Reversible in a local context.

Starlings (Percival sensitivity: Medium) primarily forage in grassland and open habitats, and typically nest in the eaves of old buildings, but also use cavities in mature trees. There will be a loss of 19.51 Ha of suitable habitat. Percival impact significance is Low (1-5% habitat loss for nesting and open foraging habitats), however, there is an abundance of grassland habitats in the surrounding area with ample trees and buildings for nesting, thus a Temporary Imperceptible Effect and Reversible in a local context is predicted for starling.

House sparrow (Percival sensitivity: Medium) breeds throughout Ireland and usually stays close to human habitation - mainly around farm buildings and built-up areas including parks and gardens. Nests in cavity in building, especially under eaves or holes formed by missing brickwork. There will be a loss of 19.51 Ha of suitable habitat. Percival impact significance is Low (1-5% habitat loss for nesting and open foraging habitats). There is a lack of existing manmade structures within the study area but an abundance in the greater area, with supporting needs for the species, thus a Temporary Imperceptible Effect and Reversible in a local context is predicted for house sparrow.

Redwing (Percival sensitivity: High) are winter visitors which uses trees and open habitats onsite to forage in. This species has been added to the red list due to the severity of long and short-term declines in its wintering population. There will be a loss of 19.51 of suitable habitat. Percival effect significance is Low (1-5% population/habitat lost). Furthermore, suitable foraging habitat is generally abundant in agricultural landscapes which are commonplace in the surrounding landscape. Thus, a Temporary Imperceptible Effect and Reversible in a local context is predicted for redwing.

Barn swallow, house martin and sand martin (Percival significance: Medium), as well as Swift (Percival significance: High) are aerial species which forage over open habitats. Barn swallows, house martins and swifts require buildings for nesting, and sand martins typically nest in sand banks or occasionally crevices in walls or bridges. There is no suitable breeding habitat for these three species on site. The closest property to a turbine is located ca. 820 m distance and is roughly equidistant south between turbines T10 and T12. Percival effect significance is Low (5-20% habitat loss for open habitats for aerial feeding). The majority of the Site is open and there will be a predicted loss of 19.51 Ha of such open habitats (note that scrub is included in this instance, as is a source of flying invertebrates, and is relatively low). Loss of these habitats for these species will give rise to a Temporary Imperceptible Effect Reversible in a local context.

Meadow pipit (Percival sensitivity: High) and skylark (Percival sensitivity: Medium) are ground-nesting species which use open habitats with some low-lying vegetative cover (typically grassland and heath) for breeding and foraging. Meadow pipit were observed to be common in open areas throughout study area and evidence of breeding was ascertained. Similarly, skylark were also recorded over open habitats on site. The majority of the Site is open and there will be a predicted loss of 19.51 ha of such open habitats on site which will give rise to a Short-term Slight Effect in a local context which is Reversible. Percival effect significance is Low (1-5% habitat loss for open habitats).

Stockdove (Percival sensitivity: High) nest in trees with holes and forage within agricultural land, typically lands for cereal production. Limited foraging habitat is present in the agricultural grassland onsite. There will be a loss of 0.11 Ha of suitable habitat. Percival effect significance is Medium (5-20% population/habitat lost). Furthermore, suitable foraging habitat is generally abundant in agricultural landscapes which are commonplace in the surrounding landscape. Thus, a Temporary Imperceptible Effect and Reversible in a local context is predicted for redwing.

Wheatear (Percival sensitivity: Medium) is similar to meadow pipit and skylark in that it requires open habitats with low lying vegetative cover, but with interspersed rocky areas for perching and feeding. There is a predicted loss of 19.51 Ha of open habitat. Percival effect significance is Low (1-5% habitat loss).

Grey wagtail forage along watercourses and may nest in bridges and buildings. As such, this species will not be subject to the direct effect of habitat loss.

It is not expected that the Proposed Development will cause a reduction in the baseline population of passerines as the area of nesting/foraging habitat lost will be Imperceptible to Slight. It is considered that the proposed effect of habitat loss will be a Permanent Imperceptible to Not Significant Effect in a local context which is Reversible. However, the trimming of vegetation along with the removal of scrub or felling of trees during the nesting season for birds could result in a Localised Temporary Significant Reversible Effect to nesting birds if it were to be undertaken during the bird nesting season (1st March – 31st of August).

Birds of Prey, Red Grouse and Waders/ Waterfowl- Other target Species

Table 10-5 below displays the direct effect character during construction as well as the significance of effects without the implementation of mitigation.

Table 10-5: Effect of habitat loss to target species

Key Receptor (Sensitivity)	Construction Direct Effect Character	Significance without mitigation
Buzzard (Low)	Recorded on various surveys throughout. The fact that pairs were noted displaying and lingering in suitable habitat, juvenile and immature birds, and the continued presence of the species during the summer seasons, indicates breeding is likely nearby. Buzzards require tall mature trees for nesting which occur at several locations outside the site. Buzzards often feed in open areas, for example, the species regularly takes earthworms from short grassy habitats. While there are some suboptimal areas within each habitat type, looking at a worst-case scenario, there will be a loss of 17.68 Ha suitable habitat. However, conifer plantations and open habitats are common in the surrounding area.	Sensitivity: Low Magnitude: Low (<5% habitat loss) Overall significance: Negligible. (Criteria: Percival, 2003) Loss of breeding and/or foraging habitat will be a Long-term Slight Effect based on the fact that breeding on habitat on site is negligible but scattered throughout the surrounding landscape and the species in common and increasing (Criteria: EPA, 2022)
Golden Plover (Very High)	Recorded on vantage point surveys in the flight activity survey area,. Golden Plover breed on open upland habitats (which includes blanket bogs, heather dominated areas and marginal grasslands), where they are known to favour areas of short vegetation (<10 cm), particularly dominated by heather mixed with grasses (Parr, 1980; Whittingham et al., 2001). The species has a restricted range in Ireland, breeding in upland areas in the north-west. No birds were noted during the breeding season, and birds appear to use the site and surrounding areas only in the non-breeding season, thus suggesting that habitats are not suitable for breeding birds on site. All observations were of birds flying through the site without landing in potential suitable habitat. While there are some suboptimal areas within each habitat type, looking at a worst-case scenario, there will be a loss of 17.68 Ha of suitable habitat.	Sensitivity: Very High Magnitude: Low (<5% habitat loss) Overall significance: High (Criteria: Percival, 2003) Loss of wintering and/or foraging habitat will be a Long-term Slight Effect Locally and a Long-term Imperceptible to Slight Effect at a county level (Criteria: EPA, 2022).

Key Receptor (Sensitivity)	Construction Direct Effect Character	Significance without mitigation
Great Black-backed Gull (Low)	Recorded during summer 2020 vantage point surveys, on a total of four occasions. While there are some suboptimal areas within each habitat type, looking at a worst-case scenario, there will be a loss of 17.68 Ha of suitable habitat.	Sensitivity: Low Magnitude: Low (<5% habitat loss) Overall significance: Negligible. (Criteria: Percival, 2003) Loss of breeding and/or foraging habitat will be a Long-term Imperceptible Effect based on a paucity of sightings, unsuitable breeding habitat/location, and general abundance of regularly burnt heath/ grassland in immediate area (Criteria: EPA, 2022)
Hen Harrier (Very High)	Recorded during both summer and winter season vantage point surveys, on a total of 17 occasions. No birds were recorded breeding within the study area. The fact that male, female and juvenile were recorded, hunting behavior recorded within the study area, and the continued presence of the species during the summer seasons, indicates breeding is likely nearby. Habitat on site is highly degraded as a result of intensive livestock grazing and burning and is deemed unlikely to be suitable for breeding hen harrier in current times, and likewise, foraging is deemed suboptimal. Hen harrier typically forage over heath bog, low intensively farmed grassland with well-established hedgerows and areas of scrub (Irwin et al., 2012). While there are some suboptimal areas within each habitat type, looking at a worst-case scenario, there will be a loss of 17.68 Ha of suitable habitat.	Sensitivity: Very High Magnitude: Low (<5% habitat loss) Overall significance: High (Criteria: Percival, 2003) Loss of breeding and/or foraging habitat will be a Long-term Slight to Moderate Effect based on a lack of breeding on site as well as low number of sightings (seven in total) (Criteria: EPA,
Herring Gull (Medium)	Recorded on five occasions during summer season vantage point surveys, with. Although this species nests primarily on the coast, it is also known to nest on buildings, in larger towns and cities. Birds nesting inland occur near larger waterbodies. Thus there is no scope for breeding on-site. Habitats on site are also largely unsuitable for foraging birds, and as such there is limited potential for foraging birds. Birds were only recorded flying through the site and not landing within the study area. It is worth noting that improved agricultural grassland is abundant in the area as is slurrying/ploughing. While there are some suboptimal areas within each habitat type, looking at a worst-case scenario, there will be a loss of 0.11 Ha of suitable habitat.	Sensitivity: Medium Magnitude: Low (<5% habitat loss) Overall significance: Very Low (Criteria: Percival, 2003) Loss of breeding and/or foraging habitat will be a Long-term Imperceptible Effect based on a low number of sightings, unsuitable breeding habitat/location, and general abundance of GA1 in immediate area (Criteria: EPA, 2022)

Key Receptor (Sensitivity)	Construction Direct Effect Character	Significance without mitigation
Kestrel (High)	Recorded on over 100 occasions from all VPs during summer and winter vantage point surveys. Conifer plantation, dry heath, grassy verges, improved agricultural grassland, recently-felled woodland and scrub all provide potential breeding and foraging habitats - thus the species is rather flexible in its habitat needs. Although breeding was not proven, it is considered that kestrel probably breeds in the vicinity of the site. The site is used frequently by foraging birds. There will be the permanent loss of 25.58 Ha of suitable habitat for Kestrel; habitat which is also present in the general area.	Sensitivity: High Magnitude: Low Overall significance: High (Criteria: Percival, 2003) Loss of breeding and/or foraging habitat will be a Long-Term Slight to Moderate Effect based on the fact that there were a high number of sightings on site, however, breeding habitat on site is scarce but is scattered throughout the surrounding landscape (Criteria: EPA, 2022).
Lesser Black-backed Gull (Medium)	Recorded on 15 occasions, during both summer and winter vantage point surveys. Although this species nests primarily on the coast, it is also known to nest on buildings, in larger towns and cities. Birds nesting inland occur near larger waterbodies, and thus there is no scope for breeding on-site. Habitats on site are also largely unsuitable for foraging birds, and as such there is limited potential for foraging birds. It is worth noting that improved agricultural grassland is abundant in the area as is slurrying/ploughing and thus any habitat lost or disturbed is amply available in the surrounding landscape. While there are some suboptimal areas within each habitat type, looking at a worst-case scenario, there will be a loss of 0.1 Ha of suitable habitat.	Sensitivity: Medium Magnitude: Low (<5% habitat loss) Overall significance: Very Low. (Criteria: Percival, 2003) Loss of breeding and/or foraging habitat will be a Long-term Imperceptible Effect based on a low number of sightings, unsuitable breeding habitat/location, and general abundance of GA1 in immediate area (Criteria: EPA, 2022)
Mallard (Medium)	Recorded on two occasions in the summer of 2021. Both sightings involved a pair of birds. Birds were only recorded flying through the site and not landing. There will be no loss of suitable habitat.	Sensitivity: Medium Magnitude: Negligible (<1% habitat loss) Overall significance: Very Low. (Criteria: Percival, 2003) Loss of breeding and/or foraging habitat will be a Long-term Imperceptible Effect based on a low number of sightings, as well as a lack of suitable breeding/foraging habitat on site (Criteria: EPA, 2022)
Merlin (Very High)	Recorded on eight occasions during both summer and winter vantage point surveys. Merlin have largely shifted to nesting in 10 year+ conifer plantations, using old corvid nests, and require open ground (heath, natural grassland, bog, etc) for hunting.	Sensitivity: Very High Magnitude: Low (<5% habitat loss) Overall significance: High (Criteria: Percival, 2003)

Key Receptor (Sensitivity)	Construction Direct Effect Character	Significance without mitigation
	Thus, whilst breeding was not detected on site, it is a possibility with both upland heath and conifer plantation occurring side-by-side. Both male and female individuals were observed hunting within the study area, and the species will be affected by construction. While there are some suboptimal areas within each habitat type, looking at a worst-case scenario, there will be a loss of 25.58 Ha of suitable habitat.	Loss of breeding and/or foraging habitat will be a Long-term Slight Effect (Criteria: EPA, 2022). Based on low number of sightings and a loss of 3.4% of suitable habitat.
Peregrine (Very High)	Recorded on eight occasions from VPs during winter vantage point surveys. Peregrines require tall cliff-faces or man-made structures which resemble these, for breeding. No such habitats or structures occur on study area. Peregrines are aerial hunters which dive on prey from above and as such are not strictly limited to any particular habitat, instead they require sufficient numbers of avian prey. As such, there are no envisaged habitat loss impacts on the species.	Sensitivity: Very High Magnitude: Negligible (<1% habitat loss) Overall significance: Low (Criteria: Percival, 2003). Loss of breeding and/or foraging habitat will be a Long-term Imperceptible to Slight Effect, based on a lack of suitable breeding habitat and resultant loss of, as well as low number of sightings (five in total) (Criteria: EPA, 2022).
Red Grouse (High)	Not observed during two and half years of surveys, however, the species was heard calling twice in summer 2021 from VP2, and this the species has been included as a precautionary measure. Requires heather for both food and shelter/nesting, and thus can be found in heath and bog habitats, where heather is abundant (where overgrazing isn't an issue). Although unlikely, and not noted during surveys, heath habitat (largely degraded through burning and overgrazing) on site could host breeding/foraging grouse. While there are some suboptimal areas within each habitat type, looking at a worst-case scenario, there will be a loss of 13.19 Ha of suitable habitat.	Sensitivity: High Magnitude: Low (<5% habitat loss) Overall significance: Very Low (Criteria: Percival, 2003). Loss of breeding and/or foraging habitat will be a Long-term Imperceptible to Not Significant Effect due to lack of sightings on site, and degradation of heath due to burning and overgrazing by cattle (Criteria: EPA, 2022).
Ringed Plover (Medium)	A single bird recorded on one occasion flying through the site without landing, in summer 2020. There will be no loss of suitable habitat for this summer migrant, which is associated with bare peat, gravel and beach habitats.	Sensitivity: Medium Magnitude: Negligible (<1% habitat loss) Overall significance: Very Low. (Criteria: Percival, 2003)

Key Receptor (Sensitivity)	Construction Direct Effect Character	Significance without mitigation
		Loss of breeding and/or foraging habitat will be a Long-term Imperceptible Effect based on a low number of sightings, as well as a lack of suitable breeding/foraging habitat on site (Criteria: EPA, 2022)
Snipe (High)	Recorded on 16 occasions during both summer and winter vantage point surveys,. Overgrazing is an issue on-site as is the case in most upland areas of Ireland. This limits snipe densities. As display behaviour was observed on several occasions, it is likely that the species breeds in low densities in wetter parts of the site. Predicted loss of wet habitats on site amounts to 13.19 Ha	Sensitivity: High Magnitude: Low (<5% habitat loss) Overall significance: Moderate (Criteria: Percival, 2003). Loss of breeding and/or foraging habitat will be a Long-term ModerateEffect due to sightings, and a moderate loss of habitat (Criteria: EPA, 2022).
Sparrowhawk (Low)	During both summer and winter vantage point surveys, recorded on 11 occasions from all VPs, all involving single birds, with. Requires mature trees for nesting and are commonly found in coniferous plantations. A second key requirement is an abundance of small birds, including meadow pipit and skylark. Both components are present on site and thus, although breeding by sparrowhawk has not been proven, it is highly plausible that it breeds within site, given its secretive nature. While there are some suboptimal areas within each habitat type, looking at a worst-case scenario, there will be a loss of 5.4 Ha of suitable habitat.	Sensitivity: Low Magnitude: Low (1-5% habitat loss) Overall significance: Very Low. (Criteria: Percival, 2003) Loss of breeding and/or foraging habitat will be a Long-term Imperceptible Effect (Criteria: EPA, 2022)

10.6.1.2 Direct Effects: Habitat Loss or Alteration

High levels of activity and disturbance during construction may cause birds to vacate territories close to works, especially for species vulnerable to disturbance. The displacement of birds from areas within and surrounding developments can effectively amount to habitat loss (Drewitt, A. L. and Langston, R. H., 2006). If a habitat is therefore avoided as a result of the disturbance, then effective habitat loss can occur. Examples of causes of disturbance during construction which may lead to displacement are vehicle and personnel movements, vibration and noise impacts from the construction process and visual intrusion (Drewitt, A. L. and Langston, R. H., 2006).

Additional effects may occur during the construction process due to road works along turbine delivery routes, the laying of cabling, the placement of underground cabling, re-working structures such as bridges along turbine delivery routes, and excavation of materials.

Studies both during construction (Pearce-Higgins et al., 2012) and during operational effects of wind farms (Pearce-Higgins et al., 2009) have shown that certain species (e.g. large wading species) can be affected particularly as a result of construction impacts (in that the affected species fail to recover to pre-construction densities).

Indirect effects may occur on species linked to aquatic habitats through pollution events, sediment laden runoff and dust deposition.

Table 10-6: Indirect Construction Effects on Avifauna

Key Receptor (Sensitivity)	Construction Direct Effect Character	Significance without mitigation
Buzzard (Low)	Recorded on various surveys throughout. The fact that pairs were noted displaying and lingering in suitable habitat, juvenile and immature birds, and the continued presence of the species during the summer seasons, indicates breeding is likely nearby. Buzzards require tall mature trees for nesting which occur at several locations outside the site. Buzzards often feed in open areas, for example, the species regularly takes earthworms from short grassy habitats. Possible noise/visual intrusion disturbance to foraging birds within the site.	Sensitivity: Low. Magnitude: Medium – high number of sightings on site and evidence of probable breeding Overall significance: Low. (Criteria: Percival, 2003). Disturbance and/or displacement will be a Short-term Slight Effect (Criteria: EPA, 2022).
Golden Plover (Very High)	Recorded on vantage point surveys in the flight activity survey area. Golden Plover breed on open upland habitats (which includes blanket bogs, heather dominated areas and marginal grasslands), where they are known to favour areas of short vegetation (<10 cm), particularly dominated by heather mixed with grasses (Parr, 1980; Whittingham et al., 2001). The species has a restricted range in Ireland, breeding in upland areas in the north-west. No birds were noted during the breeding season, and birds appear to use the site and surrounding areas only in the non-breeding season, thus suggesting that habitats are not suitable for breeding birds on site. All observations were of birds flying through the site without landing in potential suitable habitat. Possible noise/visual intrusion disturbance to foraging birds within the site - turbines proposed in core wintering area where a large flock occurs. Flocks are flighty and often spend prolonged periods of time in the air after being spooked.	Sensitivity: Very High. Magnitude: High (high number of sightings, large flock size, turbines to be erected in key habitat). Overall significance: Very High. (Criteria: Percival, 2003). Disturbance and/or displacement will be a Short-term Significant Effect at a local level if works were to be carried out within the commonage area during the winter period. Outside of the area and period it will result in a Short-term Imperceptible Effect (Criteria: EPA, 2022).
Great Black-backed Gull (Low)	Recorded during summer 2020 vantage point surveys, on a total of four occasions. Does not breed and does not have the potential to breed on site, and low foraging records indicates that noise or visual disturbance is highly unlikely to be an issue with this species.	Sensitivity: Low. Magnitude: Negligible (just one sighting). Overall significance: Very Low. (Criteria: Percival, 2003). Disturbance and/or displacement will be a Short-term Imperceptible Effect (Criteria: EPA, 2022).
Hen Harrier (Very High)	Recorded during both summer and winter season vantage point surveys, on a total of 17 occasions. No birds were recorded breeding within the study area. The fact that male, female and juvenile were recorded, hunting behavior recorded within the study area, and the continued presence of the species during the summer seasons, indicates breeding is likely nearby. Habitat on site is highly degraded as a result of intensive livestock grazing and burning and is deemed	Sensitivity: Very High. Magnitude: Low (not common but sightings not low enough to consider negligible). Overall significance: Medium. (Criteria: Percival, 2003).

Key Receptor (Sensitivity)	Construction Direct Effect Character	Significance without mitigation
	unlikely to be suitable for breeding hen harrier in current times, and likewise, foraging is deemed suboptimal. Hen harrier typically forage over heath bog, low intensively farmed grassland with well-established hedgerows and areas of scrub (Irwin et al., 2012). Possible noise/visual intrusion disturbance to foraging birds within the site.	Disturbance and/or displacement will be a Short-term Slight Effect (Criteria: EPA, 2022).
Herring Gull (Medium)	Recorded on five occasions during summer season vantage point surveys. Although this species nests primarily on the coast, it is also known to nest on buildings, in larger towns and cities. Birds nesting inland occur near larger waterbodies. Thus, there is no scope for breeding on-site. Habitats on site are also largely unsuitable for foraging birds, and as such there is limited potential for foraging birds. Birds were only recorded flying through the site and not landing within the study area. It is worth noting that improved agricultural grassland is abundant in the area as is slurrying/ploughing. Possible noise/visual intrusion disturbance to foraging birds within the site.	Sensitivity: Medium. Magnitude: Low – sightings are highly tied to slurrying/field flooding events, and there is an abundance of GA1 in the immediate area and beyond. Overall significance: Low (Criteria: Percival, 2003). Disturbance and/or displacement will be a Short-term Slight Effect (Criteria: EPA, 2022).
Kestrel (High)	Recorded on over 100 occasions from all VPs during summer and winter vantage point surveys. A. Conifer plantation, dry heath, grassy verges, improved agricultural grassland, recently-felled woodland and scrub all provide potential breeding and foraging habitats - thus the species is rather flexible in its habitat needs. Although breeding was not proven, it is considered that kestrel probably breeds in the vicinity of the site. The site is used frequently by foraging birds. Possible noise/visual intrusion disturbance to foraging birds within the site.	Sensitivity: High. Magnitude: Medium Overall significance: High. (Criteria: Percival, 2003). Disturbance and/or displacement will be a Short-term Slight to Moderate Effect (Criteria: EPA, 2022) based on the fact that there were a high number of sightings (>100) on site, however, breeding habitat on site is scarce but is scattered throughout the surrounding landscape.
Lesser Black-backed Gull (Medium)	Recorded on 15 occasions, during both summer and winter vantage point surveys. Although this species nests primarily on the coast, it is also known to nest on buildings, in larger towns and cities. Birds nesting inland occur near larger waterbodies, and thus there is no scope for breeding on-site. Habitats on site are also largely unsuitable for foraging birds, and as such there is limited potential for foraging birds. It is worth noting that improved agricultural grassland is abundant in the area as is slurrying/ploughing and thus any habitat lost or disturbed is amply available in the surrounding landscape. Possible noise/visual intrusion disturbance to foraging birds within the site.	Sensitivity: Medium. Magnitude: Low – sightings are highly tied to slurrying/field flooding events, and there is an abundance of GA1 in the immediate area and beyond. Overall significance: Low. (Criteria: Percival, 2003). Disturbance and/or displacement will be a Short-term Slight Effect (Criteria: EPA, 2022).

Key Receptor (Sensitivity)	Construction Direct Effect Character	Significance without mitigation
Mallard (Medium)	Recorded on two occasions in the summer of 2021. Both sightings involved a pair of birds. Birds were only recorded flying through the site and not landing. Habitats on site are suboptimal and breeding on site is unlikely. Possible noise/visual intrusion disturbance to foraging birds within the site.	Sensitivity: Medium. Magnitude: Low (relatively low number of sightings, no indication of breeding or foraging). Overall significance: Low. (Criteria: Percival, 2003). Disturbance and/or displacement will be a Short-term Slight Effect (Criteria: EPA, 2022).
Merlin (Very High)	Recorded on eight occasions during both summer and winter vantage point surveys. Merlin have largely shifted to nesting in 10 year+ conifer plantations, using old corvid nests, and require open ground (heath, natural grassland, bog, etc) for hunting. Thus, whilst breeding was not detected on site, it is a possibility with both upland heath and conifer plantation occurring side-by-side. Both male and female individuals were observed hunting within the study area. Possible noise/visual intrusion disturbance to foraging birds within the site.	Sensitivity: Very High. Magnitude: Medium (no evidence of breeding but possible due to habitats). Overall significance: High. (Criteria: Percival, 2003). Disturbance and/or displacement will be a Short-term Slight to Moderate Effect (Criteria: EPA, 2022).
Peregrine (Very High)	Recorded on eight occasions from VPs during winter vantage point surveys. Peregrines require tall cliff-faces or man-made structures which resemble these, for breeding. No such habitats or structures occur on study area. Peregrines are aerial hunters which dive on prey from above and as such are not strictly limited to any particular habitat, instead they require sufficient numbers of avian prey. Low risk of visual/noise disturbance although it's a species which is very adaptable, often breeding in active quarry sites, thus suggesting that noise and visual disturbance isn't a big hindering factor.	Sensitivity: Very High. Magnitude: Low (low number of sightings and lack of breeding on site). Overall significance: Low. (Criteria: Percival, 2003). Disturbance and/or displacement will be a Short-term Slight Effect (Criteria: EPA, 2022).
Red Grouse (High)	Not observed during two and half years of surveys, however, the species was heard calling twice in summer 2021 from VP2, and this the species has been included as a precautionary measure. Requires heather for both food and shelter/nesting, and thus can be found in heath and bog habitats, where heather is abundant (where overgrazing isn't an issue). Although unlikely, and not noted during surveys, heath habitat (largely degraded through burning and overgrazing) on site could host breeding/foraging grouse. Taking a precautionary approach, possible noise/visual intrusion disturbance to foraging birds within the site.	Sensitivity: High. Magnitude: Low –limited evidence of presence on site, with degraded heathland habitat onsite due to recent burning. Overall significance: Low. (Criteria: Percival, 2003). Disturbance and/or displacement will be a Short-term Imperceptible to Not Significant Effect (Criteria: EPA, 2022).
Ringed Plover (Medium)	A single bird recorded on one occasion flying through the site without landing, in summer 2020. No suitable breeding or foraging habitat onsite. Possible noise/visual intrusion disturbance to foraging birds within the site.	Sensitivity: Medium. Magnitude: Low (relatively low number of sightings, no indication of breeding or foraging).

Key Receptor (Sensitivity)	Construction Direct Effect Character	Significance without mitigation
		Overall significance: Low. (Criteria: Percival, 2003). Disturbance and/or displacement will be a Short-term Slight Effect (Criteria: EPA, 2022).
Snipe (High)	Recorded on 16 occasions during both summer and winter vantage point surveys. Overgrazing is an issue on-site as is the case in most upland areas of Ireland. This limits snipe densities. As display behavior was observed an several occasions, it is likely that the species breeds in low densities in wetter parts of the site. Possible noise/visual intrusion disturbance to foraging/breeding birds on site.	Sensitivity: High. Magnitude: High – potential breeding onsite. Overall significance: Very High. (Criteria: Percival, 2003). Disturbance and/or displacement will be Short-term Significant Effect (Criteria: EPA, 2022).
Sparrowhawk (Low)	During both summer and winter vantage point surveys, recorded on 11 occasions from all VPs, all involving single birds. Requires mature trees for nesting and are commonly found in coniferous plantations. A second key requirement is an abundance of small birds, including meadow pipit and skylark. Both components are present on site and thus, although breeding by sparrowhawk has not been proven, it is highly plausible that it breeds within site, given its secretive nature. Possible noise/visual intrusion disturbance to foraging/breeding birds on site.	Sensitivity: Low. Magnitude: Medium – high number of sightings on site and evidence of probable breeding Overall significance: Low. (Criteria: Percival, 2003). Disturbance and/or displacement will be a Short-term Slight Effect (Criteria: EPA, 2022).

10.6.2 Potential Operational Effects

10.6.2.1 Direct Effects: collision Risk

Studies on operational impacts of wind farms (Pearce-Higgins et al., 2009) have shown that certain species do exhibit levels of turbine avoidance during operational phases which may be extrapolated to reductions in breeding bird densities; however, this may not be as significant as previously thought, certainly in comparison to impacts during construction (Pearce-Higgins et al., 2012). It seems that there is little evidence for consistent post-construction population declines in any species, suggesting for the first time that wind farm construction can have greater effects on birds than wind farm operation; this is supported in the literature (Devereux et al., 2008).

A recent study on the effects of wind turbines on the distribution of wintering farmland birds (Devereux et al., 2008) did not find any consistent patterns of turbine avoidance across the species groups studied (corvids, seed-eaters, gamebirds, and skylark).

The primary cause of direct effects on birds during the operational phase of a development is collision risk. Collision risk behavioural observations of birds in relation to operational wind farms provide the basis of studies on collision risk. Fixed point observations of flight behaviour, flight lines into, through and out of the area and information about the birds' use of the area help to inform the environmental evaluation of the Proposed Development. Bird mortality may result from potential bird collision with turbine structures or turbine blades.

Not all bird species are equally susceptible to collision, and some species suffer proportionately high levels of collision mortality (Drewitt and Langston, 2008). Morphology, physical flight characteristics and differences in vision are all influencing factors. Martin and Shaw (2010) suggest that it is the characteristics of the section of a birds visual field that projects forward and hence 'looks' that are the key factors.

In some species the vertical extent of the forward binocular vision is reduced and therefore the bird is rendered blind, if, whilst in the process of flying, it undertakes behaviour such as the detection of conspecifics, remote food sources, etc. (Martin, 2011 and Martin and Shaw, 2010).

Other species have reduced fovea, are emmetropic (default focus is distant) or may contain blind spots in their field of vision (as an evolutionary trait) which may cause susceptibility to collision. Flight height or the flight heights which birds habitually use along either migration or local flight paths is also an influencing factor. Relative size and high wing loading (or low manoeuvrability) are influencing factors as larger birds with poor manoeuvrability are generally perceived as at greater risk of collision with structures (see Brown et al., 1992, quoted in Drewitt and Langston, 2006). Various species therefore exhibit different morphological and behavioural attributes which may contribute to collision risk.

Recent studies show that modern, larger multi-MW turbines show comparable fatality estimates with older generation models and expected increases in fatalities due to increases in rotor surface are not as expected, possibly due to increased altitude, increased distance between turbines and slower rotation speeds (Krijgsveld et al., 2009). Appraisal of collision risk for the proposed development is based on a predicted maximum blade tip height of 185 metres, and a rotor diameter of 162 metres (see Chapter 2Description of Development).

Relatively little is known about collision as a threat to birds. One problem is that most studies rely on the number of corpses found, but this can be extremely unreliable, since it is known that corpses are quickly removed by predators. At a wind farm site in Co. Tipperary in 2011, it was found that 72% of bird corpses left out were removed after five days. At this site in Co. Tipperary in 2012, scavengers were present at a bird corpse within forty-five minutes of it being placed in the vicinity of a turbine (J. Kearney principal ecologist FT, per. comm. 2022).

The colour, mode, intensity, and density of lighting has been shown to influence the degree to which birds (specifically, nocturnally migrating passerines) are attracted to wind turbines at night. Studies have shown that red lighting is more attractive to birds, and that steady burning lights are more attractive than flashing ones, while structures with no lighting were the least attractive (Kerlinger et al., 2010; Gehring et al., 2009). The directional intensity of lighting is also a factor in reducing the attraction of birds. As such, specification of aviation obstruction lighting to minimise effects on birds is included under operational mitigation measures.

Collision Risk Model Analysis

The Collision Risk Model Report (See Appendix 10.2) presents the results of collision risk modelling for the proposed Coumnagappul Wind Farm, Co. Waterford. This modelling used data from vantage point surveys carried out in the winters of 2020/21, 2021/22, as well as the summers of 2020, 2021, and 2022. The modelling was carried out using the Scottish Natural Heritage Collision Risk Model (Scottish Natural Heritage, 2000; Band et al., 2007 and Band, 2012). The bird occupancy method (Scottish Natural Heritage, 2000) was used to calculate the number of bird transits through the rotors, and the spreadsheet accompanying the Scottish Natural Heritage report was used to calculate collision probabilities for birds transiting through the rotors.

The following target species were recorded during vantage point surveys: black-headed gull, brent goose, buzzard, cormorant, golden plover, great black-backed gull, green sandpiper, grey heron, hen harrier, herring gull, kestrel, lapwing, lesser black-backed gull, mallard, merlin osprey, peregrine, red kite, snipe, sparrowhawk, stock dove, swift, and teal.

Sixteen species were selected for collision risk modelling: buzzard, golden plover, hen harrier, herring gull, kestrel, lapwing, lesser black-backed gull, mallard, merlin, osprey, peregrine, red kite, snipe, sparrowhawk, stock dove, and swift. These species have been selected because they were recorded within the 500 m buffers of the proposed turbines (the flight activity survey area) and at rotor swept heights, and are of conservation concern: i.e., they are red or amber-listed in Birds of Conservation Concern Ireland 2020-2026 (Gilbert et al., 2021), and/or are listed on Annex I of the Birds Directive or green-listed and sensitive to wind farm developments (i.e., buzzard). For all the other species recorded but not included for collision risk modelling, the effective collision risk can be assumed to be zero.

As the proposed grid connection will be buried underground there is no resultant collision risk associated with this element of the Proposed Development.

Passerines

Collision by resident passerines is not considered likely to be a significant issue as their flight activity is generally well below the height of rotor blades and the proposed impact of collision risk will be a Long-term Imperceptible Reversible Effect.

Non-Passerines

Potential collision risk to non-passerine target species is outlined in **Table 10-7** below.

Table 10-7: Potential collision risk to target species

Key Receptor (Sensitivity)	Operational Direct Effect Character	Significance without mitigation
Buzzard (Low)	Twenty-seven buzzard fatalities have been recorded within the European Context, in a review of 46 wind farms up to 2004 (Hoetker et al., 2006). However, this number is low in relation to the estimated European population of up to one million pairs (Gensbol, 2008) and best available knowledge suggests mortality due to wind farms is not sufficient to cause significant population declines of this green-listed species. Predicted number of collisions (assuming avoidance) is 0.052 per year.	Sensitivity: Low. Magnitude: Negligible – based on predicted 0.052 collisions per year which is equal to 0.0003% of an extremely conservative/out-dated (due to a lack of a more recent figure to work with) national population estimate of 1500 birds Overall significance: Very Low. (Criteria: Percival, 2003). The proposed impact of collision risk will be a Long-term Imperceptible Effect (Criteria: EPA, 2022).
Golden Plover (Very High)	Golden plover have been recorded in low numbers as collision fatalities at wind farms (Hoetker et al., 2006; Grunkorn 2011). The SNH guidance (SNH, 2018) does not provide a specific avoidance rate for golden plover, but states that for species not covered by the guidance “we	Sensitivity: Very High. Magnitude: Low (based on 0.136 collisions per year, which amounts to 0.0027% of local population [3,454]).

Key Receptor (Sensitivity)	Operational Direct Effect Character	Significance without mitigation
	recommend a default value of 98%". However 3 years of post-construction monitoring sites included in the CRM (Appendix 10.2) indicates a much higher avoidance rate should be applied for non-breeding golden plover populations. The studies had robust survey methodologies and were carried out at wind farm sites with high levels of golden plover flight activity. The review considers that an avoidance rate of 99.8% is a suitable precautionary estimate for winter golden plover (Gittings 2022). In further support of a high micro-avoidance rate, a study in the Netherlands of three operational wind farms where golden plovers were both diurnally and nocturnally active found no fatalities (Krijgsveld et al., 2009). Golden plovers were not recorded breeding within the 500 m turbine envelope during the survey period which reduces magnitude. The predicted number of collisions (assuming 99.8% avoidance) is 0.136 per year. Predicted number of collisions (assuming 99.8% avoidance) is 0.136 per year (0.0027% of the Dungarvan Bay SPA population and 0.0002 % of the national population)	Overall significance: Low. (Criteria: Percival, 2003). The proposed impact of collision risk will be a Long-term Negligible Effect (Criteria: EPA, 2022).
Great Black-backed Gull (Low)	A published review of the number of bird fatalities owing to collision with wind turbines showed there were zero fatalities across 46 European wind farms (Hoetker et al., 2006). Furthermore, the published avoidance rate is 98% (SNH 2010), suggesting great black-backed gulls exhibit high levels of micro-avoidance at wind farms. Predicted number of collisions (assuming avoidance) is 0.001 per year.	Sensitivity: Low. Magnitude: Negligible (no local population estimate is available, and species does not breed inland in this location. Overall significance: Very Low. (Criteria: Percival, 2003). The proposed impact of collision risk will be a Long-term Imperceptible Effect (Criteria: EPA, 2022).
Hen Harrier (Very High)	No hen harriers were observed breeding on site, so potential collision risk is significantly reduced due to the absence of the territorial display known as 'sky-dancing', which often occurs at heights within the predicted rotor envelope. Documented as occasionally soaring or arriving at winter roosts 'at height' (Watson, 1977), however no roosting was documented during surveys of the site. Literature suggests flying at low heights is a 'ubiquitous trait' supported by a number of studies (e.g. Whitfield and Madders, 2006). The species has a high, published avoidance rate (99%) (SNH, 2017) in relation to wind turbines. Predicted number of collisions (assuming avoidance) is 0.002 per year.	Sensitivity: Very High. Magnitude: Negligible (138 birds nationally would result in a 0.001% population loss. No SPA for the species occurs in the area). Overall significance: Low. (Criteria: Percival, 2003). The proposed impact of collision risk will be a Long-term Imperceptible Effect (Criteria: EPA, 2022).

Key Receptor (Sensitivity)	Operational Direct Effect Character	Significance without mitigation
Herring Gull (Medium)	A published review of the number of bird fatalities owing to collision with wind turbines showed there were 189 fatalities across 46 European wind farms (Hoetker et al., 2006). However, the published avoidance rate is 98% (SNH 2010), suggesting herring gulls exhibit high levels of micro-avoidance at wind farms. Predicted number of collisions (assuming avoidance) is 0.002 per year.	Sensitivity: Medium. Magnitude: Negligible (no local population estimate is available, and species does not breed inland in this location. Overall significance: Very Low. (Criteria: Percival, 2003). The proposed impact of collision risk will be a Long-term Imperceptible Effect (Criteria: EPA, 2022).
Kestrel (High)	Twenty-nine fatalities were recorded across 46 wind farms in a published review of the effects of turbine collision on birds in the European Context (Hoetker et al., 2006). The published avoidance rate is 95% (SNH, 2016). Predicted number of collisions (assuming avoidance) is 0.230 per year.	Sensitivity: High. Magnitude: Negligible, based on 0.230 collisions per year, which represents a loss of 0.0528% (a crude estimate based on proportion of population split by county area, used due to a lack of a county estimate) of the county population. At national level this represents an annual loss of 0.0014% of the population. However, whilst it isn't accurately measurable due to a lack of any 'local' kestrel counts, it is likely that the local magnitude would be Moderate. Overall significance: Low. (Criteria: Percival, 2003). The proposed impact of collision risk will be a Long-term Slight Effect on a county level (Criteria: EPA, 2022).
Lesser Black-backed Gull (Medium)	A published review of 46 European wind farms (Hoetker et al., 2006) found 45 fatalities across wind farms. However, the published avoidance rate (SNH, 2010) is 98%, suggesting birds exhibit a high level of micro-avoidance. Predicted number of collisions (assuming avoidance) is 0.004 per year.	Sensitivity: Medium. Magnitude: Negligible (no local population estimate is available, and species does not breed inland in this location. Annual predicted loss of national population is 0.0001%). Overall significance: Very Low. (Criteria: Percival, 2003). The proposed impact of collision risk will be a Long-term Imperceptible Effect (Criteria: EPA, 2022).

Key Receptor (Sensitivity)	Operational Direct Effect Character	Significance without mitigation
Mallard (Medium)	This species was not recorded within the 500 m turbine buffers at rotor swept heights, so the effective collision risk for this species is zero.	Sensitivity: Medium. Magnitude: Negligible. Overall significance: Very Low. (Criteria: Percival, 2003). The proposed impact of collision risk will be a Long-term Imperceptible Effect (Criteria: EPA, 2022).
Merlin (Very High)	Merlin mainly take prey from a perch, on the ground or low in flight (Gensbol 2008). Wintering birds have been shown to employ low flight attacks for over 64% of total hunts (Dickson 1996). Occasionally birds fly upwards during a pursuit flight, but this only represents 10.8% of total hunts (Dickson 1996), possibly due to increased energy expenditure. Flight patterns during the breeding season are likely to be similar with documented hunting and commuting flight often 1-2 m in height (McElheron 2005). Predicted number of collisions (assuming avoidance) is 0.002 per year.	Sensitivity: Very High. Magnitude: Negligible (0.0005% loss of national population estimate of 400 birds. No country/local estimate, however, assuming an *extreme* worst -case scenario population of one pair, the annual predicted loss of this population would be 0.1%.) Overall significance: Very Low. (Criteria: Percival, 2003). The proposed impact of collision risk will be a Long-term Imperceptible Effect (Criteria: EPA, 2022).
Peregrine (Very High)	Evidence of collision fatality is low, with only two birds recorded in published reviews of wind farm fatalities (Hoetker et al., 2006). The SNH recommended avoidance rate for collision-risk modelling is 98% (SNH, 2010), suggesting high micro-avoidance capabilities. Predicted number of collisions (assuming avoidance) is 0.001 per year.	Sensitivity: Very High. Magnitude: Negligible (0.0001% loss of national population estimate of 1,030 birds. No country/local estimate, however, assuming an *extreme* worst -case scenario population of one pair, the annual predicted loss of this population would be 0.05%. Overall significance: Very Low. (Criteria: Percival, 2003). The proposed impact of collision risk will be a Long-term Imperceptible Effect (Criteria: EPA, 2022).
Red Grouse (High)	A published review of the number of bird fatalities owing to collision with wind turbines showed there were no fatalities across 46 European wind farms between 2004 and 2006 (Hoetker et al., 2006). However, the published avoidance rate is 98% (SNH 2010), suggesting birds exhibit high levels of micro-avoidance at wind farms.	Sensitivity: High. Magnitude: Negligible. Overall significance: Very Low. (Criteria: Percival, 2003).

Key Receptor (Sensitivity)	Operational Direct Effect Character	Significance without mitigation
	This species was not recorded within the 500 m turbine buffers at rotor swept heights, so the effective collision risk for this species is zero.	The proposed impact of collision risk will be a Long-term Imperceptible Effect (Criteria: EPA, 2022).
Ringed Plover (Medium)	This species was not recorded within the 500 m turbine buffers at rotor swept heights, so the effective collision risk for this species is zero.	Sensitivity: Medium. Magnitude: Negligible. Overall significance: Very Low. (Criteria: Percival, 2003). The proposed impact of collision risk will be a Long-term Imperceptible Effect (Criteria: EPA, 2022).
Snipe (High)	A published review of 46 European wind farms (Hoetker et al., 2006) found 45 fatalities across wind farms. However, the published avoidance rate (SNH, 2010) is 98%, suggesting birds exhibit a high level of micro-avoidance. Predicted number of collisions (assuming avoidance) is 0.002 per year.	Sensitivity: High. Magnitude: Negligible (0.00002% loss of national population estimate of 8,550 birds. Overall significance: Negligible. (Criteria: Percival, 2003). The proposed impact of collision risk will be a Long-term Imperceptible Effect (Criteria: EPA, 2022).
Sparrowhawk (Low)	Sparrowhawks are a resident species of the wind farm study area, although no breeding has been recorded within the site. Published fatality rates are low, with two fatalities from a review of 46 wind farms across Europe (Hoetker et al., 2006). Predicted number of collisions (assuming avoidance) is 0.003 per year.	Sensitivity: Low. Magnitude: Negligible (0.00003% loss of national population estimate of 9,100 birds. No country/local estimate, however an extreme worst-case scenario of two pairs yields a predicted annual loss of just 0.1% of this estimated population.) Overall significance: Very Low. (Criteria: Percival, 2003). The proposed impact of collision risk will be a Long-term Imperceptible Effect (Criteria: EPA, 2022).

10.6.2.2 Indirect Effects: Disturbance and Displacement

There is evidence that the rotor blades of wind turbines during operation can displace or exclude some species, which effectively results in habitat loss for these birds. Habitat loss can be direct through land take of breeding or foraging habitats for key species or indirect such as effective habitat loss through avoidance or disturbance due to factors such as perceived collision risk. Birds may therefore avoid areas proximal to turbines until habituation takes place. There are examples in the literature of habituation in species such as geese and swans (see Fijn et al., 2012 and Madsen and Boertmann, 2008).

Available evidence suggests that breeding passerines are not adversely affected by the presence of wind turbines, and for this reason they are omitted from Table 10-7. For example, a German study found no effect on numbers or spatial distribution of skylarks within 1km of turbines (Langston and Pullan, 2004).

Whitfield and Madders (2006), suggest that most studies do not detect any significant displacement of raptor species by wind turbines although there are occasional notable exceptions.

Generally speaking, displacement of birds by the presence of turbines is not considered to be a significant effect on the species assemblage given the limited amount of habitat available onsite and the availability of habitat in the greater area. However, the placement of turbines in the commonage area poses a significant risk of displacing Annex-I protected golden plover. This species commonly winters in areas of upland heath, which is a habitat which is becoming increasingly at risk from both wind farm developments and afforestation. There are several other projects which have either been consented or are proposed which also impose a risk to this habitat, thus further implicating the consequences. This discussed at greater length in section 7.1.15: Potential Cumulative Effects.

No further works will be required along the TDR or the proposed grid route during the operational phase. No operational phase effects are predicted for both elements of the wind farm.

10.6.2.3 Indirect Effects: Barrier Effect

One of the potential operational effects of wind farms is avoidance where the wind farm may act as a barrier to movements (Masden et al., 2009). The effect of birds altering their migration flyways or local flight paths to avoid any infrastructure is a form of displacement (Drewitt and Langston, 2006). The primary effect of barrier effect is increased energy expenditure when birds have to fly further to circumvent an obstacle.

Effects can be highly variable and range from slight ‘checks’ in-flight direction, height, or speed, through to larger diversions around objects. Studies have shown that birds on migration may show avoidance of wind farms (Masden, 2009) but the observed distances involved were trivial in regard to total migration distances, and hence energy expenditure.

In relation to nocturnal flight activity recent studies utilising radar on both offshore and coastal wind farms in Europe have recorded macro-avoidance rates in wildfowl at least as high, or higher at night than during the day, implying that diurnal avoidance rates are comparable to those in periods of lower visibility (Desholm, and Kahlert, 2005). In the same study migrating flocks at night were recorded increasing their distance from individual turbines once inside the wind farm and also travelling in the corridors between turbines (Desholm, and Kahlert, 2005).

Potential disturbance and barrier effects due to the operation of the proposed wind farm are outlined in Table 10-8 below:

Table 10-8: Disturbance and Barrier effect on target species

Key Receptor (Sensitivity)	Operational Direct Effect Character	Significance without mitigation
Buzzard (Low)	Disturbance: In a review of the published impacts of wind farms on buzzard populations (Hötker et al., 2006), it was found that overall, impacts on buzzard populations post-construction, across both winter and breeding seasons was not significant and that buzzards do show habituation to the presence of wind farms (Hötker et al., 2006). It should also be noted that just one case of habituation is documented in this study with a second case showing signs of a lack of habituation. Barrier Effect: Barrier effects on either migration or regular flights of buzzard has been shown at two out of six studies to date (2004) in a European context (Hötker et al., 2006). The overall barrier effect results were shown to be not significant.	Disturbance: Magnitude: Negligible Sensitivity: Low Overall Significance: Very Low (Criteria: Percival 2003). Significance of effects is assessed as a Long-term Imperceptible to Slight Effect due to published cases of habituation, as well as a lack of habituation to wind farms, with the increase in range from Imperceptible to Slight owing to the high number of sightings of this species on site (Criteria: EPA, 2022). Barrier Effect: Magnitude: Negligible Sensitivity: Low Overall Significance: Very Low (Criteria: Percival 2003). Significance of effects to migrating birds in terms of energy expenditure assessed as Imperceptible to Slight; significance of daily barrier effect assessed as Imperceptible to Slight; overall significance considered a Long-term Imperceptible Slight Effect (Criteria: EPA, 2022).
Goldcrest (Medium)	Disturbance: In a review of the published impacts of wind farms on birds (Hötker et al., 2006), there was no information available on goldcrest populations post-construction. However, studies on the impacts of wind farms during both construction (Pearce-Higgins, et al., 2012) and operation (Pearce-Higgins, et al., 2009) have found little evidence of significant disturbance effects on passerine species; direct habitat loss is the main effect through removal of hedgerows and treelines in which goldcrests breed.	Disturbance: Magnitude: Low Sensitivity: Medium, overall effect significance is Low (Criteria: Percival 2003). Significance of effects Slight due to suitable breeding habitat and evidence on site; overall significance considered

Key Receptor (Sensitivity)	Operational Direct Effect Character	Significance without mitigation
	Barrier Effect: Barrier effects on goldcrest has been shown for 0/1 studies to date (2004) in a European context (Hötker et al., 2006), with the overall effect significance being non-significant.	Long-term Slight to Moderate Effect (Criteria: EPA, 2022). Barrier Effect: Magnitude: Low Sensitivity: Medium Overall Significance: Low (Criteria: Percival 2003). Significance of effects to migrating birds in terms of energy expenditure assessed as Imperceptible to Slight owing to evidence of barrier effect in stated two cases; significance of daily barrier effect assessed as Imperceptible to Slight; overall significance considered an Imperceptible to Slight Long-term Effect (Criteria: EPA, 2022).
Golden Plover (Very High)	Disturbance: Possible disturbance during winter months from feeding or roosting locations; feeding is mainly nocturnal and ample displacement habitat is available during daylight hours. Literature suggests differences in densities pre- and post-construction of wind farms is significant (Pearce-Higgins et al., 2012); displacement is not significant but may occur up to 175 m (Hötker et al., 2006). Barrier Effect: High published avoidance rates of wind farms (Krijgsveld et al., 2009) and changes in densities within wind farms post construction (Pearce-Higgins et al., 2012), suggests wind farms act as significant barriers to golden plover.	Disturbance: Magnitude: Low to Medium Sensitivity: Very High Overall Significance: Medium to Very High (Criteria: Percival 2003). Significance of effects Slight to Moderate; overall significance considered a Long-term, Imperceptible Effect (Criteria: EPA 2022). Barrier Effect: Magnitude: Low Sensitivity: Very High Overall Significance: Medium (Criteria: Percival 2003). Significance of effects to migrating birds in terms of energy expenditure assessed as Moderate to Significant; significance of daily barrier effect assessed as Moderate to

Key Receptor (Sensitivity)	Operational Direct Effect Character	Significance without mitigation
		Significant as literature suggests high published avoidance rates of wind farms; overall significance considered a Long-term Moderate Effect (Criteria: EPA, 2022).
Great Black-backed Gull (Low)	Disturbance: Of a literature review, carried out by Percival (2003), all studies which indicated gull species being significantly affected or being a species found to have collided, were identified at wind farms on coastal habitats. It is uncertain that disturbance may effect gull species inland. Furthermore, In a review of the published impacts of wind farms on bird populations (Hötker et al., 2006), it was found that common gulls do show habituation to the presence of wind farms (Hötker et al., 2006). Barrier Effect: Gulls will be more at risk from collision impacts as a result of their flight behaviour, but less sensitive to disturbance and displacement effects (Humphreys et al., 2015).	Disturbance: Magnitude: Negligible Sensitivity: Low Overall Significance: Very Low (Criteria: Percival 2003). Significance of effects Imperceptible due to published habituation to wind farms, and general paucity of sightings; overall significance considered be a Long-term Imperceptible Effect (Criteria: EPA, 2022). Barrier Effect: Magnitude: Negligible Sensitivity: Low Overall Significance: Very Low (Criteria: Percival 2003). Significance of effects to migrating birds in terms of energy expenditure assessed as Imperceptible; significance of daily barrier effect assessed as Imperceptible; overall significance considered a Long-term Imperceptible Effect (Criteria: EPA, 2022).
Greenfinch	Disturbance: Studies on the impact of wind farms during both construction (Pearce-Higgins et al., 2012) and operation (Pearce-Higgins et al., 2009) have found little evidence of significant disturbance effects on passerine species. Barrier Effect: Hötker et al., 2006 found evidence of a barrier effect in greenfinch in two cases, with zero cases of no effect.	Disturbance: Magnitude: Low Sensitivity: Medium Overall effect significance is Low (Criteria: Percival 2003). Significance of effects Slight due to suitable breeding habitat and evidence on site; overall significance considered

Key Receptor (Sensitivity)	Operational Direct Effect Character	Significance without mitigation
		Long-term Slight Effect (Criteria: EPA, 2022). Barrier Effect: Magnitude: Low Sensitivity: Medium Overall significance: Low (Criteria: Percival 2003). Significance of effects to migrating birds in terms of energy expenditure assessed as Imperceptible to Slight owing to evidence of barrier effect in stated two cases; significance of daily barrier effect assessed as Imperceptible to Slight; overall significance considered an Imperceptible to Slight Long-term Effect (Criteria: EPA, 2022).
Grey Heron (Low)	Disturbance: In a review of the published impacts of wind farms on birds (Hötker et al., 2006), they found that typically, birds of open habitats were avoiding turbines by several hundred metres. Grey herons were an exception to this rule and were frequently found close to or within wind farm sites, suggesting habituation. Barrier Effect: Hötker et al., 2006 found evidence of a barrier effect in four out of seven cases, with the remaining three showing no barrier effect. Results were deemed not significant.	Disturbance: Magnitude: Negligible Sensitivity: Low Overall Significance: Very Low (Criteria: Percival 2003). Significance of effects Imperceptible due to infrequent sightings and published evidence of habituation to wind farms; overall significance considered Long-term Imperceptible Effect (Criteria: EPA 2022). Barrier Effect: Magnitude: Negligible Sensitivity: Low Overall Significance: Very Low (Criteria: Percival 2003). Significance of effects to migrating birds in terms of energy expenditure assessed as Imperceptible; significance of daily barrier effect assessed as

Key Receptor (Sensitivity)	Operational Direct Effect Character	Significance without mitigation
		Imperceptible; overall significance considered to be a Long-term Imperceptible Effect (Criteria: EPA 2022).
Grey Wagtail (High)	Disturbance: Studies on the impact of wind farms during both construction (Pearce-Higgins et al., 2012) and operation (Pearce-Higgins et al., 2009) have found little evidence of significant disturbance effects on passerine species. Barrier Effect: Hötker et al. (2006) found evidence of a barrier effect in grey wagtail in one case, with zero cases of no effect.	Disturbance: Magnitude: Low Sensitivity: High Overall Significance: Low (Criteria: Percival 2003). Significance of effects Slight due to suitable breeding habitat and evidence on site; overall significance considered Long-term Slight Effect (Criteria: EPA, 2022). Barrier Effect: Magnitude of effects is assessed as Low (5-20% of habitat/population lost within the site but 1-5% in the greater areas as these habitats are continuous outside the site boundary); Species sensitivity is High, overall effect significance is Low (Criteria: Percival 2003). Significance of effects to migrating birds in terms of energy expenditure assessed as Imperceptible to Slight owing to evidence of barrier effect in stated two cases; significance of daily barrier effect assessed as Imperceptible to Slight; overall significance considered an Imperceptible to Slight Long-term Effect (Criteria: EPA, 2022).
Hen Harrier (Very High)	Disturbance: No breeding or roosting was noted within the subject site. Noise disturbance/visual intrusion unlikely to deter foraging as evidence suggests birds may continue to utilise wind farms post construction (Robinson et al., 2012). Barrier Effect: Although barrier effect has been documented in at least one study in the European context; recent evidence suggests that birds continue to use wind farms post	Disturbance: Magnitude: Low Sensitivity: Very High Overall Significance: Medium (Criteria: Percival 2003).

Key Receptor (Sensitivity)	Operational Direct Effect Character	Significance without mitigation
	construction (Whitfield and Madders, 2006) (Robinson et al., 2012) indicating wind farms may not be significant barriers.	Significance of effects Not Significant to Slight due to scarcity (eight in total) sightings during the total survey period; overall significance considered as Long-term Not Significant to Slight Effect (Criteria: EPA, 2022). Barrier Effect: Significance of effects to birds in terms of energy expenditure assessed as Not Significant; magnitude of daily barrier effect assessed as Not Significant to Slight; overall significance considered Long-term Not Significant to Slight Effect (Criteria: EPA, 2022).
Herring Gull (Medium)	Disturbance: Of a literature review, carried out by Percival (2003), all studies which indicated gull species being significantly affected or being a species found to have collided, were identified at wind farms on coastal habitats. It is uncertain that disturbance may effect gull species inland. Barrier Effect: Gulls will be more at risk from collision impacts as a result of their flight behaviour, but less sensitive to disturbance and displacement effects (Humphreys et al., 2015). For gull species such as lesser black-backed, herring and great black-backed, some studies indicate evidence for attraction, whereas others for displacement, with the remainder indicating no significant response (Cook et al., 2014; Humphreys et al., 2015).	Disturbance: Magnitude: Negligible Sensitivity: Medium Overall Significance: Very Low (Criteria: Percival 2003). Significance of effects is assessed as a Long-term Imperceptible Effect due to published cases of habituation, as well as a lack of habituation to wind farms, coupled with low number of sightings on site (Criteria: EPA, 2022). Barrier Effect: Magnitude: Negligible Sensitivity: Medium Overall Significance: Very Low (Criteria: Percival 2003). Significance of effects to migrating birds in terms of energy expenditure assessed as Imperceptible; significance of

Key Receptor (Sensitivity)	Operational Direct Effect Character	Significance without mitigation
		daily barrier effect assessed as Imperceptible; overall significance considered a Long-term Imperceptible Effect (Criteria: EPA, 2022).
House Martin (Medium)	Disturbance: Evidence suggests that flying insects are attracted to turbines (Long, et. al, 2011; Scholz & Voigt, 2021) which in turn, attracts insectivorous birds, especially hirundines and swifts (Ahlén, 2002). This evidence further suggests that construction of wind farms, instead of disturbing birds, may in fact actually lure such bird species into the rotor sweep zone, thus significantly increasing collision risk. Barrier Effect: Hötker et al. (2006) found evidence of a barrier effect in house martin in two cases, with zero cases of no effect. As mentioned above, attraction of insects to turbines may further attract insectivorous bird species, which would reduce/preclude barrier effect.	Disturbance: Magnitude: Negligible Sensitivity: Medium Overall Significance:Very Low (Criteria: Percival 2003). Magnitude Imperceptible; overall significance considered Local Long-term Imperceptible Effect (Criteria: EPA 2022). Barrier Effect: Magnitude: Negligible Sensitivity: Medium Overall Significance: Very Low (Criteria: Percival 2003). Magnitude to migrating birds in terms of energy expenditure assessed as Imperceptible; magnitude of daily barrier effect assessed as Imperceptible; overall significance considered a Local Imperceptible Long-term Effect (Criteria: EPA 2022).
House Sparrow (Medium)	Disturbance: Studies on the impact of wind farms during both construction (Pearce-Higgins et al., 2012) and operation (Pearce-Higgins et al., 2009) have found little evidence of significant disturbance effects on passerine species. Barrier Effect: Apparent lack of evidence for or against barrier effect in the species. Species not highly migratory, mostly, and only occasionally prone to smaller internal migrations.	Disturbance: Magnitude: Low Sensitivity: High Overall Significance: Low (Criteria: Percival 2003). Significance of effects Slight due to evidence of on site; overall significance considered Long-term Slight to Moderate Effect (Criteria: EPA, 2022). Barrier Effect: Magnitude: Low Sensitivity is High Overall Significance: Low (Criteria: Percival 2003).

Key Receptor (Sensitivity)	Operational Direct Effect Character	Significance without mitigation
		Significance of effects to migrating birds in terms of energy expenditure assessed as Imperceptible to Slight owing to evidence of barrier effect in stated two cases; significance of daily barrier effect assessed as Imperceptible to Slight; overall significance considered an Imperceptible to Slight Long-term Effect (Criteria: EPA, 2022).
Kestrel (High)	Disturbance: Disturbance (in terms of minimal distance to wind farm) has been recorded in 14 studies on wind farms in Europe (Hötker et al., 2006). Habituation to wind farms has been recorded in one case, however the only other case recorded the opposite (Hötker et al., 2006). A case study on the impacts of wind farms on birds conducted in southern Spain (Farfán et al., 2009), found that raptors utilise the space around the wind farm with lower frequency than prior to its existence, which represented a displacement of the home range of these species. In particular, kestrel was noted to decline sharply in the second year of operation, with other raptor species showing a decline in the first year. Barrier Effect: Barrier effects have been shown to a degree in either migrating Kestrel or regular flight paths within the European context (3 of 5 studies; Hötker et al., 2006).	Disturbance: Magnitude: Medium Sensitivity: High Overall Significance: High (Criteria: Percival 2003). Significance of effects Moderate due to published cases of disturbance and high usage of the site by kestrel; overall significance considered Long-term Moderate Effect (Criteria: EPA, 2022). Barrier Effect: Magnitude: Medium Sensitivity: High Overall Significance: High (Criteria: Percival 2003). Significance of effects in terms of energy expenditure assessed as Moderate; magnitude of daily barrier effect assessed as Slight as literature suggests low published avoidance rates of wind farms with habituation; overall significance considered a Slight to Moderate Long-term Effect (Criteria: EPA 2022).

Key Receptor (Sensitivity)	Operational Direct Effect Character	Significance without mitigation
Lesser Black-backed Gull (Medium)	Disturbance: Of a literature review, carried out by Percival (2003), all studies which indicated gull species being significantly affected or being a species found to have collided, were identified at wind farms on coastal habitats. It is uncertain that disturbance may effect gull species inland. Barrier Effect: Gulls will be more at risk from collision impacts as a result of their flight behaviour, but less sensitive to disturbance and displacement effects (Humphreys et al., 2015). For gull species such as lesser black-backed, herring and great black-backed, some studies indicate evidence for attraction, whereas others for displacement, with the remainder indicating no significant response (Cook et al., 2014; Humphreys et al., 2015).	Disturbance: Magnitude: Negligible Sensitivity: Medium Overall Significance: Very Low (Criteria: Percival 2003). Significance of effects is assessed as a Long-term Imperceptible Effect due to published cases of habituation, as well as a lack of habituation to wind farms, coupled with low number of sightings on site (Criteria: EPA, 2022). Barrier Effect: Magnitude: Negligible Sensitivity: Medium Overall Significance: Very Low (Criteria: Percival 2003). Significance of effects to migrating birds in terms of energy expenditure assessed as Imperceptible; significance of daily barrier effect assessed as Imperceptible; overall significance considered a Long-term Imperceptible Effect (Criteria: EPA, 2022).
Linnet (Medium)	Disturbance: Studies on the impact of wind farms during both construction (Pearce-Higgins et al., 2012) and operation (Pearce-Higgins et al., 2009) have found little evidence of significant disturbance effects on passerine species. Barrier Effect: Hötker et al., 2006 found evidence of a barrier effect in linnet in three cases. However, no evidence of breeding was noted on site with all observations occurring during the winter 21/22 season and no observations of the species for the other four seasons of survey onsite. Therefore, the resultant barrier effect to this species is considered to be negligible.	Disturbance: Magnitude: Low Sensitivity: Medium Overall Significance: Low (Criteria: Percival 2003). Significance of effects Slight due evidence of disturbance and number of sightings in both breeding and non-breeding seasons; overall significance considered Long-term Slight Effect (Criteria: EPA 2022).

Key Receptor (Sensitivity)	Operational Direct Effect Character	Significance without mitigation
		Barrier Effect: Magnitude: Low Sensitivity: Medium Overall Significance: Low (Criteria: Percival 2003). Significance of effects to migrating birds in terms of energy expenditure assessed as Slight; significance of daily barrier effect assessed as Slight to Moderate; overall significance considered a Not Significant to Slight Long-term Effect (Criteria: EPA, 2022).
Mallard (Medium)	Disturbance: In a review of the published impacts of wind farms on birds (Hötker et al., 2006), there was evidence of habituation to wind farms in three cases. However, a study conducted by Zhao et al. (2020) on the effect of wind farms on wintering ducks at an important wintering ground in China, found that ducks (mostly mallard and eastern spot-billed ducks) tended to inhabit areas far from wind turbines at Chongming Dongtan, both during the day and at night. Barrier Effect: Barrier effect was noted in three cases out of five (Hötker et al., 2006).	Disturbance: Magnitude: Low Sensitivity: Medium Overall Significance: Low (Criteria: Percival 2003). Significance of effects Not Significant to Slight due to inconsistent evidence of disturbance and low number of sightings; overall significance considered Long-term Not Significant to Slight Effect (Criteria: EPA 2022). Barrier Effect: Magnitude: Low Sensitivity: Medium Overall Significance: Low (Criteria: Percival 2003). Significance of effects to migrating birds in terms of energy expenditure assessed as Not Significant to Slight; significance of daily barrier effect assessed as Slight to Moderate; overall significance considered a Not Significant to Slight Long-term Effect (Criteria: EPA, 2022).

Key Receptor (Sensitivity)	Operational Direct Effect Character	Significance without mitigation
Meadow Pipit (High)	Disturbance: In a review of the published impacts of wind farms on birds (Hötker et al., 2006), there was evidence of habituation to wind farms in three cases. However, a study conducted by Zhao et al. (2020) on the effect of wind farms on wintering ducks at an important wintering ground in China, found that ducks (mostly mallard and eastern spot-billed ducks) tended to inhabit areas far from wind turbines at Chongming Dongtan, both during the day and at night. Barrier Effect: Barrier effect was noted in three cases out of five (Hötker et al., 2006). Disturbance: Pearce-Higgins et al. (2009) note a reduction of up to 15% in breeding meadow pipit as a result of turbine displacement, with an approximate distance up 100m. Peare-Higgins et al (2012) found that meadow pipit densities at two UK-based wind farm sites were reduced post construction relative to pre-construction and construction periods. Hötker et al., 2006 found evidence of habituation in three cases out of six.	Disturbance: Magnitude: Low Sensitivity: High Overall Significance: Low (Criteria: Percival 2003). Significance of effects Slight to Moderate to due to high proportion of suitable breeding habitat and evidence of breeding on site; overall significance considered Long-term Slight to Moderate Effect (Criteria: EPA, 2022). Barrier Effect: Magnitude: Low Sensitivity: High Overall Significance: Low (Criteria: Percival 2003). Significance of effects to migrating birds in terms of energy expenditure assessed as Imperceptible to Slight owing to evidence of barrier effect in stated two cases; significance of daily barrier effect assessed as Imperceptible to Slight; overall significance considered an Imperceptible to Slight Long-term Effect (Criteria: EPA, 2022).
Merlin (Very High)	Disturbance: Possible disturbance to wintering birds due to operational maintenance etc. No breeding or roosting was noted within the site. Barrier Effect: Barrier effect has been recorded in Europe (Hötker et al., 2006) though this may relate mainly to large scale migration, which is unlikely at the subject site. Numbers recorded on site were low throughout the duration of the study and barrier effects are highly unlikely to apply.	Disturbance: Magnitude: Low Sensitivity: Medium Overall Significance: Low (Criteria: Percival 2003). Magnitude is assessed as Low due to low number of sightings over course of study period; species sensitivity is Very High. Overall impact is Medium (Criteria: Percival 2003).

Key Receptor (Sensitivity)	Operational Direct Effect Character	Significance without mitigation
		Significance of effects Slight; overall significance considered a Long-term Slight Effect (Criteria: EPA, 2022). Barrier Effect: Magnitude: Low Sensitivity: Medium Overall Significance: Low (Criteria: Percival 2003). Significance of effects to migrating birds in terms of energy expenditure assessed as Imperceptible to Slight; significance of daily barrier effect assessed as Imperceptible to Slight; overall significance considered to be a Long-term Imperceptible to Slight Effect (Criteria: EPA, 2022)
Peregrine (Very High)	Disturbance: Possible disturbance to foraging birds through noise, visual intrusion. No displacement from breeding sites due to none being recorded within the proposed site boundary. Peregrines are known to nest in urban areas often in cathedrals with loud ringing bells, as well as quarries where regular rock-breaking works are undertaken. For example, Moore et al. (1997), estimated that 65 quarries were occupied in Ireland between 1991 and 1993. Thus there is evidence to suggest that the species is tolerant to human activity. Barrier Effect: Hötker et al., 2006 report one case of barrier effect in peregrines.	Disturbance: Magnitude: Low Sensitivity: Very High Overall Significance: Medium (Criteria: Percival 2003). Significance of effects Not Significant to Slight due to low level of sightings within the site and evidence suggesting tolerance to noisy human activities; overall significance considered Long-term Not Significant to Slight Effect (Criteria: EPA 2022). Barrier Effect: Magnitude: Low Sensitivity: Very High Overall Significance: Medium (Criteria: Percival 2003).

Key Receptor (Sensitivity)	Operational Direct Effect Character	Significance without mitigation
		Significance of effects to migrating birds in terms of energy expenditure assessed as Imperceptible; significance of daily barrier effect assessed as Imperceptible; overall significance considered to be a Long-term Imperceptible Effect (Criteria: EPA, 2022)
Redwing (High)	Disturbance: Studies on the impact of wind farms during both construction (Pearce-Higgins et al., 2012) and operation (Pearce-Higgins et al., 2009) have found little evidence of significant disturbance effects on passerine species. Redwing does not breed in Ireland and is a winter visitor. Barrier Effect: Hoetker et al., 2006 list two cases of a barrier effect in redwing..	Disturbance: Magnitude: Negligible Sensitivity: High Overall Significance: Very Low (Criteria: Percival 2003). Significance of effects Imperceptible to due to a lack of breeding on site as well as stated little evidence of significant disturbance to passerine species; overall significance considered Long-term Imperceptible Effect (Criteria: EPA 2022). Barrier Effect: Magnitude: Negligible Sensitivity: High Overall Significance is Very Low (Criteria: Percival, 2003). Significance of effects to migrating birds in terms of energy expenditure assessed as Imperceptible to Slight owing to evidence of barrier effect in stated two cases; significance of daily barrier effect assessed as Imperceptible to Slight; overall significance considered an Imperceptible to Slight Long-term Effect (Criteria: EPA 2022).
Skylark (Medium)	Disturbance: Studies on the impact of wind farms during both construction (Pearce-Higgins et al., 2012) and operation (Pearce-Higgins et al., 2009) have found little evidence of significant disturbance effects on passerine species. Hoetker et al., 2006 found evidence of habituation in three cases out of six.	Disturbance: Magnitude: Low Sensitivity: Medium Overall Significance: Low (Criteria: Percival 2003).

Key Receptor (Sensitivity)	Operational Direct Effect Character	Significance without mitigation
	Skylark like open habitats with short vegetation for breeding. This habitat pattern is dominant on site. Barrier Effect: Hoetker et al., 2006 found evidence of a barrier effect in meadow pipit in five out of six cases, however this result was deemed statistically not significant.	Significance of effects Slight due to suitable breeding habitat and evidence on site; overall significance considered Long-term Slight to Moderate Effect (Criteria: EPA 2022). Barrier Effect: Magnitude: Low Sensitivity: Medium Overall Significance: Low (Criteria: Percival, 2003). Significance of effects to migrating birds in terms of energy expenditure assessed as Imperceptible to Slight owing to evidence of barrier effect in stated five cases; significance of daily barrier effect assessed as Imperceptible to Slight; overall significance considered an Imperceptible to Slight Long-term Effect (Criteria: EPA, 2022).
Snipe (High)	Disturbance: Possible disturbance to breeding and wintering birds. Literature suggests differences in densities pre- and post-construction of wind farms has a significant impact upon Snipe within an area (Pearce-Higgins et al., 2012). Barrier Effect: The typical low-altitude flight patterns of snipe mean the wind farm is unlikely to act as a significant barrier to this species.	Disturbance: Magnitude: Medium, Sensitivity: High Overall Significance: Medium (Criteria: Percival 2003). The proposed impact of disturbance will be a Local Long-term Moderate Effect (Criteria: EPA 2022). Barrier Effect: Magnitude: Low Sensitivity: High Overall Significance: Low (Criteria: Percival 2003). Overall significance considered a Local Moderate Long-term Effect (Criteria: EPA 2022).

Key Receptor (Sensitivity)	Operational Direct Effect Character	Significance without mitigation
Sparrowhawk (Low)	Disturbance: In a review of the published impacts of wind farms on sparrowhawk populations (Hötker et al., 2006), it was found that overall, effects on sparrowhawk populations post-construction, across both winter and breeding season was not significant. Sparrowhawk do show habituation to the presence of wind farms (Hötker et al., 2006). Breeding was not proven although activity levels suggest that this secretive species likely breeds on or near site. Barrier Effect: Sparrowhawk is considered to be less sensitive or less willing to change their original migration direction when approaching wind farms (Hötker et al., 2006). Three cases of no barrier effect are reported by Hötker et al., 2006, with one case of barrier effect.	Disturbance: Magnitude: Low Sensitivity: High Overall Significance: Low (Criteria: Percival 2003). Significance of effects Not Significant due to published habituation to wind farms and low number of sightings (14) on site); overall significance considered Long-term Not Significant Effect (Criteria: EPA, 2022). Barrier Effect: Magnitude: Low Sensitivity: High Overall Significance: Low (Criteria: Percival 2003). Magnitude to migrating birds in terms of energy expenditure assessed as Imperceptible; magnitude of daily barrier effect assessed as Imperceptible; overall significance considered as a Long-term Imperceptible Effect (Criteria: EPA, 2022).
Spotted Flycatcher (Medium)	Disturbance: Studies on the impact of wind farms during both construction (Pearce-Higgins et al., 2012) and operation (Pearce-Higgins et al., 2009) have found little evidence of significant disturbance effects on passerine species. Barrier Effect: There is no apparent evidence of a barrier effect in this species.	N/A

Key Receptor (Sensitivity)	Operational Direct Effect Character	Significance without mitigation
Starling (Medium)	Disturbance: Studies on the impact of wind farms during both construction (Pearce-Higgins et al., 2012) and operation (Pearce-Higgins et al., 2009) have found little evidence of significant disturbance effects on passerine species. Hötker et al. (2006) found 17 cases of no negative effect post construction during the non-breeding season, with a comparative 5 cases of negative impact (P= 0.05). Furthermore, during the non-breeding season, the average minimal distance (as ascertained from 16 studies) to wind farms was 30m. Barrier Effect: Hötker et al., 2006 found evidence of a barrier effect in starling in three cases, with another three cases of no effect - results deemed statistically insignificant. A relatively high number of recorded turbine casualties (28 - the highest of any passerine, as published by Hötker et al., 2006) suggest that barrier effect is not so much an issue in this species, although this is not necessarily a positive point.	Disturbance: Magnitude: Negligible Sensitivity: Medium Overall Significance: Very Low (Criteria: Percival 2003). Significance of effects Imperceptible to due to a lack of breeding on site as well as stated little evidence of significant disturbance to passerine species; overall significance considered Long-term Imperceptible Effect (Criteria: EPA, 2022). Barrier Effect: Magnitude: Negligible Sensitivity: Medium Overall Significance: Very Low (Criteria: Percival, 2003). Significance of effects to migrating birds in terms of energy expenditure assessed as Imperceptible to Slight owing to evidence of barrier effect in stated three cases; significance of daily barrier effect assessed as Imperceptible to Slight; overall significance considered an Imperceptible to Slight Long-term Effect (Criteria: EPA, 2022).
Stock Dove (High)	Disturbance: Information on the disturbance of the species with respect to wind farms is lacking. Barrier Effect: Hötker et al., 2006 found evidence of a barrier effect in stock dove in two cases, with zero cases of no effect.	Disturbance: Magnitude: Low Sensitivity: High Overall Significance: Low (Criteria: Percival 2003). Significance of effects a conservative Imperceptible to Slight due to a lack of published data on wind farm related disturbance and a relatively high number of sightings (60) on site; overall significance considered

Key Receptor (Sensitivity)	Operational Direct Effect Character	Significance without mitigation
		Long-term Imperceptible to Slight Effect (Criteria: EPA, 2022). Barrier Effect: Magnitude: Low Sensitivity: High Overall Significance: Low (Criteria: Percival 2003). Significance of effects to migrating birds in terms of energy expenditure assessed as Imperceptible to Slight, owing to two cases of published barrier effect and zero cases of no barrier effect; significance of daily barrier effect assessed as Not Significant to Slight; overall significance considered to be a Long-term Not Significant to Slight Effect (Criteria: EPA, 2022).
Swallow (Medium)	Disturbance: Studies on the impact of wind farms during both construction (Pearce-Higgins et al., 2012) and operation (Pearce-Higgins et al., 2009) have found little evidence of significant disturbance effects on passerine species. Evidence suggests that flying insects are attracted to turbines (Long, et. al, 2011; Scholz & Voigt, 2021) which in turn, attracts insectivorous birds, especially hirundines and swifts (Ahlén, 2002). This evidence further suggests that construction of wind farms, instead of disturbing birds, may in fact actually lure such bird species into the rotor sweep zone, thus significantly increasing collision risk. Barrier Effect: Hötker et al., 2006 found evidence of a barrier effect in swallow in four cases. However, as mentioned above, attraction of insects to turbines may further attract insectivorous bird species, which would reduce/preclude barrier effect.	Disturbance: Magnitude: Negligible Sensitivity: Medium Overall Significance: Very Low (Criteria: Percival 2003). Magnitude Imperceptible; overall significance considered Local Long-term Imperceptible Effect (Criteria: EPA 2022). Barrier Effect: Magnitude: Negligible Sensitivity: Medium Overall Significance: Very Low (Criteria: Percival 2003). Magnitude to migrating birds in terms of energy expenditure assessed as Imperceptible; magnitude of daily barrier effect assessed as Imperceptible; overall significance considered a Local Imperceptible Long-term Effect (Criteria: EPA 2022).

Key Receptor (Sensitivity)	Operational Direct Effect Character	Significance without mitigation
Swift (High)	Disturbance: Studies on the impact of wind farms during both construction (Pearce-Higgins et al., 2012) and operation (Pearce-Higgins et al., 2009) have found little evidence of significant disturbance effects on passerine species. Evidence suggests that flying insects are attracted to turbines (Long, et. al, 2011; Scholz & Voigt, 2021) which in turn, attracts insectivorous birds, especially hirundines and swifts (Ahlén, 2002). This evidence further suggests that construction of wind farms, instead of disturbing birds, may in fact actually lure such bird species into the rotor sweep zone, thus significantly increasing collision risk. Barrier Effect: Hötker et al., 2006 found evidence of a barrier effect in swift in two cases. However, as mentioned above, attraction of insects to turbines may further attract insectivorous bird species, which would reduce/preclude barrier effect.	Disturbance: Magnitude: Low Sensitivity: High Overall Significance: Low (Criteria: Percival 2003). Significance of effects Imperceptible to Not Significant due to relatively low number of sightings, lack of breeding habitat and possible attraction of wind farms to insectivorous species which feed on the wing; overall significance considered Long-term Imperceptible to Not Significant Effect (Criteria: EPA, 2022). Barrier Effect: Significance of effects to migrating birds in terms of energy expenditure assessed as Imperceptible to Not Significant; significance of daily barrier effect assessed as Imperceptible to Not Significant; overall significance considered to be a Long-term Imperceptible to Not Significant Effect (Criteria: EPA, 2022).
Tree Sparrow (Medium)	Disturbance: Studies on the impact of wind farms during both construction (Pearce-Higgins et al., 2012) and operation (Pearce-Higgins et al., 2009) have found little evidence of significant disturbance effects on passerine species. Hötker et al., 2006 found one case of non-habituation and zero cases of the contrary. Barrier Effect: Hötker et al., 2006, found evidence of barrier effects.	Disturbance: Magnitude: Negligible Sensitivity: Medium Overall Significance: Low (Criteria: Percival, 2003). Significance of effects Imperceptible to due to a lack of breeding habitat on site as well as stated little evidence of significant disturbance to passerine species; overall significance considered Long-term Imperceptible Effect (Criteria: EPA, 2022).

Key Receptor (Sensitivity)	Operational Direct Effect Character	Significance without mitigation
		Barrier Effect: Magnitude: Negligible Sensitivity: Medium Overall Significance: Very Low (Criteria: Percival, 2003). Significance of effects to migrating birds in terms of energy expenditure assessed as Imperceptible; significance of daily barrier effect assessed as Imperceptible; overall significance considered an Imperceptible Long-term Effect (Criteria: EPA, 2022).
Wheatear (Medium)	Disturbance: Studies on the impact of wind farms during both construction (Pearce-Higgins et al., 2012) and operation (Pearce-Higgins et al., 2009) have found little evidence of significant disturbance effects on passerine species. Hötker et al., 2006 found one case of habituation and zero cases of the contrary. Barrier Effect: Hötker et al., 2006, found evidence of a barrier effect in wheatear in just one case, with zero cases of no effect. However, this species was recorded once during breeding walkover surveys on the 26th June 2022. The lack of subsequent sightings strongly suggests that this bird was a migrant - either a dispersing juvenile or a failed breeding adult. Therefore, the resultant barrier effect to this species is considered to be Imperceptible.	Disturbance: Magnitude: Medium Sensitivity: Medium Overall Significance: Medium (Criteria: Percival, 2003). Significance of effects Slight due stated little evidence of significant disturbance to passerine species; overall significance considered Long-term Slight Effect (Criteria: EPA, 2022). Barrier Effect: Magnitude: Medium Sensitivity: Medium Overall Significance: Medium (Criteria: Percival, 2003). Significance of effects to migrating birds in terms of energy expenditure assessed as Imperceptible to Slight owing to evidence of barrier effect in stated case; significance of daily barrier effect assessed as Imperceptible to Slight; overall significance considered an Imperceptible to Slight Long-term Effect (Criteria: EPA, 2022).

Key Receptor (Sensitivity)	Operational Direct Effect Character	Significance without mitigation
Willow Warbler (Medium)	Disturbance: Studies on the impact of wind farms during both construction (Pearce-Higgins et al., 2012) and operation (Pearce-Higgins et al., 2009) have found little evidence of significant disturbance effects on passerine species. Hötker et al., 2006 found one case of non-habituation and zero cases of the contrary. Barrier Effect: Hötker et al., 2006, do not describe cases of barrier effect or a lack thereof.	Disturbance: Magnitude: Negligible Sensitivity: Medium Overall Significance: Low (Criteria: Percival, 2003). Significance of effects Imperceptible to due to a lack of breeding habitat on site as well as stated little evidence of significant disturbance to passerine species; overall significance considered Long-term Imperceptible Effect (Criteria: EPA, 2022). Barrier Effect: Magnitude: Negligible Sensitivity: Medium Overall Significance: Very Low (Criteria: Percival, 2003). Significance of effects to migrating birds in terms of energy expenditure assessed as Imperceptible; significance of daily barrier effect assessed as Imperceptible; overall significance considered an Imperceptible Long-term Effect (Criteria: EPA, 2022).

10.6.3 Potential Decommissioning Effects

The decommissioning phase of the Proposed Development poses similar risks to potential effects vis-á-vis the construction phase. However, it should be noted that the magnitude of the effect of decommissioning is normally reduced as all infrastructure is already in situ. No works will be required along the haul route as the turbine components will be broken up on site and therefore require less clearance to remove along the same haul road. Grid connection cables will be left in the ground, therefore no potential impacts during decommissioning stage are likely to occur.

10.6.3.1 Direct & Indirect Effects

The following matrix outlines the assessment of direct effects on key avifauna receptors during decommissioning, based on the criteria previously outlined.

Note: the criteria utilised in the current assessment to define duration were as follows, from published guidance (EPA, 2022):

- Momentary: seconds to minutes;
- Brief: less than a day;
- Temporary: up to 1 year;
- Short-term: from 1-7 years;
- Medium-term: 7-15 years;
- Long-term: 15-60 years; and
- Permanent: over 60 years.

It is likely that the time period for decommissioning of the project would be ca. six months.

Passerines and Pigeons/ Doves

Decommissioning during the breeding season may result in some minimal disturbance to breeding passerine species due to increased human activity and noise. Tree trimming will not however be carried out during the bird breeding season. There will be no further habitat loss during the decommissioning phase and the resultant impact to passerine species is a Temporary Imperceptible Reversible Effect.

Birds of Prey

Although no raptors were noted breeding or roosting on site, surveys conducted as part of the proposed development indicate that buzzard, kestrel, and sparrowhawk are probably breeding within the vicinity of the study area. Merlin and hen harrier were also noted, to a lesser extent, and although breeding was not proven, these too could be breeding in the immediate vicinity, but not on site. Tree trimming will not be carried out during the bird breeding season. There will shall be no further habitat loss during the decommissioning phase. Decommissioning during the breeding or wintering season may result in some minimal disturbance to breeding or roosting kestrel, sparrowhawk, or buzzard (which may occur on the peripheries of the site), due to increased human activity and noise. The resultant impact to birds of prey is a Temporary Imperceptible Reversible Effect. As no breeding or roosting of raptors was noted on site, this prediction is worst-case scenario that assumes there is breeding and roosting raptors on site.

Waders and Wildfowl

Herring gull, great black-backed gull, and lesser black-backed gul were recorded during surveys and involved some records of birds landed on site. The increase in human activity and noise may result in a minimal temporary disturbance to these species.

Snipe were noted as being present within and immediately adjacent to the Site and potentially breeding. Golden plover were noted on several occasions over the winter seasons and involved some records of birds landed on site. The increase in human activity and noise may result in a Temporary Significant Reversible Effect to these species.

Ringed plover was noted just once on vantage point surveys, and almost certainly refers to a lone migrant. Grey heron was noted once flying over the site on one occasion, however, it did not land. No effects are anticipated for ringed plover and grey heron.

Mallard were not seen to land on site and thus no effects are anticipated.

Again, as there will be no further habitat loss during the decommissioning phase, and tree trimming will not be carried out during the bird breeding season. The resultant impact to waders and waterfowl is a Temporary Imperceptible Reversible Effect.

Red Grouse

Red grouse were heard not seen during VP surveys and could potentially occur in the heathland onsite. The increase in human activity and noise may result in a minimal temporary disturbance to these species.

Again, as there will be no further habitat loss during the decommissioning phase, and tree trimming will not be carried out during the bird breeding season. The resultant impact to Red Grouse would be a Temporary Imperceptible Reversible Effect.

10.6.4 Potential Cumulative Effects

Direct effects on avifauna during construction are primarily land take related, mainly due to the loss of nesting habitats to key species. Other sources of land take as outlined above do have the potential to for cumulative effects on nesting or resident farmland or woodland species (the typical landscape characters). Species such as robin may be affected cumulatively by further loss of hedgerows due to farming practices, etc. Even though in-combination land take is unlikely to result in range loss of any species which frequent the subject site, mitigation may be required to neutralise the effect of the Proposed Development.

Disturbance or effective habitat loss indirectly is more difficult to quantify; especially as most species of birds may habituate to disturbance over time.

There is one operational wind farm within 20 km of the Site, Woodhouse Wind Farm (I & II). There are also two privately owned single turbines within 20 km, Tierney and Kilnagrance. There is an additional granted wind farm, a granted private turbine and a proposed windfarm (by EMPower) within 20km of the site.

The nearest operational wind farm is Woodhouse Wind Farm which is located approximately 17.2km to the southwest of the site.

Table 10-9: Existing and permitted/ proposed wind farms within 20 km of the Proposed Development.

Wind Farm Name	Number of Turbines	Distance and Direction from Proposed Development Site	Status
Tierney	1	5.1 km West of site	Existing
Kilnagrance	1	14 km East of site	Existing
Woodhouse (I & II)	8	17.2 km Southwest of site	Existing
Knocknamona	8	17.2 km Southwest of site	Granted
Dyrick Hill	12	8.3 km Southwest of site	Proposed

Bird surveys conducted at Woodhouse Wind Farm (Planning reference 041788, Waterford City and County Council) took place in in the early 2000s (EIA published September 2004), before rigorous methodologies were in place, and just a very brief mention of birds can be found in the Environmental Impact Statement, and is provided in full as follows:

"Bird species within and around the site were recorded by sight and/or sound. An assessment of the breeding status for each species was made based on behaviour. As a scoping study did not indicate the presence in the area of any bird species of conservation importance, such as hen harrier, specialised single-species bird surveys were not considered necessary for this site.

A typical range of bird species associated with improved grassland and hedgerows occurs within the site. Crows were plentiful, with rook (Corvus frugilegus), jackdaw (Corvus monedula), hooded crow (Corvus corone) and magpie (Pica pica) all present. Starlings (Sturnus vulgaris) and woodpigeons (Columba palumbus) were also recorded in the pasture fields. Meadow pipit (Anthus pratensis) was present in several of the fields, while one pair of skylarks (Alauda arvensis) was located in one of the northernmost fields within the site.

Small bird species recorded in the hedgerows include robin (Erithacus rubecula), wren (Troglodytes troglodytes), blackbird (Turdus merula), song thrush (Turdus philomelus), blue tit (Parus caeruleus), coal tit (Parus ater), long-tailed tit (Aegithos caudatus), goldcrest (Regulus regulus), chiffchaff (Phylloscopus collybita) and chaffinch (Fringilla coelebs). Most of these species would probably nest locally.

Reed bunting (Emberiza schoeniclus) breeds in the wet marsh habitat in the north-west sector and moorhen (Gallinula chloropus) has a presence. A grey wagtail (Motacilla cinerea) flew over the northern farm complex and probably nests locally."

An EIAR prepared by Malachy Walsh (2014) at Knocknamona Wind Farm found the following sensitive species (please note that the BoCCI statuses quoted were different to the current list and so they have been amended to align with the 2020-2026 assessment):

High Sensitivity:

- Curlew (Red-listed)
- Woodcock (Red-listed)
- Meadow Pipit (Red-listed)
- Kestrel (Red-listed)
- Swift (Red-listed [outside site])

Medium Sensitivity:

- Sand martin (amber-listed)
- Goldcrest (amber-listed)
- Barn swallow (amber-listed)
- Skylark (Amber-listed [outside site])
- Linnet (Amber-listed [outside site])
- Starling (Amber-listed [outside site])

An additional EIAR was produced in September 2020 for proposed larger turbines and a meteorological mast at Knocknamona Wind Farm and found the following sensitive species:

High Sensitivity:

- Meadow pipit (Red-listed)
- Woodcock (Red-listed)
- Kestrel (Red-listed)
- Swift (Red-listed)

Medium Sensitivity:

- Skylark (Amber-listed)
- Goldcrest (Amber-listed)
- House martin (Amber-listed)
- Linnet (Amber-listed)
- Stonechat (Amber-listed)
- Starling (Amber-listed)
- Swallow (Amber-listed)
- Tree Sparrow (Amber-listed)

Although not listed as a key receptor in any of the above detailed surveys at Knocknamona, golden plover is the most relevant target species requiring cumulative analysis. The following summary text is provided in the 2020 report:

"The results of surveys for the area indicate that golden plover do not rely on the wind farm site and surrounding area, are not resident or regularly occurring in the area and that the potential for interactions between the proposed larger turbines and golden plover will be negligible. Based on the negligible potential for interactions between the proposed larger turbines, potential significant impacts to golden plover can be ruled out and therefore this species is not identified as a key sensitive receptor and is not considered further in the assessment."

An EIAR Ornithological Chapter prepared by Fehily Timoney (2023) for the proposed Dyrick Wind Farm found the following sensitive species:

Very High Sensitivity (Annex-I):

- Golden Plover (Red-listed)
- Hen harrier (Amber-listed)
- Merlin (Amber-listed)
- Peregrine (Green-listed)

High Sensitivity (Red-listed):

- Grey Wagtail
- Kestrel
- Lapwing
- Meadow Pipit
- Pochard
- Snipe
- Stock Dove
- Swift

Medium Sensitivity (Amber-listed):

- Black-headed Gull
- Coot
- Cormorant
- Goldcrest
- Greenfinch
- Herring Gull
- House Martin
- House Sparrow
- Lesser black-backed gull
- Linnet
- Mallard
- Mute Swan
- Spotted Flycatcher
- Starling
- Swallow
- Teal
- Wheatear
- Willow Warbler

Although not listed as a key receptor in any of the above detailed surveys at Knocknamona, golden plover is the most relevant target species requiring cumulative analysis. The following summary text is provided in the 2023 report:

“Of most relevance is the occurrence of golden plover, which has a predicted 6.21 strikes/annum (assuming avoidance of 99.8%) at Dyrick Hill.”

Whilst it is not possible to determine with certainty, Dyrick Hill will likely have a cumulative impact on golden plover in terms of land-take and displacement/disturbance . In terms of collision risk, it will have a cumulative impact and would increase the predicted collision rate of 0.136 per annum to 6.346 per annum which increases the county local population loss by 0.18% (0.004% increases to 0.184%) per annum. For kestrel, the cumulative impact would increase the predicted collision rate of 0.230 per annum to 2.95 per annum.

Based on the evidence available in addition to the fact that there is a significant distance to many of these wind farms, the lack of migration paths during survey, along with the results of hinterland surveys undertaken for the proposed development, any cumulative effects on birds during the construction phase would be a Long-Term Imperceptible Cumulative Effect.

1.1.1.1 Cumulative Effects During Construction

Direct effects on avifauna during construction are primarily land take related, mainly due to the loss of nesting habitats to key species. Other sources of land take as outlined above do have the potential for cumulative effects on nesting or resident farmland or woodland species (the typical landscape characters) in addition to specialist species such as kestrel (potentially affected by forestry operations). Species such as goldcrest and willow warbler may be affected cumulatively by further loss of hedgerows due to farming practices, etc. Even though in-combination land take is unlikely to result in range loss of any species which frequent the subject site, mitigation will be required to neutralise the effect of the Proposed Development. Disturbance or effective habitat loss indirectly is more difficult to quantify; especially as most species of birds may habituate to disturbance over time. Any cumulative effects on birds during the construction phase would be a Long-Term Imperceptible Cumulative Effect.

1.1.1.2 Cumulative Effects During Operation

Direct effects on avifauna during operation which may be cumulatively added to by other existing pressures or proposed developments include collision related mortality, ongoing disturbance/displacement, and barrier effect. Flight height or the flight heights which birds habitually use along either migration or local flight paths is an influencing factor in determining whether the proposed development will combine with additional wind farms to produce additive, synergistic or antagonistic effects.

These effects include increased Barrier Effect (potentially obstructing migratory flightpaths), increased collision risk (through combined mortality in susceptible species) and increased disturbance to birds utilising foraging grounds whilst on migration.

Considering the distances of the five previously listed wind farm sites in relation to the proposed Coumnagappul l study area, the lack of migration paths during surveys, along with the results of hinterland surveys undertaken for the proposed development, the cumulative collision risk on any avian receptors is considered negligible. Furthermore, studies have found that local wintering birds will habituate to the presence of turbines and therefore avoid collision (Langston & Pullan, 2004). Cumulative collision mortality combined with other wind farm developments is predicted to be a Long-Term Imperceptible Cumulative Effect.

However for golden plover it is predicted to be a Long-Term Slight Cumulative Effect. However this is considered to be a highly cautious increase as adding the cumulative impacts in terms of predicted annual risk from both previously mentioned wind farms with golden plover, both national and local loss rates remain as negligible, with 0.004 increasing to 0.184, respectively.

As the predicted annual collision rate of kestrel at Dyrick Hill is greater than one per year, this also warrants further thought in terms of cumulative impact. The cumulative impact in terms of annual predicted collisions from both wind farms is 2.95 predicted collisions per year (0.0037% of national population). This does not change the Percival Negligible status of kestrel, and thus is not considered to be a cumulative impact.

1.1.1.3 Cumulative Effects During Decommissioning

The potential cumulative effects during decommissioning are considered to be the same as those described for the construction phase of the proposed development.

10.7 Mitigation Measures for Avifauna

Mitigation measures are described below which will avoid, reduce and where possible, offset potential negative effects arising in relation to avifauna from the construction, operation and decommissioning of the site. These mitigation measures will be implemented in full.

10.7.1 Mitigation by Avoidance and Design

See Chapter 9 Biodiversity, Section 9.10.1.

10.7.2 Mitigation Measures during the Construction Phase of the Project

10.7.2.1 Introduction

Construction of this project is expected to cause temporary (disturbance) adverse effects on local ecological receptors, as outlined in section 7.5 above. The mitigation measures described below will reduce these effects significantly.

10.7.2.2 Project Ecologist/ ECoW

A Project Ecologist/Ecological Clerk of Works (ECoW) with appropriate experience and expertise (in implementing ecological mitigation measure for wind farm developments) will be employed for the duration of the construction phase to ensure that all the mitigation measures outlined in relation to the environment are implemented. The Project Ecologist/ECoW will be awarded the authority to stop construction activity if there is potential for significant adverse ecological effects to occur.

10.7.2.3 Avifauna

The removal of vegetation and scrub as well as trimming of trees along the TDR and Site will be undertaken outside of the bird breeding season (March 1st to August 31st inclusive). This will help protect nesting birds.

This is in line with best practice recommendations for mitigation measures in regard to birds and wind farms as recommended by statutory bodies such as English Nature and the Royal Society for the Protection of Birds (Drewitt, A. L. and Langston, R. H., 2006).

Construction operations will take place during the hours of daylight to minimise disturbances to roosting birds, or active nocturnal bird species. This is in line with best practice recommendations for mitigation measures in regard to birds and wind farms as recommended by statutory bodies such as English Nature and the Royal Society for the Protection of Birds (Drewitt and Langston, 2006). Limited operations such as concrete pours, turbine erection and installation of the grid connection may require night-time operating hours; these works will be supervised by the project ecologist/ECoW.

Toolbox talks will be undertaken with construction staff on disturbance to key species during construction. This will help minimise disturbance. This is in line with best practice recommendations for mitigation measures with regard to birds and wind farms as recommended by statutory bodies such as English Nature and the Royal Society for the Protection of Birds (Drewitt and Langston, 2006).

Where removed or altered at TDR Nodes, re-instated hedgerows will be planted with locally sourced native species. This will result in habitat enhancement for local species of conservation importance such as meadow pipit. This is in line with best practice recommendations for mitigation measures in regard to birds and wind farms as recommended by statutory bodies such as English Nature and the Royal Society for the Protection of Birds (Drewitt and Langston, 2006).

A re-confirmatory pre-construction survey (March/April) will be conducted of the proposed turbine locations to assess any evidence of target species activity or occupation of new territories (e.g. in the case of breeding snipe). Should any nesting locations be recorded, works at these locations will be restricted to outside the breeding season (March 1st to August 31st inclusive) or until chicks are deemed to have fledged (following monitoring).

The use of “white lights” on the turbines will not occur as these can attract night flying birds such as migrants, and insects, which in turn can attract bats. Certain turbines will be illuminated with medium intensity fixed red obstacle lights of 2000 candelas where required by the IAA Lighting will be fitted with baffles to ensure that the light is directed skywards and will not be discernible from the ground.

10.7.3 Mitigation Measures during the Operation Phase of the Project

A post construction monitoring programme will be implemented at Coumnagappul in order to confirm the efficacy of the mitigation measures; the results of this will be submitted annually to the competent authority and NPWS. Published guidance on assessing the impacts of wind farms on birds from English Nature and the Royal Society for the protection of birds recommends the implementation of an agreed post development monitoring programme as a best practice mitigation measure (Drewitt and Langston, 2006).

In addition, published recommendations on swans and wind farms (Rees, 2012) suggests that systematic post construction monitoring; adapted to quantify collision, barrier, and displacement, be conducted over a period of sufficient duration to allow for annual variation or in combination effects. The following individual components will be carried out:

1. Fatality Monitoring (to be conducted during years 1, 2, 3, 5, 10 and 15 post construction)- A comprehensive fatality monitoring programme will be undertaken following published best practice (Shawn et al., 2010; Fijn et al., 2012 and Grunkorn, 2011); the primary components are as follows:
    a) Initial carcass removal trials to establish levels of predator removal of possible fatalities. This will be done following best recommended practice and with due cognisance to published effects such as predator swamping, whereby excessive placement of carcasses increases predator presence and consequently skews results (Shawn et al., 2010). No turbines which are used for carcass removal trials will be used for subsequent fatality monitoring. Carcass removal trials will be continued for the duration of fatality searches.

b) Turbine searches for fatalities will be undertaken following best practice (Fijn et al., 2012 and Grunkorn, 2011) in terms of search area (minimum radius hub height of 81m) and at intervals selected to effectively sample fatality rates based on carcass removal rates (1 per month). To be conducted during years 1, 2, 3, 5, 10 and 15 post construction to allow for annual variation and cumulative effects. Dependant on results further monitoring to be agreed with NPWS.

c) A standardised approach with a possible control group and/or variation in search techniques such as straight line transects/ randomly selected spiral transects/ dog searches will be undertaken. This will provide a means of robustly estimating the post construction collision fatality impact (if any).

d) Recorded fatalities will be calibrated against known predator removal rates to provide an estimate of overall fatality rates.

Reports will be submitted to the competent authority and NPWS following each round of surveys.

2. Flight Activity Survey (to be conducted during years 1, 2, 3, 5, 10 and 15 post construction) - A flight activity survey will be undertaken during the summer and winter months to include both vantage point and hinterland surveys as Per SNH (2017) guidance:

    a) Record any barrier effect i.e. the degree of avoidance exhibited by species approaching or within the Site (Drewitt and Langston, 2006). Target species to be all raptors and owls, all wild goose and duck species, all swan species, and all wader species.

    b) Record changes in flight heights of key receptors post construction.

Reports will be submitted to the competent authority and NPWS following each round of surveys. This survey is to be conducted during years 1, 2, 3, 5, 10 and 15 post construction to allow for annual variation and cumulative effects. Dependant on results further monitoring requirements will be agreed with NPWS.

3. Monthly Wildfowl Census (to be conducted during years 1, 2, 3, 5, 10 and 15 post construction). A monthly wildfowl census, following the methods utilised for the baseline survey, is to be repeated on a monthly basis during the winter period. This aims to:

    c) Assess displacement levels (if any) of wildfowl such as swans post construction

    d) Assess overall habitat usage changes within the vicinity of the Proposed Development post construction.

This survey will be conducted during years 1, 2, 3, 5, 10 and 15 post construction to allow for annual variation and cumulative effects. Dependant on results further monitoring requirements will be agreed with NPWS. Reports will be submitted to the competent authority and NPWS following each round of surveys.

4. Breeding Bird Survey (to be conducted during years 1, 2, 3, 5, 10 and 15 post construction). A breeding bird survey (moorland breeding bird and Common Bird Census), following methods used in the baseline survey to be repeated yearly between early April to early July. This aims to:

    a) Assess any displacement effects such as those recorded on breeding birds. Overall density of breeding birds to be annually recorded.

5. Breeding Wader Survey (to be conducted during years 1, 2, 3, 5, 10 and 15 post construction). A breeding bird survey, following methods used in the baseline survey to be repeated yearly April-May-June.

Both of the above surveys are to be conducted during years 1, 2, 3, 5, 10 and 15 post construction to allow for annual variation and cumulative effects. Dependant on results further monitoring requirements will be agreed with NPWS.

10.8 Residual Effects on Avifauna

To minimise effects on those species which the literature suggests can be negatively impacted, a re-confirmatory pre-construction survey (March/April) will be conducted of the proposed turbine locations to assess any evidence of target species activity or the occupation of new territories. Should any new nests be recorded, works at these locations will be restricted to outside the breeding season (April-July) or until chicks are deemed to have fledged (following monitoring).

A comprehensive monitoring program, detailed in Section 1.6.3, will also be implemented following construction of the Proposed Development; this will monitor the degree of barrier effect, if any, on existing species as a result of the development, in addition to comprehensively monitoring any bird fatalities.

It is considered that with the implementation of mitigation, the Proposed Development will have a Slight-Imperceptible Reversible Residual Effect and in the local context on birds.

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