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INTRODUCTION

Overview of the Proposed Development

5.1 This chapter assesses the Proposed Development as described in **Chapter 2** in this EIAR. Minimum and maximum tip height, MW power output, foundation size, hardstand dimensions, hub height and rotor diameter parameters being proposed and all design permutations within that range as set out in **Table 2-1** of **Chapter 2** in this EIAR are being applied for. All terms relating to the Proposed Development are defined in **Chapter 2**.

5.2 The Proposed Development is located within the administrative areas of Co. Westmeath and Co. Meath.

5.3 Any forestry permanently lost due to the Proposed Development will be replanted elsewhere as per Department of Agriculture, Food and the Marine (DAFM) (2017) guidelines. These replant lands will not be located within the same hydro- or hydrogeological sub-catchment as the Proposed Development and therefore will have no connectivity to the Proposed Development. The replant lands will be further assessed separately as part of a licensing process by the DAFM, when the exact location is identified. This rationale is outlined further in Methodology section below.

Overview of the Local Environment

5.4 The Proposed Development Site predominantly consists of a mixture of agricultural land, primarily grazing and forestry. Some of the forestry is on land that was previously used for peat extraction. The Proposed Development Site is generally flat with some gently undulating terrain and levels ranging from c. 85 m above ordnance datum (AOD) to 106 AOD. The lowest part of the Proposed Development is along D'arcy's Crossroads Stream at the northwest boundary of the Site. There are several eskers running through the area, some of which show signs of having been locally used for sand and gravel extraction. The western boundary of the Proposed Development Site extends across the Westmeath and Meath County administrative boundary, to include part of the River Boyne and Blackwater cSAC (Site Code: 002299). The River Stonyford and its tributary, D'arcy Crossroad Stream (see **Figure 5-1**) form part of this cSAC.

5.5 For most of the Cable Corridor, the cable will be embedded within existing roads or under botanically species-poor roadside verges. Only small sections of the Cable Corridor, near the Proposed Substation, will require excavation works, which is confined to areas of agricultural land. There are roadside drainage ditches which flow parallel to the road. The Cable Corridor crosses the Kilskeer Stream and Clonmellon Stream.

5.6 The Proposed Substation is located is on the western outskirts of Clonmellon, 200m from the settlement boundary, and in the townland of Galboystown.

Statement of Authority

Richard Arnold

5.7 This Chapter has been reviewed by Richard Arnold BSc MRes MCIEEM CEnv. Richard has over 24 years of experience as a professional ecological consultant. This experience includes work on some of the largest development projects in the UK and Ireland, as well as some work in the Middle East. Richard has worked on projects in most development sectors, including pipelines, cable routes, railways, roads, urban regeneration, ports, power

stations and renewable energy projects, such as wind farms, and at all stages of the development process, from design to completed development.

Jonathon Dunn

5.8 This chapter has been written by Jonathon Dunn MA (Cantab.) MSc PhD MCIEEM. Jonathon also undertook habitat surveys, mammal surveys and bat surveys. Jonathon has worked in the environmental sector since 2014 and joined SLR Consulting in 2021. Prior to working in environmental consultancy, he used to undertake research at Newcastle University on avian ecology and conservation. He holds a PhD in avian ecology from Newcastle University, a MSc in Ecology, Evolution and Conservation from Imperial College London and a MA (Cantab.) in Natural Sciences from the University of Cambridge. Jonathon has extensive experience undertaking and managing bird surveys, along with bat, botanical and mammalian surveys. Jonathon has worked on a wide variety of projects with a focus on wind farms.

Sinéad Clifford

5.9 This chapter has been written by Sinéad Clifford BSc (Hons). Sinéad also undertook habitat surveys, mammal surveys and bat surveys (including call analysis). Sinéad has worked in the environmental sector since 2015 and joined SLR Consulting in 2021. She holds a BSc. in Wildlife Biology from Institute of Technology Tralee, and a Certificate (Distinction) in Ecological Consultancy from Ecology Training UK (formerly Acorn Ecology). Sinéad has strong field skills, and regularly carries out bat, ornithological, botanical and mammalian surveys. In addition, she has extensive experience managing bat surveys for large scale projects, including wind energy developments.

Michael Austin

5.10 The collision risk modelling report was written by Michael Austin. Mike is a Senior Consultant (in Ecology) with SLR. He has over 30 years' experience within ecology and ornithology, both in conservation and consultancy. He has experience of ECoW work at several sites (predominantly at wind farms but also in other sectors). He holds a CSCS card for working on construction sites. Mike has managed a wide range of major Environmental Impact Assessment projects for infrastructure developments throughout the UK, in particular within the renewables industry. Since 2007 Mike has project managed a range of major Environmental Impact Assessments for wind farms and other developments. In addition to this he is proficient in data management systems and GIS. Prior to joining SLR, he held a number of positions as a consultant within RPS Planning and Development and Ecology UK. Before joining the consultancy industry Mike worked within conservation on species recovery projects and habitat management, for RSPB and local wildlife trusts.

Ross Macklin

5.11 The aquatic ecology and fisheries reports were written by Ross Macklin PhD (in preparation) B.Sc. (Hons) MCIEEM., MIFM, HDip GIS, PDip IPM (Principal ecologist with Triturus Environmental Ltd). Ross is an ecologist with over 16 years' professional experience in Ireland. He specialises in freshwater fisheries ecology, biology and water quality. He has considerable experience in a wide range of ecological and environmental projects including EIAR, EcIA, AA/NIS, CEMP reporting, as well as biodiversity, water quality monitoring, invasive species and fisheries management. He also has expert identification skills in macrophytes, freshwater invertebrates, protected aquatic habitats and protected aquatic species including freshwater pearl mussel.

Sharon Spratt

5.12 The Annex I habitat surveys and reports were undertaken and written by Sharon Spratt BSc (Hons), PhD, associate member of CIEEM and full member of Institution of Environmental Sciences (IES). Sharon has 14 years of post-graduate experience with specialisms in habitat mapping, botanical surveys and conservation management. At the time of the surveys, she was working as an independent field ecologist for the National Fen Survey of Ireland for the past two years. Sharon is also a county recorder with the Botanical Society of Britain and Ireland.

Isobel Abbott

5.13 Some of the bat surveys and reports were undertaken and written by Isobel Abbott PhD. Isobel is an independent ecological consultant, with >15 years of experience in bat ecology, bat survey, assessment and mitigation. Isobel has a BSc (Hons) in Zoology from UCC, where she also obtained a PhD on the effectiveness of bat mitigation measures employed in Irish national road schemes. She currently holds nationwide NPWS licences to capture and handle bat species, and to disturb bat roosts for the purposes of ecological impact assessment.

MKO Personnel

5.14 MKO personnel carried out bird surveys and wrote the baseline bird reports.

5.15 The year 1 report was prepared by Andrew O'Donoghue (B.Sc.) an Ornithologist with MKO and Project Director, Dervla O'Dowd (B.Sc.). The field surveys carried out from June 2019 to March 2020 were undertaken by Andrew O'Donoghue, Eric Dempsey, Declan Manley and Kristina O'Connor all of whom are competent experts in bird surveying.

5.16 The year 2 report was prepared by Patrick Manley (B.Sc.) a Project Ornithologist with MKO. The field surveys were undertaken by Athena Michaelides, Andrew O'Donoghue, Declan Manley, Kristina O'Connor, Niall McHugh, Peter Capsey and Paul Troake, all of whom are competent experts in bird surveying.

5.17 The year 3 report was prepared by Donnacha Woods (B.Sc., M.Sc.) a Project Ornithologist with MKO. The field surveys were undertaken by Kate Bismilla, Declan Manley, Tom Rea, Niall McHugh, Ian Hynes and Laura Hynes, all of whom are competent experts in bird surveying.

Certainty and Sufficiency of Information Provided

5.18 The information contained in this chapter includes robust data which has been used to describe the likely significant effects of the Proposed Development on biodiversity. No significant limitations were identified in terms of scale, scope or context in the preparation of this assessment. Details on any minor constraints and limitations have been discussed further in the chapter.

METHODOLOGY AND GUIDANCE

Turbine Range

5.19 As stated in **Chapter 2**, a range of turbine permutations between a minimum hub height of 97.5 m and maximum hub height of 99 m, a minimum tip height of 175 m and a maximum tip height of 180 m, and a minimum rotor diameter of 155 m and maximum of 162 m has been assessed in this EIAR. The approach in this chapter was to undertake an impact assessment for all permutations within the range. For brevity, only the worst-case results (i.e. the turbine parameters within the range that gives rise to the largest magnitude effect) have been presented, with details of the impact assessment of other permutations presented to illustrate the effects of the other permutation. Any marked deviations in effects on biological receptors is discussed in this current chapter. For the other effects, the differences between the effects of all options within the range are assessed to be negligible in relation to biodiversity. Where there is only a negligible change to the effect, this is stated for each effect.

Legislation, Policy and Guidance

5.20 This chapter has been prepared in accordance with the relevant parts of the following legislation, policy and guidance.

International Policy

- UN Convention on Biological Diversity (CBD), and
- The Ramsar Convention on Wetlands of International Importance.

European Legislation and Policy

- Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora ("the Habitats Directive"),
- Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds as amended by Regulation (EU) 2019/1010 of the European Parliament and of the Council of 5 June 2019 on the alignment of reporting obligations in the field of legislation related to the environment ("the Birds Directive"),
- The Bern Convention on the Conservation of European Wildlife and Natural Habitats;
- Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy ("the Water Framework Directive"),
- European Communities (Planning and Development) (Environmental Impact Assessment) Regulations 2018, as amended, and
- Regulation (EU) No 1143/2014 of the European Parliament and of the Council of 22 October 2014 on the prevention and management of the introduction and spread of invasive alien species, as amended, together with Commission Implementing Regulation (EU) 2016/1141 and Implementing Regulation (EU) 2019/1262.

National Legislation and Policy

- The Wildlife Acts 1976, as amended,
- S.I. No. 477/2011 - European Communities (Birds and Natural Habitats) Regulations 2011,

- S.I. 235 of 2022 - the Flora (Protection) Order 2022,
- Project Ireland 2040,
- National Planning Framework,
- National Development Plan 2021-2030,
- National Heritage Plan 2030, and
- National Biodiversity Action Plan 2017-2021.

Local Policy

5.21 The relevant provisions of the Westmeath County Development Plan 2021 – 2027 ("the WCDP") and of the Meath County Development Plan 2021 – 2027 ("the MCDP") have also been considered and are shown in **Appendix 5-1** found in Volume III of this EIAR:

- WCDP, Chapter 12 (Natural Heritage and Green Infrastructure),
- MCDP, Chapter 8 (Cultural and Natural Heritage Strategy), and

5.22 Regional Spatial and Economic Strategy 2019-2031 (Eastern & Midlands Regional Assembly). This will identify the region's key strategic assets, opportunities and challenges and sets out policy responses for the same.

Guidance

5.23 Similarly, the following current best practice guidance has been applied during the preparation of this Chapter and appendices:

- BS42020: 2013 Biodiversity: Code of Practice for Planning and Development,
- CIEEM Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal (2018 and updated 2022),
- EC Commission Guidance 2017: Guidance on the preparation of the Environmental Impact Assessment Report,
- EPA Guidelines on the information to be contained in Environmental Impact Assessment Reports (EIAR) 2022,
- All Ireland Pollinator Plan 2021-2025,
- Bat Conservation Ireland (BCI) (2012),
- NatureScot guidance for birds e.g. (NatureScot, 2018), (NatureScot, 2017), and
- NatureScot guidance for bats e.g. (NatureScot, 2021).

Scoping

5.24 An informal scoping request on the preparation of the EIAR for the Proposed Development was sent to various consultees on 9 and 10 November 2022 (see **Chapter 2**). A summary of key points relating specifically to biodiversity taken from the responses is provided in **Table 5-1**. The responses are included in **Chapter 1**.

Table 5-1: Summary of Consultation Responses

Consultee	Date of First Consultation	Consultee's Comments	Response
An Taisce	09/11/2022	No response	None required
BirdWatch Ireland	09/11/2022	No response	None required
Department of Agriculture, Food and the Marine	09/11/2022	No response	None required
Department of Arts, Heritage, Regional and the Rural and Gaeltacht Affairs – Development Applications Unit (DAU; Nature Conservation)	09/11/2022	The Department recommends that bird survey should also include the use of avian radar systems to detect nocturnal migrating birds…	The bird survey contractor, MKO, consulted with NPWS for every year throughout the bird surveys carried out between June 2019 to September 2021 (see **Appendix 5-2** found in Volume III of this EIAR). NPWS did not recommend the use of avian radar systems to detect migrating birds and the use of such systems is not standard practice. Therefore, it was not done. NatureScot (2017) guidance states that: "*SNH recommends that radar is only used to assess sites where there is likely to be high nocturnal activity of important species, especially if an SPA qualifying species is potentially affected*". Given the distance from the nearest SPA (see **Table 5-4** for more details), the species that form its special conservation interest and the size of the populations recorded at the SPA, high levels of nocturnal activity by those species at the Proposed Development were not expected (see below for more details). Moreover, in our experience, it can be extremely difficult to obtain meaningful data from avian radar systems because they do not

Consultee	Date of First Consultation	Consultee's Comments	Response
			distinguish between species (Welcker et al., 2016; Schmaljohann, H. et al., 2008) and therefore does not distinguish between large flocks of small birds and small flocks of large birds. Therefore, it is concluded that the use of avian radar systems is not required or beneficial in respect of the Proposed Development.
		…and also, separately, the use of avian acoustic sound meters to record and interpret sonograms to determine particular migratory and non-migratory species traversing the proposed site.	As above, the bird survey contractor, MKO, consulted with NPWS throughout the bird survey period, Again, NPWS did not recommend the use of avian acoustic sound meters to detect nocturnal migrating birds and the use of such systems is not standard or best practice (see NatureScot 2017). Therefore, it was not done. Like radar, acoustic detectors (sound meters) also suffer from limitations, as not all birds will call while flying. Similarly, abundance can be difficult to infer and crucially, it is difficult to tell where birds are flying in relation to potential turbine locations and at what heights. This means that acoustic detectors cannot provide meaningful information about the level of collision risk posed to nocturnal species. It is our view that the use of acoustic detectors is not required or beneficial in respect of the Proposed Development.
		Vantage point surveys conducted between dawn and dusk are limited and only provide half the picture, as considerable migration of passerines, geese, swans and other species (including other water birds) takes place at night.	Woodcock *Scolopax rusticola* surveys were undertaken to search for roding (displaying) woodcock and any other nocturnal species were also recorded, such as owls, if present (see paragraph 5.70). No species which are the qualifying/special conservation interest of the SPAs with an ecological connection to the Proposed Development or any other Annex I or other species of conservation concern were detected during these surveys. These SPAs are the River Boyne and River Blackwater SPA and Lough Derravaragh SPA, which are 4 km and 16 km from the Proposed Development, respectively.

Consultee	Date of First Consultation	Consultee's Comments	Response
			They are designated for the following bird species: common kingfisher *Alcedo atthis*; and whooper swan *Cygnus cgnus*, Eurasian pochard *Aythya ferina*, tufted duck *Aythya fuligula* and Eurasian coot *Fulica atra, respectively*. Seven whooper swan flight lines were recorded, suggesting relatively minor levels of diurnal activity (see **Table 5-7** and **Table 5-8**). Whooper swan have been shown to migrate at both day and night, but only at night in certain favourable conditions (Pennycuick, et al., 1996) and therefore nighttime movements will be fewer than those recorded during the day. In accordance with NatureScot (2017) guidance, we have applied a correction factor to the diurnal levels of whooper swan flight activity, which accounts for any regular nocturnal flight activity. The results of this have been assessed within this chapter (paragraph 5.525). There was one record of Eurasian coot breeding at Newtown Lough and no flight lines for this species were recorded during flight activity surveys. However, this species migrates almost exclusively at night (Wernham, et al 2002). The absence of any diurnal observations means that it is not possible to apply a correction factor to account for any nocturnal activity and therefore calculate collision risk. Nevertheless, the potential for Eurasian coot mortality during the operation of the Proposed Development has been assessed within this chapter (paragraph 5.439). Similarly, no pochard or tufted duck were recorded during any of the surveys. It is known that these species make local movements at night (Dirksen, Spaans and van der Winden 2000) however information on nocturnal migration is lacking; for example, there are no records of these species from Ireland's network of nighttime recording locations (compared to 147 for coot), and only small

Consultee	Date of First Consultation	Consultee's Comments	Response
			numbers of tufted duck and pochard, respectively, from the UK records. Nevertheless, the potential for pochard and tufted duck mortality during the operation of the Proposed Development has been assessed within this chapter (paragraph 5.439). The DAU suggests that considerable passerine migration can take place at night. However, NatureScot (2017) guidance states that "*it is generally considered that passerine species are not significantly impacted by wind farms*". Moreover, the SPAs within 20 km do not include passerine species as qualifying/special conservation interest Therefore collision-related impacts on passerines have not been assessed with this chapter. There is evidence in the scientific literature (e.g. Welcker et al., 2016) which suggests that nocturnal migrants (especially passerines) do not have a higher collision risk with wind turbines than diurnal species, but rather appear to circumvent collision more effectively. This supports our approach to passerines in this chapter.
		Nine thousand EU Annex I Greenland white-fronted geese *Anser albifrons flavostris* migrate to and from the Wexford Slobs on their way to Greenland via Iceland. This potentially places the turbines in the proposed wind farm in the path of the migrating geese.	Wexford Harbour Slobs SPA is c. 200 km southeast from the Proposed Development. Satellite tracking studies have shown that this species migrates in spring through Ireland from south to north to Iceland and onto Greenland, and then and then back again in autumn. Greenland white-fronted geese were a target species in the vantage point surveys undertaken at the Proposed Development site over two years and none were seen. For white fronted geese, a different race of the same species, the scientific literature indicates 67% of spring and 71% of migratory flights occur during the day (Kölzsch et al., 2016) with the rest undertaken at night. Therefore, the complete absence of any Greenland white-fronted geese observations during the surveys confirms that any nocturnal flight activity will be negligible. Thus, it is

Consultee	Date of First Consultation	Consultee's Comments	Response
			highly unlikely that any significant migration will occur over the Proposed Development.
		Bat surveys need to account for species such as Leisler bat *Nyctalus leisleri* which mostly fly at a high altitude therefore passive surveying at height should be undertaken.	We have undertaken an automated static detector survey 'at-height' to assess the activity of high-flying bat species, such as Leisler's bat. This showed that Leisler's bat activity at height was generally comparable to or lower than that on the ground, indicating that ground level survey results are representative of at height activity.
		Any proposed mitigation measures to document turbine bat strikes/ collisions/ other fatalities including barotrauma must be adequate (including site visits and inspections).	We have proposed a suite of post-construction monitoring surveys (which is not mitigation) to document any bird collisions and mitigation measures should bird collisions be recorded or suspected . Our proposed post-construction monitoring surveys for birds will also be extended for bats. This will include carcass searches using trained sniffer dogs, plus searcher efficiency and carcass removal trials, as recommended by NatureScot (2021) guidance.
		Lastly, the EIAR should also assess impacts on amber and red-listed species;	This chapter has assessed impacts on amber- and red-listed species.
		areas of High Nature Value (HNV) land;	This chapter has assessed impacts to HNV lands.
		compliance with Article 10 of the EU Habitats Directive in terms of protection of stepping stones and wildlife corridors in the landscape,	This chapter has assessed impacts on ecological stepping stones/wildlife corridors. We have recommended compensation and enhancement measures to ensure that the connectivity of the ecological network is not only maintained but enhanced.
		this is particularly important given the presence in the vicinity of the proposed wind	Impacts on marsh fritillary butterfly are assessed in this chapter (see paragraph 5.392).

Consultee	Date of First Consultation	Consultee's Comments	Response
		farm of EU Annex II species marsh fritillary butterfly	
EPA	10/11/2022	No response	None required
Inland Fisheries Ireland	10/11/2022	The site is adjacent to and may have potential to impact on a wide range of fisheries waters on the Rivers Stonyford, Athboy and Boyne including areas designated as SAC's, angling waters, adult holding areas, nursery and spawning waters, etc. forming parts of the Eastern River Basin District Many turbines are sited adjacent to a range of smaller watercourses which act primarily as contributories to downstream habitat for juvenile salmonids, lampreys and other species as well as macrophytes, algae and macroinvertebrates which as drift form a significant part of the food supply to the downstream fisheries. IFI requests particular regard to the following: All natural water courses which have to be traversed during site development and road construction works should be effectively bridged prior to commencement. If temporary crossing structures are required, IFI approval will be necessary as regards specification and timing of installation. Design and choice of temporary crossing structures	**Chapter 7** 'Water' demonstrates that the Proposed Development will cause no deterioration to named waterbodies. The effect on the Proposed Development on ecological receptors, including SACs has been fully assessed in this Chapter and associated NIS shown in **Appendix 5-11** found in Volume III of this EIAR. Experienced aquatic ecologists undertook baseline ecological and hydrological surveys in July 2022 following IFI guidance for wind farm developments including physico-chemical surveys, at the catchment level, to inform impact assessment of downstream fisheries and other aquatic receptors. In general, water courses in the vicinity of the Proposed Development have been historically straightened and deepened and despite being within the River Boyne and River Blackwater cSAC, were not always of inherently high aquatic value. See later in chapter for additional detail. The mitigation/monitoring regime for the Proposed Development as pertains to aquatic ecology is described in this chapter in paragraph 5.629 onwards. The Construction and Environmental Plan (CEMP), Surface Water Monitoring Plan (SWMP, which includes SuDS principles) and Ecological Monitoring Plan (EMP) are shown in **Appendix 2.2** found in Volume III of this EIAR. All monitoring and mitigation measures adhere to the IFI requirements and will be implemented in full.

Consultee	Date of First Consultation	Consultee's Comments	Response
		must provide for passage of fish and macroinvertebrates, the requirement to protect important fish habitats e.g. spawning and over wintering areas, as well as preventing erosion and sedimentation. In certain circumstances, access for angling or commercial fishing purposes may also be required. No temporary crossing on any watercourse shall be installed without the approval of IFI as regards sizing, location, duration and timing. The preferred option is for clear span 'bridge type' structures on fisheries waters. The crossing of watercourses at natural fords is not permitted because of the amount of uncontrolled sedimentation that can be generated. The creation of fords on streams and rivers through the introduction of stone is prohibited. IFI has provided specific technical advice on temporary and permanent watercourse crossings and has indicated that no crossing shall be provided without their express approval. To minimise adverse impacts on the fisheries resource works in rivers, streams and watercourses should normally (except in exceptional circumstances and with the	

Consultee	Date of First Consultation	Consultee's Comments	Response
		agreement of IFI) be carried out during the period July-September. It is essential that consultants assess and critically review the soil type and structure at the proposed turbine locations, and along the route of any proposed access track(s)/road(s) including areas where temporary or permanent stock piling of excavated material takes place. This is particularly important if the areas concerned contain peat soils. Systems should be put in place to ensure that there shall be no discharge of suspended solids or any other deleterious matter to watercourses during the construction / operational phase and during any landscaping works. A number of requirements for construction and operation were listed in relation to this concern. Request for pre-cast concrete wherever possible during construction to avoid alteration of pH of water. Biosecurity measures requested during construction phase to avoid spread of invasive species. No in-stream works without written approval of IFI. All works should also be carried out as per Guidelines:	

Consultee	Date of First Consultation	Consultee's Comments	Response
		• IFI's Guideline documents on protection of fisheries during construction work in and adjacent to waters http://www.fisheriesireland.ie/fisheries-and-construction-works . • Urban Watercourse Riparian Zone guideline document. https://www.fisheriesireland.ie/documents/86-planning-for-watercourses-in-the-urbanenvironment-1/file.html	
Irish Peatland Conservation Council	10/11/2022	No response	None required
Irish Raptor Group	10/11/2022	No response	None required
Irish Red Grouse Association	10/11/2022	No response	None required
Irish Wildlife Trust	10/11/2022	No response	None required
Meath County Council (Environment Department)	09/11/2022	Recommends Ecological Impact Assessment, Invasive Species Management Plan (ISMP), and Habitat and Species Management Plan (HASMP) as part of EIA	Ecological Impact Assessment has been undertaken in the current Chapter. We have also included an ISMP and HASMP as part of the EIA (see **Appendix 5-10**, which is included in Volume III of this EIAR).

Consultee	Date of First Consultation	Consultee's Comments	Response
Waterways Ireland	10/11/2022	No response	None required
Westmeath County Council (Environment Department)	10/11/2022	No response	None required

Replant Lands

5.25 Replant lands equivalent in area size to the permanently clear-felled lands will be required (see **Table 5-12** for details). There are practical difficulties with identifying replant lands at the planning application stage and it is often more beneficial for the environment to wait until closer to the time of commencement of development works to identify the replant lands.

5.26 While the environmental impact of felling is considered at the planning application stage, felling can only occur after the grant of a felling licence by the DAFM. However, the extent of felling required is determined by the grant of planning permission. Therefore, the scope of the licence required can only be determined after the grant of planning permission. It follows that the details of the area size and location of the replant lands will not be capable of being determined until after planning permission is granted.

5.27 It is environmentally prudent to process felling and afforestation licences closest to the time when these activities are to occur. For example, if a licence is obtained at the planning application stage, it is probable that the licence would expire before the planning process and post-planning delivery preparations could be completed. Moreover, the identification and licensing of replant lands after the grant of planning permission has the benefit of ensuring that the licence is compliant with up-to-date legislation and environmental information, and that the cumulative environmental assessment considers the wider environmental impacts at that point in time. This reflects the fact that key environmental issues relating to afforestation (i.e. water, soils, biodiversity, archaeology, landscape, and climate) are subject to regular updates in terms of best practice, guidelines, standards, and national policies. Therefore, deferring the identification of replant lands until such time as they are required enables identification of optimum lands available from an environmental perspective.

5.28 In general terms, there will be a long-term alteration of habitat due to afforestation. Preparation of the site for planting include mounding of soil above the existing vegetation layer and new drainage channels, which could result in emissions of sediment and chemicals (herbicides or fertilisers) to watercourses and negative effects on ecological receptors. Similarly, the planting schedule could generate disturbance to animals via the use of plant machinery and human presence.

5.29 The Applicant commits to there being no likely significant cumulative residual effects between the Proposed Development and the replant lands. If required, mitigation measures will be included in the licensing application at the time the replant lands are identified to ensure no such cumulative adverse effects will rise. In general terms, these will include the implementation of good forestry work practices (e.g. Environmental Requirements for Afforestation and Forestry Standards Manual) and good afforestation work practices (e.g. DAFM's (2023a) Environmental Requirements for Afforestation and (2023b) Forestry Standards Manual), to the extent they are applicable best practice at the time of the licencing application. Any relevant measures to avoid disturbing relevant animal receptors (e.g. no working at night) will also be carried out.

5.30 Consequently, the replant lands are not discussed further in this chapter.

Desktop Assessment

5.31 A desk study was used to collate existing information on ecological receptors in and around the Proposed Development (further details on spatial extent is provided below).

5.32 The following resources were used for the desktop assessment:

- Satellite imagery[1],
- Environmental Protection Agency (EPA) maps[2],
- National Biodiversity Data Centre (NBDC) database[3],
- Environmental Sensitivity Mapper[4],
- National Parks and Wildlife Services (NPWS)[5],
- NPWS data request. Request received on 17/08/2022,
- Bat Conservation Ireland (BCI) data request. Results accurate as of 24/06/2022,
- A review of Greenland White-fronted Geese in Ireland 1982/83 – 2011/12 (Burke et al. 2014),
- The Irish Wetland Bird Survey (I-WeBS)[6],
- Birds of Conservation Concern 3 (BoCCI3): 2014-2019 (Colhoun & Cummins, 2013), and
- Birds of Conservation Concern in Ireland 4 (BoCCI4): 2020-2026 (Gilbert, Stanbury, & Lewis, 2021).

5.33 These data and sources were used to help shape the scope of field surveys but were not used for impact assessment. All desktop data were either collected at too coarse a spatial scale or were not specifically collected for the purposes of wind farm impact assessment.

5.34 Some of the organisations listed above collate their data at various spatial scales. A 10 km grid square N66 was used to collate spatial data for the Main Wind Farm Site, whose development footprint is of a similar spatial scale and is entirely contained within this 10 km grid square. A 2 km grid square resolution was used for the Cable Corridor, which consist of a much smaller development footprint. The Cable Corridor is primarily confined to existing surfaced roads. As such, a 2 km grid square were only examined for the parts of the Cable Corridor that were off-road (which also included the offsite Proposed Substation). This consisted of square N66P (c. 100 m along improved agricultural grassland). Note that some species lack Irish population estimates in terms of the estimated number of individuals. In some cases, NPWS have made estimates using geographical range as a proxy for population size. Where this is the case, the number of individuals is presented as the number of occupied 1 km grid squares.

5.35 As the accommodation works proposed along the Turbine Delivery Route (TDR) are minor and consist of trimming vegetation, provision of temporary surfaces, widening of field access and temporary removal of signage/street furniture (see **Appendix 14-1** found in Volume III of this EIAR), desktop searches were not undertaken.

Designated Sites

5.36 The following websites were accessed[7] for information on designated sites in the vicinity of the Proposed Development:

- NPWS, and
- NBDC.

[1] www.google.ie/maps Last accessed 27/03/2024
[2] https://gis.epa.ie Last accessed 27/03/2024
[3] https://maps.biodiversityireland.ie/ Last accessed 27/03/2024
[4] https://airomaps.geohive.ie/ESM/ Last accessed 27/03/2024
[5] www.npws.ie/ Last accessed 27/03/2024
[6] www.birdwatchireland.ie/our-work/surveys-research/research-surveys/irish-wetland-bird-survey/ Last accessed 27/03/2024. Data were supplied by the Irish Wetland Bird Survey (I-WeBS), a scheme coordinated by BirdWatch Ireland under contract to the National Parks and Wildlife Service of the Department of Housing, Local Government and Heritage
[7] Last accessed 27/03/2024

5.37 As a starting point, all European and national sites within 20 km surrounding the Proposed Development were identified. For international sites, this included SACs, candidate SACs, proposed SPAs, SPAs, Important Bird Areas (IBAs) and Ramsar sites. For national sites, this included NHAs, pNHAs and nature reserves. The rationale for this search distance is explained later in paragraph 5.131.

Field Assessment

5.38 Ecological surveys were carried out to yield sufficient data to support this assessment. A brief description of the surveys undertaken and survey data are presented in **Table 5-2** below.

Table 5-2: Summary of Field Surveys

Survey	Description	Timing	Guidance Applied
Habitats and Flora Full details are contained within **Appendix 5-9** found in Volume III of this EIAR	Walkover survey at Proposed Development	June and August 2022, and November 2022	(Fossitt, 2000) (Smith et al., 2011)
	Annex I habitat surveys within Northern Cluster	July 2022 and September 2023	(European Commission, 2003) (Perrin et al., 2014)
	Condition assessment of Possible Ancient Woodland (PAW) in Southern Cluster	June 2022	(Perrin and Daily, 2010)
Birds Full details are contained within **Appendix 5-2** found in Volume III of this EIAR	Vantage Point (VP) surveys covering each turbine location plus a 500 m radius around the same Two VPs 36 hours/VP/season over 0.5 years[8] Three VPs x 36 hours/VP/season over 2 years[9]	Breeding season 2019: June to September 2019	(NatureScot, 2017)
		Non-breeding season 2019/20: October 2019 to March 2020	
		Breeding season 2020: May to September 2020	
		Non-breeding season 2020/21: October 2020 to March 2021	
		Breeding season 2021: April to September 2021	
	Breeding walkover surveys within the Main Wind Farm	Breeding season 2019: May to July 2019	(Adapted Brown and Shepherd as

[8] June to September 2019
[9] October 2019 to September 2021

Survey	Description	Timing	Guidance Applied
	Site plus a 500 m buffer zone	Breeding season 2020: May to July 2020	outlined in Gilbert et al., 1998) for 2019 breeding season (O'Brien and Smith as outlined in Gilbert et al., 1998) for subsequent breeding seasons
		Breeding season 2021: April to July 2021	
	Breeding raptor surveys within the Main Wind Farm Site plus a 2 km buffer zone	Breeding season 2019: May to July 2019	(Hardey et al., 2013)
		Breeding season 2020: May to July 2020	
		Breeding season 2021: April to July 2021	
	Breeding woodcock surveys within the Main Wind Farm Site plus a 500 m buffer zone	Breeding season 2019: June 2019	(Gilbert et al., 1998)
		Breeding season 2020: May and June 2020	
		Breeding season 2021: May and June 2021	
	Winter walkover surveys within the Main Wind Farm Site plus a 500 m buffer zone	Non-breeding season 2019/20: October 2019 to March 2020	(Bibby et al, 2000)
		Non-breeding season 2020/21: October 2020 to February 2021	
	Wildfowl distribution and abundance surveys within the Main Wind Farm Site plus a 500 m buffer zone for foraging wildfowl and a 1 km buffer for roosting wildfowl	Breeding season 2019: September 2019	(NatureScot, 2017) (BirdWatch Ireland, 2015)
		Non-breeding season 2019/20: October 2019 to March 2020	
		Breeding season 2020: May, August and September 2020	

Survey	Description	Timing	Guidance Applied
		Non-breeding season 2020/21: October 2020 to February 2021	
		Breeding season 2021: April to May 2021	
Terrestrial Mammals (excluding bats)	Searches within 150 m of any proposed infrastructure at Main Wind Farm Site and at Proposed Substation	June and August 2022, November 2022	(Cresswell et al., 2012)
	Trail cameras within Main Wind Farm (Northern and Southern Cluster)	August 2022	
Bats Full details are contained in **Appendix 5-3** found in Volume III of this EIAR	Preliminary ecological appraisal within Main Wind Farm Site	June 2022	(Collins, 2016) (NatureScot, 2021)
	Summer roost assessment within Main Wind Farm Site	June, July and August 2022	
	Winter roost assessment within Main Wind Farm Site	October and November 2022	
	Surveys of trees/structures along Cable Corridor and TDR	June and August 2022	
	Ground-level static detectors: at all eight turbines for spring, summer and autumn 2022 rounds	Spring: 12 to 24 May 2022 Summer: 13 to 27 July 2022 Autumn: 29 September to 12 October 2022	
	At-height static detector: located on meteorological mast for summer and autumn rounds 2023	Round 1: 1 to 21 June 2023 Round 2: 4 to 31 August 2023	
	Transects: two locations (both in Southern Cluster)	Spring: 19 May 2022 Summer: 24 June 2022	

Survey	Description	Timing	Guidance Applied
		Autumn: 3 October 2022	
	Emergence surveys at structures within Main Wind Farm Site	23 June, 4 July, 5 August, 7 September and 8 September 2022	
Other Protected Fauna	Invertebrates, amphibians and reptiles within Main Wind Farm Site	June 2022	(NRA, 2009)
	Marsh fritillary butterfly *Euphydryas aurinia* habitat suitability and larval web survey	June 2022 and October 2022	(NBDC, 2023)
Fisheries and Aquatic Ecology Full details are contained in **Appendix 5-4** found in Volume III of this EIAR	Undertaken on a catchment-wide scale, the baseline surveys focused on aquatic habitats in relation to fisheries potential (including both salmonid and lamprey habitat), white-clawed crayfish *Austropotamobius pallipes*, freshwater pearl mussel *Margaritifiera margaritifera* (eDNA only), macro-invertebrates (biological water quality), macrophytes and aquatic bryophytes, aquatic invasive species, and species of conservation value which may use the watercourses in the catchment in which the Proposed Development is located e.g. otters *Lutra lutra* and amphibians.	19 to 22 July 2022	(Environment Agency, 2003)

Study Areas

5.39 See **Figure 5-1** and **Figure 5-2** and below for further details on taxon-specific surveys areas.

Habitats, Flora, Terrestrial Mammals (Excluding Bats) and Other Protected Fauna

5.40 The survey area included the Main Wind Farm Site (including the Northern and Southern turbine clusters), plus adjacent lands to the Cable Corridor and TDR nodes, and Proposed Substation.

5.41 All areas within 50 m of any proposed infrastructure of the Proposed Development were surveyed for signs of mammals. Areas within the Main Wind Farm Site were assessed for habitat suitability for amphibians and reptiles.

5.42 Annex I habitat surveys were conducted both at areas within the Northern Cluster where Annex I habitats had been mapped previously as of Annex I type.

5.43 Relevés for PAW habitats were conducted within areas in the southern cluster previously mapped as of PAW type.

Birds

5.44 The survey areas used for the ornithological impact assessment differ according to receptor as recommended by relevant good practice survey guidance (NatureScot, 2017). These are summarised in the 'Field Assessment' Section below and are described in more detail within the baseline survey reports (**Appendix 5-2** found in Volume III of this EIAR).

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

Bats

5.46 The survey areas used for bat impact assessment were as recommended by relevant good practice survey guidance (NatureScot, 2021). These are summarised below and are described in more detail within the baseline survey reports (**Appendix 5-3** found in Volume III of this EIAR).

Fisheries and Aquatic Ecology

5.47 The survey areas used for the fisheries and aquatic ecology impact assessment followed a catchment-level approach. All freshwater watercourses which could be affected directly or indirectly by the Proposed Development were considered with a total of 13 riverine sites and 13 lacustrine sites targeted for detailed aquatic assessment. These sites were both within the Main Wind Farm Site and along the Cable Corridor. None of the proposed TDR accommodation works or the Proposed Substation location are located next to any watercourses. The surveys are summarised below and are described in more detail within the baseline survey report (**Appendix 5-4** found in Volume III of this EIAR).

Habitats and Flora

5.48 Terrestrial habitats were mapped according with Fossitt (2000) and the good-practice measures outlined in Heritage Council guidance (Smith et al., 2011). The locations of any rare or invasive plant species were recorded using a hand-held GPS.

5.49 Annex I habitat surveys were carried out in July 2022 and September 2023 at areas where potential Annex I fen habitats were located. A representative number of relevés were taken to describe the vegetation in greater detail and to understand the habitat condition. Relevé number was selected based on the estimated size of total fen habitat in accordance with Perrin et al. (2014) and amended to account for the lowland context and scale of fen habitats present. The dataset was then analysed using the 'ERICA 'tool to assign each relevé to the Irish Vegetation Classification (IVC). Full data are presented in **Appendix 5-9** found in Volume III of this EIAR. In addition, round-leaved winter green, a rare plant, was searched for as historical records are present at nearby Newtown Lough.

5.50 Condition assessment surveys were undertaken in 2022 at areas where PAW had been previously recorded. Methodology was in accordance with Perrin and Daily, (2010). This involved assigning a DOMIN scale score to every tree species within a 10 x 10 m relevé,

measuring mean diameter at breast height, and tree height. Ground cover was also recorded to further assess condition, assigning each plant species to a DOMIN scale score.

5.51 All habitat surveys were conducted during optimal times of year.

Birds

5.52 Baseline ornithology surveys were conducted during the period June 2019 to September 2021. Full data are presented in **Appendix 5-2** found in Volume III of this EIAR.

Target Species

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

5.54 Passerines (relating to the largest order of birds, *Passeriformes*, which includes over half of all living birds and consists chiefly of altricial songbirds of perching habits) are generally not considered to be significantly impacted by wind farms (NatureScot, 2017; Garcia et al., 2015; Beston et al., 2016; Stewart et al., 2007), so were not included as primary or secondary target species. However, amber- and red-listed passerine species were recorded as incidentals to provide a full picture of ornithology at the Proposed Development.

Primary Target Species

5.55 Current NatureScot guidelines (NatureScot, 2017) state that “in most circumstances the target species will be limited to those species which are afforded a higher level of legislative protection.”

5.56 Primary target species were specifically limited to species upon which effects are most likely to be potentially significant in EIA terms, e.g. breeding and non-breeding species forming qualifying features (sometimes termed ‘special conservation interests’ or SCIs) for nearby SPAs, or species listed on Annex I of the Birds Directive. In addition, some species red-listed under the Birds of Conservation Concern in Ireland (BoCCI) scheme (Colhoun & Cummins, 2013; Gilbert et al., 2021) were also included as primary targets. While being red-listed does not afford species a higher level of legislative protection, it does reflect poor conservation status and vulnerability of bird populations to negative effects from wind farms. All red-listed non-passerine species were included as primary target species.

5.57 This approach to identifying primary target species enabled recording to focus on the species of greatest importance without the distraction of having to record detailed flight data for a larger number of more common species.

Breeding Season

5.58 The recorded primary target species for VP surveys during the breeding season included the following:

- common kestrel *Falco tinnunculus*,
- common snipe *Gallinago gallinago*,
- European golden plover *Pluvialis apricaria*,
- northern lapwing *Vanellus vanellus*,
- mallard *Anas platyrhynchos*, and
- peregrine falcon *Falco peregrinus*.

5.59 Common kestrel, common snipe and northern lapwing are not listed under Annex I of the Birds Directive but they are currently red-listed under the latest BoCCI 4: 2020-2026 scheme (Gilbert et al., 2021). Similarly, mallard are not listed under Annex I of the Birds Directive but are currently amber-listed and are qualifying interests for nearby NHA or pNHAs.

Non-Breeding Season

5.60 The recorded primary target species for VP surveys during non-breeding season surveys included the following:

- black-headed gull *Chroicocephalus ridibundus*,
- common kestrel,
- common snipe,
- Eurasian curlew *Numenius arquata*,
- Eurasian teal *Anas crecca*,
- Eurasian woodcock,
- European golden plover,
- great cormorant *Phalacrocorax carbo*,
- hen harrier *Circus cyaneus*,
- northern lapwing,
- mallard,
- merlin *Falco columbarius*,
- peregrine falcon, and
- whooper swan.

5.61 Similarly, black-headed gull, Eurasian woodcock, great cormorant and Eurasian teal are not listed under Annex I of the Birds Directive but are either currently red-listed or amber-listed, and/or are qualifying interests for nearby NHA or pNHAs

Secondary Target Species

5.62 Secondary target species were limited to species that may be affected by wind farms but either lack a higher level of legislative protection (not listed on Annex I of the Birds Directive or listed as SCIs) and/or are not red-listed under the latest BoCCI4 scheme.

5.63 Secondary target species included the following:

- any other wildfowl and wader species not recorded as primary target species,
- common buzzard *Buteo buteo*,
- Eurasian sparrowhawk *Accipiter nisus*,
- grey heron *Ardea cinerea*, and
- gulls *Larus* spp. (where not recorded as primary target species).

Baseline Survey Methodologies

5.64 Surveys were carried out following NatureScot guidance (NatureScot, 2017). Further details are provided in **Appendix 5-2** found in Volume III of this EIAR with a summary provided below.

Flight Activity Surveys

5.65 Surveys first commenced in June 2019 and ended in September 2021. As per current guidance, a minimum of 72 hours of flight activity surveys were conducted from each of three VP locations across two years for the two breeding seasons. Slightly less survey effort

was provided for each winter season (66, 71 and 61 hours for VPs 1 to 3, respectively) but overall, the minimum total requirements were met. See paragraph 5.114 for constraints and limitations.

5.66 The number of hours completed at each VP, in each season, is summarised in **Table 5-3**.

Table 5-3: VP Survey Hours

VP Number	Total Survey Effort Per Season (hh:mm), June 2019 to September 2021				
	2019 Summer (Jun-Sep)	2019/20 Winter (Oct-Mar)	2020 Summer (May-Sep)	2020/21 Winter (Oct-Mar)	2021 Summer (Apr-Sep)
1	30:00	30:00	36:00	36:00	37:05
2	30:00	30:00	36:00	41:00	36:30
3	-	29:00	36:00	42:00	37:15

Breeding Walkover Surveys

5.67 Surveys were undertaken twice in the summer of 2019 (June and July), seven times in 2020 (twice in May, three times in June and twice in July) and 15 times in 2021 (twice in April, twice in May, six times in June and five times in July).

5.68 Surveys were carried out within the Main Wind Farm Site plus a 500 m buffer zone beyond as recommended by NatureScot (2017) guidance, using the adapted Brown and Shepherd methodology described in Gilbert et al. (1998) for the summer of 2019 and the O'Brien and Smith (1992) methodology thereafter, which is suitable for lowland grassland sites.

5.69 Full details are provided in **Appendix 5-2** found in Volume III of this EIAR.

Breeding Woodcock Surveys

5.70 Surveys were undertaken three times in the summer of 2019 (June), six times in 2020 (twice May and four times in June) and five times in 2021 (once in May and four times in June).

5.71 Surveys were carried out within the Main Wind Farm Site plus a 500 m buffer zone in accordance with the Gilbert et al. (1998) methodology. While woodcock were the targets of surveys, any other nocturnal birds were also recorded.

5.72 Full details are provided in **Appendix 5-2** found in Volume III of this EIAR.

Breeding Raptor Surveys

5.73 The survey methodology for breeding raptors in 2019, 2020 and 2021 used short watches of potentially suitable habitat from appropriate viewpoints to identify potential nesting territories.

5.74 Survey timings followed those in Hardey et al. (2013), as per current NatureScot (2017) guidelines. Surveys were carried out four times in the summer of 2019 (twice in June and twice in July), ten times in 2020 (three times in May, four times in June and three times in July) and 15 times in 2021 (three times in April, nine times in June and three times in July).

5.75 Full details are provided in **Appendix 5-2** found in Volume III of this EIAR.

Waterbird Distribution Surveys

5.76 Wetland sites within 1 km of the Main Wind Farm Site were surveyed for wildfowl populations in the non-breeding and breeding seasons.

5.77 Count methodology was in accordance with NatureScot (2017) and BirdWatch Ireland (2015) guidance and were undertaken during daylight hours.

5.78 Surveys were carried out 12 times in the 2019/20 non-breeding season, seven times in the 2020 breeding season, 10 times in the 2020/21 non-breeding season and three times in the 2021 breeding season.

5.79 Full details are provided in **Appendix 5-2** found in Volume III of this EIAR.

Winter Walkover Surveys

5.80 Winter transect surveys were used to obtain a fuller picture of species of conservation concern within the Main Wind Farm Site plus a 500 m buffer. This consisted of walking transects that covered the different habitats. The methodology was based on Bibby et al. (2000).

5.81 Surveys were carried out six times in the 2019/20 non-breeding season and four times in the 2020/21 non-breeding season.

5.82 Full details are provided in **Appendix 5-2** found in Volume III of this EIAR.

Terrestrial Mammals (Excluding Bats)

5.83 Dedicated mammal surveys were carried out in the summer of 2022. The focus of these surveys was to search for mammal resting/breeding places, which are most vulnerable to disturbance and habitat loss. In addition, any other signs/sightings were recorded and mapped using a hand-held GPS during both dedicated mammal surveys and opportunistically during other ecological surveys. Survey methodology followed that outlined by Cresswell et al. (2012), with a particular focus on badger Meles meles, pine marten Martes martes and red squirrel Sciurus vulgaris.

5.84 Trail cameras were also deployed at suitable locations in both turbine clusters near tracks adjacent to forestry under licence from NPWS (license no. 111/2022 (amended)).

5.85 Otters were searched for during the aquatic surveys (see below).

Bats

5.86 Baseline bat surveys were conducted during the period July 2021 to September 2022.

5.87 Surveys were carried out following the relevant NatureScot guidance (NatureScot, 2021).

5.88 Further details are provided in **Appendix 5-3** found in Volume III of this EIAR with a summary provided below.

Habitat Appraisal for Potential Bat Roost Features and Assessment of Habitat Risk

5.89 A desk study was used to compile information on potential roosts and foraging habitats within the Main Wind Farm Site and along the Cable Corridor, plus along the TDR where any accommodation works will take place. The survey area was walked summer 2022 and winter 2022/23 to search for potential winter and summer roosts, plus to undertake an initial site risk assessment for bats.

Emergence Survey

5.90 Following roost searches, emergence surveys were carried out in June to September 2022 at suitable structures within the Main Wind Farm Site. Two surveyors were stationed either side of the structure, each with bat detector (Wildlife Acoustics, EM3+ Batbox Duet) to record calls. Target notes were made on bats exiting the structure and use of the surrounding area. Static detectors (Wildlife Acoustics, SM4BatFS) were also deployed outside putative roosts.

5.91 No emergence surveys were undertaken at potential tree roosts, as none were classified as having more than 'moderate' bat roost potential.

Activity Survey – Transect Survey

5.92 Activity surveys were carried out once per season (spring, summer and autumn) at two transects in each turbine cluster. Transects were conducted simultaneously using BatLogger-M or Batbox Duet detectors to record calls. Flight lines were recorded, following methodology from Collins (2016).

Activity Survey – Static Bat Detector Survey (Ground-Level and At-Height)

5.93 Ground-level full spectrum bat detectors (Anabat Swift, Titley Scientific) were deployed at eight turbine locations for the spring, summer and autumn 2022 seasons, following methodology from NatureScot (2021).

5.94 An 'at-height' full spectrum bat detector (Wildlife Acoustics, SM4BatFS) was deployed at the met mast for two rounds during the summer and part of the autumn of 2023, following methodology from NatureScot (2021).

Other Protected Fauna

5.95 No specific surveys for reptiles were conducted and were searched for on an *ad hoc* basis during other surveys, as NRA (2009) guidance states that direct observation is an effective survey technique.

5.96 Amphibians were surveyed for during aquatic ecology surveys (see below) and on an *ad hoc* basis during other surveys.

5.97 Dedicated surveys for marsh fritillary butterfly were undertaken in the summer of 2022. Numerous devil's bit scabious *Succisa pratensis* (the foodplant for the butterfly species) was recorded in the Northern Cluster. An assessment of habitat suitability and a search for larval webs was undertaken. The habitat suitability assessment and larval web survey was based upon the methodology outlined in the National Biodiversity Data Centre's monitoring scheme (NBDC, 2023).

Fisheries and Aquatic Ecology

5.98 Baseline surveys were carried out in July 2022. Full data are presented in **Appendix 5-4** found in Volume III of this EIAR with a summary provided below.

5.99 Surveys focused on the detection of freshwater habitats and species of high conservation value. A strict biosecurity protocol was used following guidance and the Check-Clean-Dry approach with further details in **Appendix 5-4** found in Volume III of this EIAR.

Physical surveys

5.100 All survey sites were assessed in terms of physical watercourse characteristics, substrate and flow.

Fish stock assessment

5.101 Electro-fishing was carried out under DECC licence at all riverine survey sites that were not dry at the time of the survey (12 out of 13 sample sites; see Table 5-2 for details of when surveys were carried out). Surveys were undertaken following best practice (CEN, 2003; CFB, 2008) and Section 14 licencing requirements. In addition, a fisheries habitat appraisal was undertaken to establish the importance of the survey sites for fish species.

White clawed-crayfish survey

5.102 Surveys were undertaken under a NPWS open licence (C31/2022) to capture and release crayfish at their site of capture. Hand searching and sweep netting was undertaken following Reynolds et al. (2010). An appraisal of crayfish habitat was undertaken.

Freshwater pearl mussel survey

5.103 There are no known pearl mussel records in the surrounding catchments and so no stage 1 or stage 2 survey was undertaken. As a precaution, eDNA samples were collected (see section below) to confirm pearl mussel absence.

eDNA analysis

5.104 eDNA samples were undertaken from the Athboy River, D'arcy's Crossroads Stream and Stonyford River and analysed for pearl mussels, white-clawed crayfish and crayfish plague *Aphanomyces astaci*. A sample was also taken from Newtown Lough and analysed for the same aquatic receptors as for the riverine locations, while also searching for European eel *Anguilla anguilla* and smooth newt *Lissotriton vulgaris* DNA. This was to validate physical site surveys and to search for populations of cryptic aquatic receptors. eDNA samples were undertaken from locations where there was no desktop data on the status of pearl mussel.

Otter survey

5.105 Searches were made for otter signs and sightings within 150 m of each aquatic survey site (see **Figure 5-2**) and mapped using a hand-held GPS. Notes were made on the quantity and visible constituents of spraint.

Kingfisher survey

5.106 Any evidence of kingfisher breeding or feeding within 150 m of each aquatic survey site (see **Figure 5-2**) was recorded at the same time as the otter survey.

Biological water quality (Q-sampling)

5.107 Biological water quality was assessed via Q-sampling at all riverine survey sites (13 sample sites). Methodology followed Feeley et al. (2020) and samples were converted into Q-ratings per Toner et al. (2005). Any rare invertebrate species were identified.

Lake and pond macro-invertebrate communities

5.108 A pond net was used to sweep macrophytes to capture macro-invertebrates at Newtown Lough and 12 no. wetted pond survey sites.

Macrophytes and aquatic bryophytes

5.109 Botanical surveys were conducted via instream wading at all riverine sites. Specimens were collected for on-site identification. Any rare macrophyte or bryophyte species were recorded and the aquatic vegetation community assessed for correspondence with Annex I habitat types. Links with Annex I lake habitats were also assessed at lacustrine sites.

Amphibian pond surveys

5.110 All pond sites were appraised for the presence of amphibians (smooth newt and common frog *Rana temporaria*), which included an assessment of habitat and sweep netting.

Constraints and Limitations

5.111 Desk study data is unlikely to be exhaustive, especially in respect of species, and is intended mainly to set a context for the study. It is therefore possible that important habitats or protected species not identified during the data search do in fact occur within the vicinity of the Proposed Development. Interpretation of maps and aerial photography has been conducted in good faith, using recent imagery, but it has not been possible to verify the accuracy of any statements relating to land use and habitat context outside of the field study area. The field surveys were designed to address any limitations with the desk study data.

5.112 Any constraints and limitations relating to field surveys carried out to obtain ecological baseline data and the resulting impact assessment are described for specific ecological receptors below.

Birds

5.113 The validity of ornithological survey data requires that they were obtained using accepted methodologies and that surveys were carried out in suitable conditions. The field survey methodologies outlined above and described in greater detail in **Appendix 5-2** found in Volume III of this EIAR were all carried out using survey standards recommended by NatureScot (2017) and were carried out during suitable times of the year and in suitable conditions.

5.114 Two and a half years of surveys have been completed, which is more than the recommended two years' worth of survey required by current NatureScot (2017) guidance. The data were also collected within the last five years in accordance with NatureScot (2017) guidance.

5.115 Regarding seasonal survey effort, more than 72 hours of breeding season survey effort was undertaken at each of the three VP locations, which is the minimum required for two years of surveys. For the non-breeding season, survey effort was slightly less than the 72 hours required by NatureScot (2017) guidance (66, 71 and 61 hours for VPs 1, 2 and 3, respectively). However, we do not consider this to affect the efficacy of the assessment in accordance with best practice, as the survey effort is still high and will be representative of avian winter flight activity.

5.116 Although some surveys were completed in suboptimal conditions regarding weather conditions (i.e., visibility during VP watches falling to between 1-3 km), in most cases all the

relevant 2 km viewing arc was visible and this is not considered to significantly affect the validity of the data collected. It is also noted that during such an extensive series of surveys it is inevitable that some surveys were completed in suboptimal conditions.

5.117 Regarding VP survey coverage, there are some minor gaps in coverage to the north of the 500 m buffer surrounding the Northern Cluster, and, within the northern and northeastern part of the 500 m buffer surrounding the Southern Cluster. However, the gaps in coverage are not thought to represent a significant limitation, as all key habitats were surveyed, the gaps pertain to the buffer only, and visibility on the ground was better than suggested by the viewshed analysis. It is considered that the VP data are representative of the Main Wind Farm Site as a whole and sufficient to inform a robust impact assessment of the Proposed Development.

5.118 The following species were recorded as primary species in the first year of surveys but were not in the second year of surveys: black-headed gull, Eurasian teal, great cormorant and mallard. While this precludes a quantitative assessment of collision risk for subsequent years, a qualitative assessment is possible.

5.119 While no dedicated barn owl *Tyto alba* survey was undertaken, all potential bat roosts were checked for barn owl pellets and other signs of occupancy (they were recorded near Rosmead House ruins and were suspected to roost or breed there). Similarly, while no dedicated kingfisher survey was undertaken, kingfishers and their nests were searched for during the aquatic ecology surveys (no nests were recorded but a commuting kingfisher was recorded during a wildfowl distribution survey >500 m from the Main Wind Farm Site).

5.120 No dedicated nocturnal bird surveys were undertaken other than those for woodcock. For a fuller explanation, see **Table 5-1** (Scoping Responses).

Bats

5.121 The layout for the Proposed Development changed slightly following the completion of ground-level static detector surveys. However, the habitats that the detectors were deployed in are still representative of the turbine locations and the Proposed Development as a whole.

5.122 At the time of writing, an assessment of bat activity relative to other survey sites was not possible. This was because the Ecobat tool was offline for maintenance.

5.123 In the absence of Ecobat, the overall risk presented to each species by collision was calculated by adapting Table 3b from NatureScot (2021) guidance, substituting Ecobat activity category for vulnerability of bat species populations. This is acceptable, with the guidance stating that an equivalent justification instead of Ecobat category can be used.

Fisheries and Aquatic Ecology

5.124 During surveys one out of 13 riverine sites were dry and electro-fishing was not conducted, following best practice. In addition, biological water quality samples could have been affected by low summer river levels.

Overall

5.125 The limitations and uncertainties above are therefore minor and did not affect the ability to make an accurate assessment of the likely significant effects of the Proposed Development in accordance with best practice.

Evaluation Criteria for Ecological Assessment

Assessing Impact Significance

5.126 CIEEM guidelines state that ecological receptors which are important (i.e., Important Ecological Features or 'IEFs') and potentially affected by the Proposed Development should be subject to detailed assessment. It is not necessary to carry out detailed assessment of receptors that are sufficiently widespread, unthreatened and resilient to Proposed Development impacts and would remain viable and sustainable. However, the EU Biodiversity Strategy 2020 and Irish National Biodiversity Action Plan 2017-2021 emphasise the need to achieve no net loss and enhancement of biodiversity. Also, the EIA Directive requires full consideration of biodiversity.

Determining the Zone of Influence

5.127 Determining whether an IEF has the potential to be affected by the Proposed Development relates to the concept of the Zone of Influence (ZoI). The ZoI relates to the nature of the development, its likely impacts and the presence of connections or pathways between ecological receptors and the development. Thus, ecological receptors that lack a connection to the development are considered outside the ZoI, even if they are directly within the development site. Conversely, receptors that are considerably removed from the development can still be considered within the ZoI if a pathway for impacts exists. Typically, the ZoI can only be fully determined after the impact assessment is completed.

5.128 All connections (ecological, hydrological and hydrogeological) which provide pathways for impacts between the Proposed Development and ecological receptors in the surrounding area are identified and described in **Table 5-4** and **Table 5-5**.

5.129 For all receptors that are not designated nature conservation sites, the initial ZoI for the construction and decommissioning phase is as follows:

- Direct effects: up to a 50 m buffer surrounding permanent and temporary proposed site infrastructure for the Main Wind Farm Site and Proposed Substation, and up to a 5 m buffer along the Cable Corridor and at TDR nodes, and
- Indirect effects: dependent on the type of works and the published sensitivities of the ecological receptor.

5.130 For all receptors that are not designated nature conservation sites, the ZoI for the operational phase is dependent on the published sensitivities of the ecological receptor, if available.

5.131 Regarding designated nature conservation sites, DoEHLG (2010) guidelines suggest that a 15 km study area is adopted as a starting point when assessing the potential for source-receptor connectivity between a project and European sites. However, this is an arbitrary distance and, in some cases, could be much smaller or larger depending on whether there is hydrological, hydrogeological or ecological connectivity present. We used a 20 km study area initially, which is slightly larger than the 15 km recommended in recognition that 20 km is the maximum distance SPA QI bird species typically travel (NatureScot or formerly SNH, 2016). This initial search area was then reappraised during impact assessment, which identified a small number of designated nature conservation sites with remote connections outside of the initial search area.

Determining Importance

5.132 Ecological features can be important for a variety of reasons. The importance of ecological receptors should be considered within a defined geographical context and for the Proposed Development the following geographic frame of reference is used:

- international (i.e. Europe),
- national (i.e. Ireland),
- regional/county (i.e. Co. Westmeath[10]),
- local (i.e. the townlands containing the Proposed Development, and
- site (i.e. the Proposed Development).

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

5.134 Important habitats are listed on Annex I of the Habitats Directive, the Irish National Biodiversity Action Plan 2017-2021, under the Wildlife Acts and in Westmeath County Development Plan 2021-2027, Chapter 12 (Natural Heritage and Green Infrastructure) and Meath County Development Plan 2021-2027, Chapter 8 (Cultural and Natural Heritage Strategy). Where habitats are currently in a degraded or unfavourable conservation condition, it is their potential value rather than their current value that should be considered.

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

- species of European conservation importance (as listed on Annex I of the Birds Directive or Annex II or IV of the Habitats Directive), and
- species red-listed in Ireland under the relevant lists e.g. Birds of Conservation Concern (BoCCI) (Gilbert et al., 2021).

5.136 Where appropriate, the value of resident or regularly occurring species populations has been determined using the standard '1% criterion' method (Percival, 2003; Holt, et al., 2012). Using this, the presence of >1% of the international population of a species is considered internationally important and >1% of the national population is considered nationally important. IWeBS data were used to assess regional/county populations of wintering wildfowl (data from all IWeBS sites in County Westmeath were collated); however, this is only available for wintering wildfowl and is not available for all birds or for the breeding season. Where detailed regional or county-level species population data was absent, we have estimated county-level populations for Westmeath County Council by multiplying the ROI population totals by 0.03. This 0.03 figure is the land area taken up by the County of Westmeath as a proportion of the ROI total land area. This assumes that species populations are evenly distributed, which may not be realistic; however, in the absence of detailed spatial data this is considered a reasonable approximation. Data collected from bird surveys for the Proposed Development are at the local scale.

5.137 This information, combined with baseline survey results, was utilised to evaluate each ecological receptor recorded within the ZoI in terms of its importance. The exception is for habitats where the approach is to provide a balance sheet of losses and gains for the

[10] This refers to a unit of scale i.e. the size of a county and does not relate to the fact that the Proposed Development spans both County Westmeath and County Meath. Co. Westmeath has been used as most of the Proposed Development is contained within it.

Proposed Development as a whole. This is because evaluating individual habitat types can exclude consideration of assemblages.

5.138 IEFs are defined as those features which are within the ZoI whose importance is at the 'local' scale or greater.

Characterisation of Impacts and Effects

5.139 Following CIEEM (2018) and EPA (2022) guidelines, impacts and effects have been described in terms of:

- quality e.g. positive/neutral/negative,
- extent e.g. spatial area,
- context e.g. conform/contrast with baseline conditions,
- magnitude e.g. size/amount/intensity/volume,
- probability e.g. likely/unlikely,
- duration e.g. temporary/short-term/medium-term/long-term/permanent,
- frequency e.g. once/rarely/occasionally/frequently/constantly,
- timing e.g. critical life-stage or season, and
- reversibility e.g. reversible/irreversible.

5.140 The assessment will describe those characteristics that are relevant to understanding the ecological effect and determining the significance, and as such does not need to incorporate all stated effects.

5.141 A full definition of all the terms used are described in **Appendix 5-5** found in Volume III of this EIAR.

Significant Effects

5.142 EPA (2022) guidelines state that where possible the concept of significance should follow discipline-specific definitions. For the purposes of this assessment, CIEEM (2018) guidelines have been adapted following BS42020 standard, which states that a 'significant effect' is an effect that is sufficiently important to require assessment and reporting so that the decision maker is adequately informed of the environmental consequences of permitting a project. In accordance with CIEEM (2018) guidelines, effects can be considered significant at a wide range of scales from international to local. For example, a significant effect on a regionally important population of a species is likely to be of regional significance. In addition, according to BS42020 standard, effects on anything that the LPA/competent authority must consider because of law or policy, must be included in the assessment, regardless of the CIEEM definition of importance. The WCDP refers to Nelson et al., (2019) and the MCDP refers to all plant, animal or bird species protected by law. Consequently, effects on species protected by law and policy are also included.

Determining Significant Effects

5.143 To determine whether an effect is significant or not, both direct and indirect impacts must be considered.

5.144 Direct impacts are changes that are directly attributable to a defined action, e.g. the physical loss of habitat occupied by an IEF species during the construction process.

5.145 Indirect ecological impacts are attributable to an action, but effect an ecological receptor via an intermediary ecosystem, process or receptor e.g. the creation of roads which cause hydrological changes, which, in the absence of mitigation, could lead to the drying out of wetland habitats used by IEF species.

5.146 The following have been considered:

Designated sites and ecosystems

5.147 Whether the Proposed Development and associated activities is likely to undermine the conservation objectives for the designated site or influence the conservation status of the site or its qualifying habitats/species.

5.148 Whether the Proposed Development is likely to result in a change in ecosystem structure and function.

Habitats and species

5.149 Whether the Proposed Development will influence the extent, structure and function as well as its distribution and its composition of a habitat.

5.150 Whether the Proposed Development will affect the abundance and distribution of a species.

5.151 For specific taxonomic groups, there are defined impact assessment methodologies that are to be used for wind farms. These are outlined below.

Birds

5.152 NatureScot (2018) provides guidance for assessing the significance of impacts on bird populations from onshore wind farms that do not affect protected areas. NatureScot guidance is widely recognised as the industry-standard for assessing wind farm impacts on birds in the UK and Ireland and broadly follows the latest CIEEM guidance.

5.153 Disturbance impacts have been assessed with reference to the relevant literature for each avian taxonomic group (Goodship & Furness, 2022; Drewitt & Langston, 2006; Hötker, et al., 2006; Pearce-Higgins et. al, 2009; Rees et al., 2005; Rees, 2012), and the literature has also been used to identify appropriate disturbance-free buffer zones that will be provided to help prevent breeding failure due to disturbance.

5.154 The standard Band Collision Risk Model (CRM) (Band et al., 2007) was used to estimate collision risk based on recorded target species activity levels and flight behaviour, proposed turbine numbers and specifications, and the relevant species biometrics and flight characteristics. Modelling collision risk under the Band CRM is a two-stage process. Stage 1 estimates the number of birds that fly through the rotor swept disc. Stage 2 predicts the proportion of these birds that have the potential to be hit by a rotor blade. Combining both stages produces an estimate of collision mortality in the absence of any avoidance action/behaviour by birds. Avoidance rates are then applied to generate predicted rates of collision mortality. Further details of the CRM methodology are provided in **Appendix 5-8** found in Volume III of this EIAR.

Bats

5.155 NatureScot (2021) provides guidance for conducting risk assessment for bat species occurring at wind farms. This involves following a two-stage process: stage one involves assessing the Proposed Development and habitat related features. Once this has been completed, stage two involves considering the results from stage one in relation to bat activity, considering the relative vulnerability of each species of bat present at the population level.

5.156 Levels of bat activity are quantified using the Ecobat tool (Lintott, et al., 2018). The tool compares data entered by the user with bat survey information collected from similar areas at the same time of year and in comparable weather conditions. It is important to understand both “typical” and unusually high levels of bat activity at the Proposed Development so potentially important peaks in activity are not overlooked. Thus, bat activity must be

examined in terms of both the highest Ecobat activity category and the most frequent activity category for the overall risk assessment. However, at the time of writing, the Ecobat tool has been offline while maintenance works are carried out since early 2023. NPWS were contacted to make them aware of the situation.

5.157 In the absence of Ecobat, the overall risk presented to each species by collision was calculated by adapting Table 3b from NatureScot (2021) guidance, substituting Ecobat activity category for vulnerability of bat species populations. This is acceptable, with the guidance stating that an equivalent justification instead of Ecobat category can be used.

5.158 See **Appendix 5-3** found in Volume III of this EIAR for further details of bat survey results.

Cumulative Impacts and Effects

5.159 Cumulative effects can result from individually insignificant but collectively significant impacts taking place over a period or concentrated in a location. These impacts can be:

- additive/incremental e.g. where multiple activities/projects with potentially insignificant individual effects add together to contribute to a significant effect due to their proximity in time and space. These can be additive or synergistic, or
- associated/connected e.g. where multiple activities forming separate planning applications/consent processes are part of the same overall project.

5.160 Other plans and projects that should be considered when establishing cumulative effects include:

- proposals for which consent has been applied but which are awaiting determination,
- projects which have been granted consent, but which have not yet been started or which have been started but are not yet completed (i.e. under construction),
- proposals which have been refused permission, but which are subject to appeal, and the appeal is undetermined,
- proposals which will be implemented by a public body where no consent from a competent authority is needed,
- constructed developments whose full environmental effects are not yet felt and therefore cannot be accounted for in the baseline, or
- developments specifically referenced in a National Policy Statement, a National Plan or a Local Plan.

Residual Effects and the Mitigation Hierarchy

5.161 Where likely significant effects have been identified, the mitigation hierarchy has been applied, as recommended in the CIEEM guidelines. The mitigation hierarchy sets out a sequential approach beginning with the avoidance of impacts where possible and followed by the application of mitigation measures to minimise unavoidable impacts. The remaining effects are termed 'residual effects'. If significant residual effects remain, then compensation for any remaining impacts may be undertaken.

5.162 It is important to clearly differentiate between avoidance mitigation, compensation and enhancement and these terms are defined here as follows:

- avoidance is used where an impact has been avoided, e.g. through changes in scheme design,
- mitigation is used to refer to measures to reduce or remedy a specific negative impact in situ,
- compensation describes measures taken to offset residual effects, i.e. where mitigation in situ is not possible, and

- enhancement is the provision of new benefits for biodiversity that are additional to those provided as part of mitigation or compensation measures, although they can be complementary.

DESCRIPTION OF EXISTING ENVIRONMENT

5.163 For all receptors other than designated nature conservation sites, the results of both the desktop studies and field surveys are presented together. Full details of the sources for desktop data (including when the data searches were made) are presented in paragraph 5.31 and **Appendix 5-7**. Full details of the field surveys (including when the surveys were made) are shown in **Table 5-2**.

Designated Conservation Sites

5.164 Site synopses for all designated sites is shown in **Appendix 5-6** found in Volume III of this EIAR.

International Sites

5.165 A fuller description of all SACs (including cSACs) or SPAs (no proposed SPAs were present) within the ZoI is given in the accompanying NIS, with the summary presented here only.

5.166 The Proposed Development is adjacent with the River Boyne and River Blackwater cSAC: while the Proposed Substation, Cable Corridor or any TDR node are further away from the cSAC, proposed enhancement measures, consisting of fencing along the Killacroy Stream and D'arcys Crossroads Stream as well as some hedgerow / treeline planting will overlap with the edge of the cSAC (subject to discussion and agreement with NPWS).

5.167 There are eight SACs within 20 km of the Proposed Development (see **Figure 5-3** and **5-6**). Of these, the River Barrow and River Nore cSAC is the only one with any connection to the Proposed Development, with downstream hydrological connections between riparian habitats and species to both Northern and Southern Clusters. There are also potential hydrogeological connections to groundwater dependent alkaline fen habitats. In addition, there are also potential ecological connections to mobile river lamprey, Atlantic salmon *Salmo salar* and otter.

5.168 There are two SPAs within 20 km of the Proposed Development. There is a downstream hydrological connection to the River Boyne and River Blackwater SPA. For Lough Derravaragh SPA, there is a potential but weak ecological connection as special conservation interest whooper swan, for this SPA, were recorded passing over or near (within 500 m) the Main Wind Farm Site and utilising Newtown Lough and a field to the east of the Main Wind Farm Site. Whooper swan was recorded on twelve occasions during the non-breeding season surveys (twice in the 2019/20 non-breeding season and ten times during the 2020/21 non-breeding season).

5.169 The only Ramsar site within 20 km is Lough Derravaragh (site no. 847). This site is also an SPA, an Important Bird Area (IBA) and Nature Reserve. There are no other IBAs or Nature Reserves within 20 km of the Proposed Development.

5.170 There is also remote, downstream hydrological connectivity between the Proposed Development and the Boyne Coast and Estuary SAC, and Boyne Estuary SPA. This SAC and SPA are located beyond the initial 20 km search distance.

5.171 There is also one SPA, Wexford Harbour and Slobs SPA, which was highlighted by NPWS as having a potential ecological connection to the Proposed Development. This SPA is located beyond the initial 20 km search distance.

5.172 **Table 5-4** provides a list of the designated sites and identifies any source-receptor pathways or connectivity. Those with pathways can be considered to be within the ZoI. Qualifying interests with sufficient connectivity or potential connectivity to the Proposed Development, which require further consideration are highlighted in bold.

Table 5-4: International Sites within 20 km of Proposed Development and beyond if connectivity present

Site Name	Code	Qualifying Interests	Value	Distance (km) and Direction from Proposed Development	Connectivity
SACs and cSACs					
River Boyne and River Blackwater cSAC	002299	**Alkaline fens [7230]** Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*) [91E0] **River lamprey *Lampetra fluviatilis* [1099]** **Salmon [1106]** **Otter [1355]**	International	0	There is strong potential hydrological connectivity to potential breeding/foraging sites for aquatic QI species (river lamprey, salmon and otter) via D'arcys Crossroads Stream, Kilskeer and Stonyford 07. There is remote downstream hydrological connectivity to alluvial forest riparian habitats (the nearest known location for this habitat type within the cSAC is at Drogheda, which is over 70 km instream distance away). There are no potential connections via emissions to the air, as the Cable Corridor does not cross the cSAC. There are also potential hydrogeological connections, as the Proposed Development is very near the cSAC and within the same groundwater body. cSAC QI groundwater dependent terrestrial ecosystem (GWDTE) alkaline fen habitats have been mapped c.525 m west of the Main Wind Farm Site. There are also potential ecological connections, as mobile QI species (river lamprey, salmon and otter) could move both within and outside of cSAC due to hydrological connections. Another connection is via light/noise from the construction of the Cable Corridor, especially when in proximity to mobile QI species outside the cSAC.
Girley (Drewstown) Bog SAC	002203	Degraded raised bogs still capable of natural regeneration [7120]	International	7.9 northeast	QI degraded raised bogs can be a GWDTE habitat. Although the SAC is within the same groundwater body (Athboy) as the Proposed Development, it is over 7.9 km direct-line distance from the same, and so it is unlikely that there are strong hydrogeological

Site Name	Code	Qualifying Interests	Value	Distance (km) and Direction from Proposed Development	Connectivity
					connections. There are no downstream hydrological connections. There is also no ecological connectivity as the SAC is not designated for any mobile QI species.
Lough Bane and Lough Glass cSAC	002120	Hard oligo-mesotrophic waters with benthic vegetation of *Chara spp*. [3140] White-clawed crayfish [1092]	International	8.2 northwest	The only QI habitat is not a GWDTE habitat (it is surface water-fed), so there is no hydrogeological connection. There are no downstream hydrological connections. There is no strong ecological connectivity as the designated mobile QI, white-clawed crayfish, is an aquatic species and the SAC is over 57 km instream distance from the Proposed Development (upstream connection). Furthermore, white-clawed crayfish are not currently present within the cSAC (NPWS, 2021a).
Lough Lene SAC	002121	Hard oligo-mesotrophic waters with benthic vegetation of Chara spp. [3140] White-clawed crayfish [1092]	International	9.7 west	The only QI habitat is not a GWDTE habitat (it is surface water-fed), so there is no hydrogeological connection. There are no downstream hydrological connections. There is no strong ecological connectivity as the designated mobile QI, white-clawed crayfish, is an aquatic species and the SAC is over 55 km instream distance from the Proposed Development (upstream connection). Furthermore, white-clawed crayfish are not currently present within the SAC (NPWS, 2021b).
White Lough, Ben Loughs and Lough Doo SAC	001810	Hard oligo-mesotrophic waters with benthic vegetation of Chara spp. [3140] White-clawed crayfish [1092]	International	11.5 northwest	The only QI habitat is not a GWDTE habitat (it is surface water-fed), so there is no hydrogeological connection. There are no downstream hydrological connections. No strong ecological connectivity as the designated mobile QI, white-clawed crayfish, is an aquatic species and the SAC is over 59 km instream distance from the Proposed Development (upstream connection). Furthermore, white-clawed crayfish are not currently present within the SAC (NPWS, 2021c).

Site Name	Code	Qualifying Interests	Value	Distance (km) and Direction from Proposed Development	Connectivity
Killyconny Bog (Cloghbally) SAC	000006	Active raised bogs [7110] Degraded raised bogs still capable of natural regeneration [7120]	International	16.3 northeast	The two QI habitats can be GWDTE habitats, but the SAC is not within the same groundwater body as the Proposed Development. Also, the SAC is at a considerable distance from the Proposed Development, so there are no hydrogeological links. There are no downstream hydrological connections. There is also no ecological connectivity as the SAC is not designated for any mobile QI species.
Mount Hevey Bog SAC	002342	Active raised bogs [7110] Degraded raised bogs still capable of natural regeneration [7120] Depressions on peat substrates of the *Rhynchosporion* [7150]	International	16.8 south	The three QI habitats can be GWDTE habitats, but the SAC is not within the same groundwater body as the Proposed Development. Also, the SAC is at a considerable distance from the Proposed Development, so there are no hydrogeological links. There are no downstream hydrological connections. There is also no ecological connectivity as the SAC is not designated for any mobile QI species.
Wooddown Bog SAC	002205	Degraded raised bogs still capable of natural regeneration [7120]	International	17.8 southwest	The QI bog habitats can be GWDTE habitats, but the SAC is not within the same groundwater body as the Proposed Development. Also, the SAC is at a considerable distance from the Proposed Development, so there are no hydrogeological links. There are no downstream hydrological connections. There is also no ecological connectivity as the SAC is not designated for any mobile QI species.
Boyne Coast and Estuary SAC	001957	Estuaries [1130] Mudflats and sandflats not covered by seawater at low tide [1140] Annual vegetation of drift lines [1210]	International	48.2 northeast	There is a very remote hydrological connection (c.72 km instream distance); however, this is so remote that it effectively means that there is effectively no connection. The SAC is within a separate groundwater body and so there is no hydrogeological connectivity to the Proposed Development. There is also no ecological connectivity as the SAC is not designated for any mobile QI species.

Site Name	Code	Qualifying Interests	Value	Distance (km) and Direction from Proposed Development	Connectivity
		Salicornia and other annuals colonizing mud and sand [1310] Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) [1330] Embryonic shifting dunes [2110] Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes) [2120] Fixed coastal dunes with herbaceous vegetation (grey dunes) [2130]			
SPAs (no proposed SPAs were present)					
River Boyne and River Blackwater SPA	004232	**Kingfisher [A229]**	International	4.1 southeast	There is downstream hydrological connectivity to potential breeding/foraging sites for riparian QI species (kingfisher) via D'arcys Crossroads Stream, Kilskeer and Stonyford 07. The SPA is riparian and is surface water fed, therefore, there are no potential hydrogeological connections. Kingfishers are mobile and can travel along watercourses (especially non-breeding birds, which are less restricted to territories). However, no evidence of kingfishers was recorded within 500 m of the Proposed Development during any bird or aquatic surveys, so there is no ecological connectivity.

Site Name	Code	Qualifying Interests	Value	Distance (km) and Direction from Proposed Development	Connectivity
Lough Derravaragh SPA	004043	Whooper swan [A038] Pochard [A059] Tufted duck [A061] Eurasian coot [A125] Wetland and Waterbirds [A999]	International	16 west	The SPA is a lough, which is not a GWDTE habitat (it is surface water-fed). There are no downstream hydrological connections. QI whooper swan was recorded within the 500 m buffer surrounding the outermost turbines on twelve occasions during the non-breeding season surveys (twice in the 2019/20 non-breeding season and ten times during the 2020/21 non-breeding season). It is not known if these birds form part of this or any SPA population, however such a link cannot be excluded as birds may make local movements between sites during the winter. Although coot was not recorded within 500 m of the Proposed Development, this species is only known to fly at night and all bird surveys were undertaken during daylight hours. Therefore, the possibility that small numbers of coot associated with the SPA, either migrating or making local movements, passing through the Proposed Development could not be excluded. Similarly, tufted duck and pochard were not recorded within 500 m of the Proposed Development. However, both these species make local movements at night but information on nighttime migration is lacking. Therefore, the possibility that small numbers of tufted duck or pochard associated with the SPA, either migrating or making local movements, passing through the Proposed Development could not be excluded. On that basis, the potential ecological connections for these species are as follows: Construction/decommissioning and operation of the Proposed Development – disturbance/displacement of birds, including barrier effects to migration flyways. Operation of the wind farm – collision risk – commuting birds.

Site Name	Code	Qualifying Interests	Value	Distance (km) and Direction from Proposed Development	Connectivity
					Regarding waterbirds and wetland birds, the conservation objectives for this qualifying interest relate to the maintenance and restoration of the wetland habitat within the SPA. As detailed above, there is no hydrological or hydrogeological connectivity between the Proposed Development and Lough Derravaragh SPA. Therefore, there is no ecological connection with this qualifying feature.
Boyne Estuary SPA	004080	Shelduck *Tadorna tadorna* [A048] Eurasian oystercatcher *Haematopus ostralegus* [A130] European golden plover [A140] Grey plover *Pluvialis squatarola* [A141] Northern lapwing [A142] Knot *Calidris canutus* [A143] Sanderling *Calidris alba* [A144] Black-tailed godwit *Limosa limosa* [A156] Redshank *Tringa totanus* [A162] Turnstone *Arenaria interpres* [A169] Little tern *Sterna albifrons* [A195] Wetland and Waterbirds [A999]	International	48.2 northeast	There is a very remote hydrological connection (c.72 km instream distance), which is so remote that there is effectively no connectivity. The SPA is within a separate groundwater body and so there is no hydrogeological connectivity to the Proposed Development. The QI bird species are mobile and could travel from the SPA to the Proposed Development. However, the distance between the Proposed Development and SPA is greater than the core foraging distances for any QI bird named in NatureScot (2016) guidance, making it unlikely there is any ecological connectivity. Also, many of the birds are coastal birds and so the inland habitats at the Proposed Development are unsuitable for them. Although European golden plover, northern lapwing and common shelduck were recorded during bird surveys, the distance from the SPA is sufficiently large that it is unlikely there is any strong ecological connectivity.

Site Name	Code	Qualifying Interests	Value	Distance (km) and Direction from Proposed Development	Connectivity
Wexford Harbour and Slobs SPA	004076	Little grebe *Tachybaptus ruficollis* [A004] Great crested grebe *Podiceps cristatus* [A005] Cormorant [A017] Grey heron [A028] Bewick's swan Cygnus *columbianus bewickii* [A037] Whooper swan [A038] Light bellied brent goose *Branta bernicla hrota* [A046] Shelduck [A048] Wigeon *Mareca penelope* [A050] Teal [A052] Mallard [A053] Pintail *Anas acuta* [A054] Scaup *Aythya marila* [A062] Goldeneye *Bucephala clangula* [A067] Red-breasted merganser *Mergus serrator* [A069] Hen harrier [A082]	International	c. 200 km SE	There is no hydrological connectivity between Wexford Harbour and Slobs SPA and the Proposed Development. The SPA is within a different catchment (SPA is within WFD Catchment 12 Slaney and Wexford Harbour and the Proposed Development is within WFD Catchment 7 Boyne) and at a considerable distance from the Proposed Development and so there are no hydrogeological links. With respect to Greenland white-fronted goose, this species was not recorded during any of the diurnal bird surveys. The absence of any Greenland white-fronted geese observations during the day confirms that nocturnal flight activity is also negligible, based on evidence that most (c 70%) white-fronted geese movements are during the day (Kölzsch et al. 2016). Therefore, there is no perceptible ecological connectivity. Given the distance (approx. 200 km) between the SPA and the Proposed Development there is no perceptible ecological connection for the other qualifying interests.

Site Name	Code	Qualifying Interests	Value	Distance (km) and Direction from Proposed Development	Connectivity
		Coot [A125] Oystercatcher [A130] Golden plover [A140] Grey plover [A141] Lapwing [A142] Knot [A143] Sanderling [A144] Dunlin *Calidris alpina* [A149] Black-tailed godwit [A156] Bar-tailed godwit *Limosa lapponica* [A157] Curlew [A160] Redshank [A162] Black-headed gull [A179] Lesser black-backed gull *Larus fuscus* [A183] Little tern [A195] Greenland white-fronted goose [A395] Wetland and Waterbirds [A999]			

National Sites

5.173 The rationale for identifying ecological connectivity to SACs, cSACs and SPAs has also been extended to NHAs and pNHAs. Sites beyond 20 km were also considered if there was hydrological or ecological connectivity.

5.174 There are five NHAs and 10 pNHAs within 20 km of the Proposed Development (see **Figure 5-4** and **5-6**). There are also an additional eight pNHAs located beyond 20 km from the Proposed Development which have a remote downstream hydrological connection. None of the five NHAs have any connectivity to the Proposed Development. Of the 18 pNHAs, only Lough Glore pNHA, Lough Ramor pNHA and Royal Canal pNHA have source-receptor links (and do not overlap with SACs).

5.175 Lough Glore pNHA has a potential ecological connection via wintering populations of coot, common snipe, northern lapwing, Eurasian curlew, Eurasian teal, pochard, tufted duck and common kestrel. Lough Ramor pNHA has a similar connection but for wintering populations of great cormorant. Royal Canal pNHA has ecological connectivity via highly mobile otter, which could travel along upstream hydrological connections.

5.176 Only national sites with sensitive habitats in proximity to the Proposed Development are likely to have connections via emissions to the air (e.g. dust). The same is true for light or noise emissions, which could disturb sensitive species, like otter. The only site where this applies is likely to be Lough Shesk pNHA, which overlaps with the River Blackwater and River Boyne cSAC.

5.177 There are some pNHAs within 20 km of the Proposed Development that overlap with SACs or SPAs. The SAC or SPA designation supersedes that of the pNHA and effects on these pNHAs have been assessed in the NIS shown in **Appendix 15.11** found in Volume III of this EIAR and are not considered in the current Chapter. The only situation where this would not apply would be if part of the pNHA was located outside of the SAC or SPA; however, there are no such instances for the designated sites considered for this Proposed Development. pNHAs included within European sites include:

- River Boyne and River Blackwater cSAC overlaps with Lough Shesk pNHA, Trim pNHA, Boyne Woods pNHA, Slane Riverbank pNHA, Crewbane Marsh pNHA, Rossnaree Riverbank pNHA, Dowth Wetland pNHA, King William's Glen pNHA, Boyne River Islands pNHA,
- White Lough, Ben Loughs and Lough Doo SAC overlaps with the pNHA of the same name,
- Kilconny Bog (Cloghbally) SAC overlaps with the pNHA of the same name,
- Mount Hevey Bog SAC overlaps with the pNHA of the same name, and
- Boyne Coast and Estuary SAC and Boyne Estuary SPA overlaps with Boyne Coast and Estuary pNHA.

5.178 None of the NHAs or pNHAs described in **Table 5-5** are nature reserves.

5.179 **Table 5-5** provides a list of the designated sites and identifies any source-receptor pathways. These can be considered within the ZoI. Qualifying interests with connectivity to the Proposed Development are highlighted in bold.

Table 5-5: National Sites within 20 km of Proposed Development and beyond if connectivity present

Site Name	Code	Qualifying Interests	Value	Distance (km) and Direction from Proposed Development	Connectivity
NHAs					
Girley Bog NHA	001580	Peatlands [4]	National	7.9 northeast	The QI peatlands can be a GWDTE. Although the NHA is within the same groundwater body as the Proposed Development, it is over 7.9 km direct-line distance from the same, and so it is unlikely that there are strong hydrogeological connections. There are no downstream hydrological connections. There is also no ecological connectivity as the NHA is not designated for any mobile QI species.
Jamestown Bog NHA	001324	Peatlands [4]	National	12.9 east	The QI peatlands can be a GWDTE. Although the NHA is within the same groundwater body as the Proposed Development, it is over 12.9 km direct-line distance from the same, and so it is unlikely that there are strong hydrogeological connections. There are no downstream hydrological connections. There is also no ecological connectivity as the NHA is not designated for any mobile QI species.
Lough Derravaragh NHA	000684	Peatlands [4] Birds [12]	National	16 west	Birds QI are considered under the NIS shown in **Appendix 15.11** found in Volume III of this EIAR for the SPA of the same name. QI peatland habitats can be a GWDTE; however, the NHA is in a separate groundwater body to the Proposed Development, and therefore there are no hydrogeological connections. There are no downstream hydrological connections.
Wooddown Bog NHA	000694	Peatlands [4]	National	17.8 southwest	The QI peatland habitats can be a GWDTE, but the NHA is not within the same groundwater body as the Proposed Development. Also, the NHA is at a

Site Name	Code	Qualifying Interests	Value	Distance (km) and Direction from Proposed Development	Connectivity
					considerable distance from the Proposed Development, so there are no hydrogeological links. There are no downstream hydrological connections. There is also no ecological connectivity as the NHA is not designated for any mobile QI species.
Molerick Bog NHA	001582	Peatlands [4]	National	18.2 southeast	The QI peatland habitats can be a GWDTE and the NHA is within the same groundwater body as the Proposed Development. However, the NHA is at considerable distance from the Proposed Development, so it is unlikely there are any strong hydrogeological connections. There are no downstream hydrological connections. There is also no ecological connectivity as the NHA is not designated for any mobile QI species.
pNHAs					
Lough Shesk pNHA	000556	Overlaps with River Boyne and River Blackwater cSAC; no site synopsis available	National	0 north	Considered under River Boyne and River Blackwater cSAC
White Lough, Ben Loughs and Lough Doo pNHA	001810	Overlaps with SAC of same name; no site synopsis available	National	11.5 northwest	Considered under SAC of same name
Lough Glore pNHA	000686	Productive midland limestone lake, range of aquatic vegetation, insects and birds (**pochard**, great-crested grebe, **tufted duck**, common ringed	National	11.9 northwest	The lake habitats are not GWDTEs (surface water-fed), so there is no hydrogeological connectivity. There is also no downstream hydrological connectivity. Of the named QI bird species, Eurasian coot, Eurasian teal, common snipe, northern lapwing, Eurasian curlew and common kestrel were recorded by bird surveys.

Site Name	Code	Qualifying Interests	Value	Distance (km) and Direction from Proposed Development	Connectivity
		plover *Charadrius hiaticula*, grey heron, **Eurasian coot**, water rail *Rallus aquaticus*, **Eurasian teal**, **common snipe**, **northern lapwing**, **Eurasian curlew**, reed bunting *Emberiza schoeniclus* and **common kestrel**)			Three snipe (one in breeding 2020, one in non-breeding 2020/21 and one in 2021 breeding seasons), three lapwing (all in non-breeding 2019/20 season), two curlew (all in non-breeding 2019/20 season) and 25 kestrel (two in 2019 breeding, seven in 2019/20 non-breeding, three in 2020 breeding, ten in 2020/21 non-breeding and three in 2021 breeding seasons) flight lines were recorded within 500 m of the Proposed Development. Although coot was not recorded within 500 m of the Proposed Development, this species is only known to fly at night and all bird surveys were undertaken during daylight hours. Therefore, the possibility that small numbers of coot associated with the pNHA, either migrating or making local movements, passing through the Main Wind Farm Site could not be excluded. Similarly, teal, tufted duck and pochard were not recorded within 500 m of the Main Wind Farm Site. However, both these species make local movements at night but information on nighttime migration is lacking. Therefore, the possibility that small numbers of teal, tufted duck or pochard associated with the pNHA, either migrating or making local movements, passing through the Main Wind Farm Site could not be excluded. The pNHA site synopsis does not make it clear when snipe, lapwing, curlew and kestrel are present at the pNHA. The core foraging range for northern lapwing in the non-breeding season is 12 km (Gillings and Fuller, 1999). Therefore, there is some potential connectivity to the Proposed Development for this species in the winter season only.

Site Name	Code	Qualifying Interests	Value	Distance (km) and Direction from Proposed Development	Connectivity
					The core foraging ranges for common snipe and common kestrel in the breeding season are c. 400 m (Green et al., 1990)., and 1.8 km^2 (Boileau et al., 2006), respectively. As the separation distance between the pNHA and the Proposed Development is greater than these core foraging ranges, no breeding season connection for common snipe and common kestrel is likely. There is no foraging range data for non-breeding common snipe, common kestrel or Eurasian curlew, so some connectivity to the pNHA for winter populations has been assumed as a precaution.
Lough Naneagh pNHA	001814	Transitional fen and lake habitats, along with species-rich grassland and woodland	National	12.4 northwest	Fen habitats are GWDTEs; however, the pNHA is in a separate groundwater body as the Proposed Development, so there is no hydrogeological connectivity. There is no downstream hydrological connectivity. There is also no ecological connectivity as the pNHA is not designated for any mobile QI species.
Lough Ramor pNHA	000008	Marginal lake plant communities, breeding (black-headed gull, common snipe, Eurasian curlew, mallard, Eurasian teal, red-breasted merganser and great crested grebe, northern lapwing) and non-breeding birds (**great cormorant,** whooper	National	14.9 north	The lake habitats are not GWDTEs (surface water-fed), so there is no hydrogeological connectivity. There is also no downstream hydrological connectivity. Of the named QI bird species, black-headed gull, common snipe, Eurasian curlew, mallard, Eurasian teal, northern lapwing, great cormorant and whooper swan were recorded by bird surveys. Two black-headed gull (all in 2019/20 non-breeding season), three snipe (one in breeding 2020, one in non-breeding 2020/21 and one in 2021 breeding seasons), three lapwing (all in non-breeding 2019/20 season), two curlew (all in non-breeding 2019/20 season), four mallard (all in non-breeding 2019/20 season), one great

Site Name	Code	Qualifying Interests	Value	Distance (km) and Direction from Proposed Development	Connectivity
		swan, Eurasian wigeon, Eurasian teal and mallard, northern lapwing)			cormorant (non-breeding 2019/20 season) and five whooper swan (once in non-breeding 2019/20 and four times in non-breeding 2020/21 seasons) flight lines were recorded within 500 m of the Proposed Development. No Eurasian teal was recorded within 500 m of the Proposed Development, so no ecological connectivity for these species is likely. Black-headed gull were recorded at the Proposed Development in the non-breeding season only and the pNHA is designated for the breeding population only, so no connection is likely. The core foraging range for northern lapwing in the non-breeding season is 12 km (Gillings and Fuller, 1999) and 0.4 to 0.8 ha in the breeding season (RSPB, 2023). This is smaller than the distance between the pNHA and the Proposed Development, so no ecological connection is likely for northern lapwing. The core foraging ranges for common snipe and Eurasian curlew in the breeding season are c. 400 m (Green et al., 1990) and 1 km (NatureScot, 2016), respectively, which are smaller than the distance between the pNHA and the Proposed Development, so no ecological connection is likely. It is unlikely mallards are from the pNHA as mallard typically travel between 1-2 km from roosts to foraging sites (Legagneux et al., 2009), which is much smaller than the intervening distance between the Proposed Development and the pNHA. The core foraging range for whooper swan is <5 km (NatureScot, 2016) and so it is unlikely that the birds recorded at the Proposed Development are from this

Site Name	Code	Qualifying Interests	Value	Distance (km) and Direction from Proposed Development	Connectivity
					pNHA population, making any ecological connection unlikely. There is no published core foraging distance for non-breeding great cormorant, so some connectivity to the pNHA for winter populations has been assumed as a precaution.
Royal Canal pNHA	002103	Diversity of species along linear habitats, **otter** and opposite-leaved pondweed *Groenlandia densa*	National	15.3 southwest	The canal habitats are not GWDTEs (surface water-fed), so there is no hydrogeological connectivity. There is also no downstream hydrological connectivity. Mobile QI otter could travel from the canal upstream to the Proposed Development (although there is an instream distance of c. 29 km), so there is some possible, remote ecological connectivity.
Killyconny Bog (Cloghbally) pNHA	000006	Overlaps with SAC of same name; no site synopsis available	National	16.3 northeast	Considered under SAC of same name
Mount Hevey Bog pNHA	001584	Overlaps with SAC of same name; no site synopsis available	National	16.8 south	Considered under SAC of same name
Hill of Mael And the Rock of Curry pNHA	000681	Limestone protrusions	National	18.5 northwest	The limestone habitats are not GWDTEs (surface water-fed) and the pNHA is within a different groundwater body to the Proposed Development, so there is no hydrogeological connectivity. There is also no downstream hydrological connectivity. There is also no ecological connectivity as the pNHA is not designated for any mobile QI species.

Site Name	Code	Qualifying Interests	Value	Distance (km) and Direction from Proposed Development	Connectivity
Ballynbarny Fen pNHA	001573	Fen community	National	19.2 southeast	The QI fen habitats are GWDTEs and the pNHA is within the same groundwater body as the Proposed Development. However, the pNHA is at considerable distance from the Proposed Development, so it is unlikely there are any strong hydrogeological connections. There are no downstream hydrological connections. There is also no ecological connectivity as the pNHA is not designated for any mobile QI species.
Trim pNHA	001357	Overlaps with River Boyne and River Blackwater cSAC; no site synopsis available	National	22.2 southeast	Considered under River Boyne and River Blackwater cSAC
Boyne Woods pNHA	004592	Overlaps with River Boyne and River Blackwater cSAC; no site synopsis available	National	27.5 northeast	Considered under River Boyne and River Blackwater cSAC
Slane Riverbank pNHA	001591	Overlaps with River Boyne and River Blackwater cSAC; no site synopsis available	National	32.7 northeast	Considered under River Boyne and River Blackwater cSAC
Crewsbane Marsh pNHA	000553	Overlaps with River Boyne and River Blackwater cSAC; no site synopsis available	National	34.8 northeast	Considered under River Boyne and River Blackwater cSAC
Rossnaree Riverbank pNHA	001589	Overlaps with River Boyne and River	National	36.4 northeast	Considered under River Boyne and River Blackwater cSAC

Site Name	Code	Qualifying Interests	Value	Distance (km) and Direction from Proposed Development	Connectivity
		Blackwater cSAC; no site synopsis available			
King Wiliam's Glen pNHA	001084	Overlaps with River Boyne and River Blackwater cSAC; no site synopsis available	National	40.4 northeast	Considered under River Boyne and River Blackwater cSAC
Dowth Wetland pNHA	001861	Overlaps with River Boyne and River Blackwater cSAC; no site synopsis available	National	40.7 northeast	Considered under River Boyne and River Blackwater cSAC
Boyne River Islands pNHA	001862	Overlaps with River Boyne and River Blackwater cSAC; no site synopsis available	National	41.6 northeast	Considered under River Boyne and River Blackwater cSAC
Boyne Estuary and Coast pNHA	001957	Overlaps with River Boyne and River Blackwater cSAC; no site synopsis available	National	48.2 northeast	Considered under River Boyne and River Blackwater cSAC

Habitats

Desktop Study

5.180 There are no previously mapped Annex I habitats (GeoHive, 2023) present within the Proposed Development. However, there is an area of *Cladium* fen (7210) and alkaline fen (7230) c. 180 m northwest of turbine T4, which has been largely planted with and/or naturally colonised by trees. There is also another area of the same habitat types 420 m southeast of turbine T1 at Newtown Lough.

5.181 There are also four previously mapped possible ancient woodland (PAW) areas from the 'Cavestown site' at the Proposed Development (GeoHive, 2023), all in proximity to the Southern Cluster.

5.182 Habitat contribution to ecological networks has been assessed by Parker et al. (2016). Those areas that contribute most to ecological networks (i.e. those that contribute to three ecological networks) are considered to have the highest biodiversity value.

5.183 The land within the Southern Cluster contributes towards one (turbine locations T6, T7 and T8) or two (turbine locations T4 and T5) ecological networks, sensu Parker et al. (2016). Most of the land at the Northern Cluster (turbine locations T1 to T3) contributes to just one ecological network. Thus, most of the land at the Main Wind Farm Site has an intermediate biodiversity value in this regard.

Field Survey

5.184 Field surveys showed Annex I transition mire habitats were present nearby parts of the Proposed Development, as were PAW habitats. In summary, there was one area of Annex I H7140 transition mire and quaking bog habitat within the Northern Cluster (see **Appendix 5-9** found in Volume III of this EIAR). There was also a second area with a few smaller trenches that shared some affinities with Annex I transition mire and quaking bog habitats. These were very small, isolated fragments i.e. but are not one contiguous area of habitat and are part of recolonising cutover bog and bog woodland habitats.

5.185 The three blocks of PAW habitat did not contain many of the indicator species typical of AW habitats (Perrin and Daly, 2010) within the relevés chosen (see **Appendix 5-9** found in Volume III of this EIAR). Therefore, it is likely that the PAW areas are not of the confirmed ancient woodland type.

5.186 A summary of the existing habitats within the Main Wind Farm Site, Proposed Substation and those bounding the Cable Corridor is shown **Table 5-6**.

5.187 Habitat maps in relation to the development footprint are shown in **Figure 5-5** (habitats at TDR nodes are described in **Appendix 5-9** found in Volume III of this EIAR).

5.188 Further details of the following habitat types (including a PAW condition assessment) recorded are provided in **Appendix 5-9** found in Volume III of this EIAR. The Annex I habitat report is shown in the same

Table 5-6: Habitat Types Within Proposed Development

Fossitt Code	Fossitt Name	EU Annex I or PAW Affiliation?	Area (ha) / Length (m)				Occurrence within Proposed Development
			Main Wind Farm Site	Cable Corridor	Substation	Total	
BC4	Flower beds and borders	No	-	0.03 ha	-	0.03 ha	Along Cable Corridor
BL1	Stone walls and other stoneworks	No	0.04 ha / 313.56 m	0.00 ha / 194.33 m	-	0.04 ha / 507.89 m	Within walls and ruins in Main Wind Farm Site, plus as walls along Cable Corridor.
BL3	Buildings and other artificial surfaces	No	1.63 ha	11.46 ha / 83.35 m	0.02 ha	13.11 ha / 83.35 m	Roads and buildings within Main Wind Farm Site, along Cable Corridor.
ED2	Bare ground	No	0.18 ha	0.05 ha	-	0.24 ha	Bare area within fields within Main Wind Farm Site.
ED3	Recolonising bare ground	No	251.37 m	85.59 m	-	336.96 m	Within Main Wind Farm Site and along Cable Corridor.
ED3 x WS1 x WS3	Recolonising bare ground x scrub x ornamental / non-native shrub mosaic	No	-	0.87 ha	-	0.87 ha	In an area of land along Cable Corridor used as a landfill, with large sections of invasive plants present.
FL5	Eutrophic lake	No	0.09 ha	0.02 ha	-	0.11 ha	Within Main Wind Farm Site in the Southern Cluster.
FL8	Other artificial lakes and ponds	No	-	0.04 ha	-	0.04 ha	Along Cable Corridor
FW1	Upland / eroding river	No	-	116.00 m	-	116.00 m	Along Cable Corridor
FW2	Lowland / depositing river	No	2249.46 m	213.45 m	-	2462.91 m	Bounding the Main Wind Farm Site and crossing the Cable Corridor.

Fossitt Code	Fossitt Name	EU Annex I or PAW Affiliation?	Area (ha) / Length (m)				Occurrence within Proposed Development
			Main Wind Farm Site	Cable Corridor	Substation	Total	
FW4	Drainage ditches	No	381.55 m	-	-	381.55 m	Within the Main Wind Farm Site as field boundaries.
GA1	Improved agricultural grassland	No	106.33 ha	60.46 ha	8.73 ha	175.52 ha	Within the Main Wind Farm Site and at Proposed Substation, plus next to Cable Corridor.
GA1 x ED2	Improved agricultural grassland x bare ground mosaic	No	0.13 ha	-	-	0.13 ha	Within Main Wind Farm Site.
GA2	Amenity grassland	No	-	3.67 ha	-	3.67 ha	Along Cable Corridor.
GS1	Dry and calcareous grassland	No	1.48 ha	-	-	1.48 ha	Within Southern Cluster along an esker.
GS2	Dry meadows and grassy verges	No	-	0.24 ha	-	0.24 ha	Predominantly along Cable Corridor and at TDR nodes.
GS4	Wet grassland	No	0.22 ha	1.96 ha	-	2.19 ha	Within wet patches within Southern Cluster.
PB4	Cutover bog (recolonizing)	No	1.31 ha	-	-	1.31 ha	Within Northern Cluster.
PF3	Transition mire and quaking bog	**Yes – H7140**	2.11 ha	-	-	2.11 ha	Within Northern Cluster.
WD1	(Mixed) broadleaved woodland	**Yes – PAW**	49.15 ha	3.31 ha	-	52.46 ha	Within Main Wind Farm.
WD4	Conifer plantation	No	25.86 ha	0.72 ha	-	26.58 ha	Within Main Wind Farm.

Fossitt Code	Fossitt Name	EU Annex I or PAW Affiliation?	Area (ha) / Length (m)				Occurrence within Proposed Development
			Main Wind Farm Site	Cable Corridor	Substation	Total	
WD5	Scattered trees and parklands	No	12.84 ha	-	-	12.84 ha	Within Southern Cluster.
WL1	Hedgerows	No	2,338.94 m	7,844.01 m	551.16 m	10,734.11 m	Bounding fields and roads within Main Wind Farm Site, Proposed Substation, plus along the Cable Corridor.
WL1 x FW4	Hedgerow x drainage ditch mosaic	No	182.89 m	-	-	182.89	Within Main Wind Farm Site.
WL1 x WL2	Hedgerow x tree line mosaic	No	448.07 m	611.31 m	-	1,059.39 m	Within Main Wind Farm Site where hedgerow has started to turn into tree line.
WL2	Tree lines	No	2,156.36 m	4,611.66 m	93.50 m	6,861.52 m	Within Main Wind Farm Site and Proposed Substation, plus along the Cable Corridor.
WN2	Oak-ash-hazel woodland	**Yes – PAW**	7.32 ha	-	-	7.32 ha	Within the Southern Cluster.
WN6	Wet willow-alder-ash woodland	No	0.22 ha	-	-	0.22 ha	Small sections within wetter areas in Southern Cluster.
WN7	Bog woodland	No	2.30 ha	-	-	2.30 ha	Small section to west of Southern Cluster and in Northern Cluster.
WS1	Scrub	No	0.46 ha	3.10 ha	-	3.57 ha	Within Main Wind Farm Site.

Rare Flora

Desktop Study

5.189 The data search yielded two rare and/or protected plants at the Proposed Development (both Main Wind Farm Site and Cable Corridor; see **Appendix 5-7** found in Volume III of this EIAR): marsh saxifrage *Saxifraga hirculus* and round-leaved wintergreen *Pyrola rotundifolia subsp. Rotundifolia*. None were present for the Proposed Substation.

Field Survey

5.190 Round-leaved wintergreen and marsh saxifrage were explicitly searched for during all habitat and botanical surveys (including at Newtown Lough). None were found.

5.191 No other rare or protected plants were recorded during field surveys at the Proposed Development.

Invasive Non-Native Plants

Desktop Study

5.192 The data search yielded records of two species of invasive or non-native plants (see **Appendix 5-7** found in Volume III of this EIAR): cherry laurel *Prunus laurocerasus* and sycamore *Acer pseudoplatanus*. There is the potential for these species to be present within the Proposed Development.

Field Survey

5.193 Japanese knotweed *Fallopia japonica*, cherry laurel and snowberry *Symphoricarpos alba* were all recorded during surveys (see **Figure 5-5**). Japanese knotweed was recorded within an abandoned area used for illegal dumping adjacent to the Cable Corridor (at least 20 m from the road verge and separated by a hedge, outside of the Proposed Development). Cherry laurel was recorded within a hedge in Clonmellon adjacent to the Cable Corridor. Snowberry was recorded along the proposed access track for the Southern Cluster.

5.194 No invasive aquatic plants were recorded during aquatic surveys.

5.195 Snowberry, winter heliotrope *Petasites fragrans* and cherry laurel were recorded in various locations around the TDR (at areas along the TDR where accommodation works will be required) within hedgerows (see **Appendix 5-9** found in Volume III of this EIAR).

5.196 Of the species mentioned, Japanese knotweed is the only species listed on the Third Schedule of the European Communities (Birds and Natural Habitats) Regulations 2011-2021 (S.I. 477/2011).

Birds

Desktop Study

5.197 BirdWatch Ireland has created a sensitivity mapping tool, which assesses the potential sensitivity of at-risk bird populations to wind energy developments (McGuinness, et al., 2015). The areas of the Proposed Development all lacked data i.e. there is no prior information to suggest that avian populations in the general area thought to be particularly sensitive to wind farm developments.

5.198 The data search yielded records of 30 species of rare (red- or amber-listed) and/or specially protected (Annex I) birds at the Main Wind Farm Site and surrounding area (see **Appendix 5-7** found in Volume III of this EIAR for details on data sources). This included opportunistic data and data collected for other purposes.

5.199 There are desktop records for four Annex I listed species: common kingfisher, corncrake *Crex crex*, peregrine falcon and whooper swan.

5.200 In addition, there are desktop records for 10 red-listed species: barn owl, common kestrel, common snipe, common swift *Apus apus*, corncrake, Eurasian curlew, northern lapwing, stock pigeon *Columba oenas*, whinchat *Saxicola rubetra* and yellowhammer *Emberiza citrinella*.

5.201 Finally, there are records for 17 amber-listed species: barn swallow *Hirundo rustica*, black-headed gull, common coot, common linnet *Carduelis cannabina*, common starling *Sturnus vulgaris*, Eurasian teal, Eurasian tree sparrow *Passer montanus*, Eurasian wigeon, great cormorant, great crested grebe, house martin *Delichon urbicum*, house sparrow *Passer domesticus*, mallard, mute swan *Cygnus olor*, sand martin *Riparia riparia*, skylark *Alauda arvensis* and spotted flycatcher *Muscicapa striata*.

5.202 Thus, there is the potential for these and other bird species to be present within or nearby the Main Wind Farm Site.

5.203 NPWS also have data on one occupied peregrine nest site recorded within the general area of the Proposed Development during the 2017 National Peregrine survey.

5.204 For the Cable Corridor, the only notable desktop records were for Annex I-listed common kingfisher, and amber-listed barn swallow, mallard and sand martin.

Field Survey

Flight Activity Surveys

5.205 Full details of the flight activity survey results (including figures showing flight lines for primary target species) are provided in **Appendix 5-2** found in Volume III of this EIAR. The following sections present seasonal summaries of ‘at risk’ flight activity within the Collision Risk Zones (CRZ), defined as the areas encompassed by the relevant Wind Farm Polygon (WP) (i.e. the area within 500 m of the outermost turbine blades) in accordance with NatureScot (2017) guidance. ‘At risk’ flights are defined as those crossing the relevant WP at Potential Collision Height (PCH), i.e. within each rotor-swept area (between 18 m above ground level (AGL) and 180 m AGL). This is the ‘worst-case’ scenario and is based on a 99 m hub height and a 162 m rotor diameter (the PCHs for the ‘best-case’ scenario is based on a turbine with a 97.5 m hub height and 155 m diameter, which gives PCHs of 20 – 175 m AGL). This is the worst-case scenario because it represents the highest collision risk i.e. the largest PCH range. The PCH range for the worst-case scenario contains the best-case scenario PCH range as well. Consequently, using the worst-case scenario allows for the assessment of all permutations within the turbine range.

5.206 Fifteen primary target species were recorded during flight activity surveys and of these, only whooper swan is listed as an SCI species for any SPAs within 20 km of the Proposed Development.

5.207 In general, there were very few ‘at risk’ flight events for any primary target species; the only exception was for European golden plover and to a lesser extent, northern lapwing.

5.208 **Table 5-7** and **Table 5-8** summarise the cumulative numbers of birds recorded passing through the CRZ during baseline surveys undertaken during June 2019 to September 2021

inclusive, and those potentially at risk of turbine collision, for the Northern and Southern Clusters, respectively.

Table 5-7: Summary of 'At Risk' Flights of Primary Target Species by Season11 within Northern Cluster

Species Name	Period of Analysis	Within WP		
		Flight Lines	Flights	Time at Potential Collision Heights (s)
Common kestrel	Apr-19 to Aug-19	1	1	20
	Sep-19 to Mar-20	7	7	813
	Apr-20 to Aug-20	2	3	1,012
	Sep-20 to Mar-21	4	4	389
	Apr-21 to Sep-21	2	3	153
Common snipe	Apr-21 to Sep-21	1	3	0
Eurasian curlew	Sep-19 to Mar-20	2	33	4,820
European golden plover	Sep-19 to Mar-20	2	590	1,059,400
Great cormorant	Sep-19 to Mar-20	1	1	45
Hen harrier	Sep-19 to Mar-20	1	1	45
Mallard	Sep-19 to Mar-20	4	19	665
Merlin	Sep-19 to Mar-20	1	1	5
	Sep-20 to Mar-21	1	1	4
Northern lapwing	Sep-19 to Mar-20	3	26	3,320
	Apr-20 to Aug-20	1	2	218
Peregrine falcon	Sep-20 to Mar-21	1	1	135
	Apr-21 to Sep-21	1	1	160
Whooper swan	Sep-20 to Mar-21	3	10	620

[11] For a full definition of seasons used, see **Appendix 5-8** found in Volume III of this EIAR

Table 5-8: Summary of 'At Risk' Flights of Primary Target Species by Season11 within Southern Cluster

Species Name	Period of Analysis	Within WP		
		Flight Lines	Flights	Time at Potential Collision Heights (s)
Black-headed gull	Sep-19 to Mar-20	2	2	215
Common kestrel	Apr-19 to Aug-19	1	1	20
	Sep-19 to Mar-20	1	1	500
	Apr-20 to Aug-20	2	2	33
	Sep-20 to Mar-21	7	7	495
	Apr-21 to Sep-21	1	1	15
Common snipe	Sep-20 to Mar-21	2	5	126
European golden plover	Apr-19 to Aug-19	1	4	260
	Sep-19 to Mar-20	8	2,195	2,394,100
	Sep-20 to Mar-21	3	400	105,160
Peregrine falcon	Sep-19 to Mar-20	1	1	60
	Sep-20 to Mar-21	4	4	398
	Apr-21 to Sep-21	1	1	160
Whooper swan	Sep-19 to Mar-20	1	4	280
	Sep-20 to Mar-21	1	11	4,180

Breeding Walkover Surveys

5.209 Full results of the breeding walkover surveys in 2019, 2020 and 2021 breeding seasons are presented in **Appendix 5-2** found in Volume III of this EIAR.

5.210 Little grebe were confirmed breeding in 2019 (adults with recently fledged young on a small pool, c.960 m NE from turbine T4). Common buzzard, yellowhammer and Eurasian sparrowhawk were recorded as possibly breeding due to their presence in suitable breeding habitat (no nests were detected), according to the BTO breeding status codes (BTO, 2023b).

5.211 In 2020, common kestrel and northern lapwing were confirmed as breeding, with one kestrel territory identified (1.3 km NW from turbine T2) and an adult lapwing feeding a fledged chick at a small pond (1.2 km NE from turbine T4). Common snipe were also recorded drumming (displaying), indicating probable breeding (c. 360 m NW of turbine T1). No nest locations were confirmed for any of these three species.

5.212 In 2021, Eurasian coot (c. 700 m NE of turbine T3) and Eurasian sparrowhawk (c. 380 m NW of turbine T5 and c. 380 m SW of turbine T4) were confirmed breeding, with territories for both identified. Common kestrel (c. 1.5 km NE of turbine T6) and common buzzard (c. 575 m NE of turbine T4) were also probably breeding. No nest locations were confirmed for any of these birds. There was a probable snipe territory c. 875 m SE of turbine T4.

Breeding Woodcock Surveys

5.213 Full results of the breeding Eurasian woodcock surveys in 2019, 2020 and 2021 breeding seasons are presented in **Appendix 5-2** found in Volume III of this EIAR.

5.214 In 2019, roding (display) flights were recorded indicating probable breeding at a location c. 340 m NE from turbine T4, and another location c. 230 m SW and c. 290 m NE from turbines T5 and T7, respectively.

5.215 In 2020, one confirmed breeding area was identified for a minimum of one pair located c. 430 m west of turbines T4 and T5.

5.216 In 2021, there were two probable territories recorded c. 200 m NW of turbine T5 and 0 m from turbine T3 (minimum two pairs).

5.217 No nests were identified for any of the observations.

Breeding Raptor Surveys

5.218 Full results of the breeding raptor surveys undertaken in 2019, 2020 and 2021 are presented in **Appendix 5-2** found in Volume III of this EIAR. A summary is presented below.

5.219 In 2019, common buzzard and Eurasian sparrowhawk were recorded as probably breeding due to their presence in suitable breeding habitat; however, no territories or nest locations were recorded. Common kestrel was also recorded as confirmed breeding, c. 800 m from turbine T4, although no nest was identified.

5.220 In 2020, there were two confirmed common buzzard territories, c. 2.1 km NE of turbine T2 and c. 2.2 km E of turbine T6, and one probable territory. There were three probable Eurasian sparrowhawk territories c. 800 m NW of turbine T5, c. 1.3 km SE of turbine T7 and c. 4 km SE of turbine T8. There was also a confirmed common kestrel territory c.1.3 km NE of turbine T4 and a probable territory c. 1.2 km S of turbine T8. No nests were identified.

5.221 In 2021, there was a confirmed common buzzard territory c. 2.4 km SE of turbine T3 and one probable territory. There was a probable Eurasian sparrowhawk territory c. 2.2 km NE of turbine T6. Also, there was a probable common kestrel territory c.1.7 km E of turbine T6. No nests were identified.

Waterbird Distribution Surveys

5.222 Full results of the waterbird distribution surveys are presented in **Appendix 5-2** found in Volume III of this EIAR.

5.223 In summary, the following Annex I, red- or amber-listed species were recorded within 500 m of the Proposed Development, as shown in **Table 5-9** below.

5.224 Winter European golden plover foraging activity was concentrated in improved grassland habitats to the south-west (but outside of) the Proposed Development.

5.225 Whooper swan foraging activity was limited in extent and was predominantly outside of the 500 m survey buffer (there was a single observation of swans within 500 m from the 2020/21 non-breeding surveys).

5.226 Foraging wildfowl activity was concentrated outside of the 500 m survey buffer, mostly in Crowenstown Lough, Lough Shesk, Freehan Lough, with the rest at Newtown Lough or at unnamed loughs.

Table 5-9: Summary of Species Recorded During Waterbird Distribution Surveys

Species	Peak Counts of Birds within 500 m of Proposed Development		
	Non-Breeding 2019/20	Breeding 2020 and Non-Breeding 2020/21	Breeding 2021
Common shelduck	1	-	-
Common snipe	3	6	4
Eurasian teal	50	-	-
Eurasian wigeon	45	-	-
European golden plover	65	-	-
Great cormorant	1	-	-
Lesser black-backed gull	2	-	-
Little grebe	2	-	-
Mallard	6	-	-
Mute swan	2	-	-
Whooper swan	-	2	-

Winter Walkover Surveys

5.227 Full results of the winter walkover survey are presented in **Appendix 5-2** found in Volume III of this EIAR. A summary showing the results for any Annex I, red- or amber-listed bird species is presented in **Table 5-10** below.

5.228 Eurasian wigeon and Eurasian teal observations were associated with loughs that are just on the edge of the 500 m survey buffer (Newtown Lough for wigeon and unnamed lough at Ballinlig for teal).

Table 5-10: Summary of Species Recorded During Winter Walkover

Species	Peak Counts of Birds within 500 m of Proposed Development	
	Non-breeding 2019/20	Non-breeding 2020/21
Common kestrel	1	1
Common snipe	1	1
Eurasian teal	37	-
Eurasian wigeon	42	-

Species	Peak Counts of Birds within 500 m of Proposed Development	
	Non-breeding 2019/20	Non-breeding 2020/21
European golden plover	70	2
Little grebe	1	-
Mute swan	1	-
Northern lapwing	-	1

Incidental Sightings

5.229 Barn owl was heard and seen during a bat survey in 2022 near Rosmead House (c. 360 SW of turbine T8), with feathers nearby suggesting that this species nests or roosts in the ruins. Sand martin, meadow pipit *Anthus pratensis* and Eurasian woodcock were recorded during bat surveys, where the woodcock was seen roding NW of turbine T7.

5.230 Other incidental birds of conservation concern recorded during bird surveys include common gull *Larus canus*, grey wagtail *Motacilla cinerea*, goldcrest *Regulus regulus*, greenfinch *Chloris chloris*, house martin, house sparrow, linnet, redwing *Turdus iliacus*, sand martin, skylark, starling, swallow, swift and willow warbler *Phyllocopus trochilus*.

5.231 Grey wagtail were recorded as possibly breeding, as were skylark (at least one pair for both species). There was a breeding colony of sand martin nearby the Northern Cluster.

Terrestrial Mammals (Excluding Bats)

Desktop Data

5.232 The data search yielded records of seven species of rare and/or protected mammals (see **Appendix 5-7** found in Volume III of this EIAR): Eurasian badger, Eurasian red squirrel, Eurasian otter, Irish hare *Lepus timidus*, pine marten and west European hedgehog *Erinaceus europaeus*. There is the potential for these species to be present within the Proposed Development.

5.233 There are also records of four species of invasive or non-native mammals: American mink *Neogale vison*, eastern grey squirrel *Sciurus carolinensis*, European rabbit *Oryctolagus cuniculus* and feral ferret *Mustela furo*.

5.234 For the Cable Corridor, there were desktop records of Eurasian badger, Eurasian otter, Irish hare, pine marten and west European hedgehog (see **Appendix 5-7** found in Volume III of this EIAR).

Field Surveys

5.235 Five species of mammals were recorded during the dedicated mammal surveys (see **Figure 5-7**). A summary is provided for each species below. Note that Eurasian otter results are discussed in paragraph 5.98 under aquatic ecology.

5.236 In addition, while they were not recorded by field surveys, it is likely that the following species are also present based on desktop data and the availability of suitable foraging/breeding habitats: Irish hare and west European hedgehog.

Badger

5.237 Latrines, snuffle pits and setts were recorded in the Southern Cluster only. A large, active sett (likely main sett) was recorded in PAW habitats south of turbine T4 by c. 250 m, with other subsidiary sett entrances and snuffle pits present. Another large, active sett was recorded along the Stonyford River with multiple annex setts nearby. There was also another series of badger setts c. 340 m SW of turbine T8. An active latrine was recorded at the trail camera location in the Southern Cluster.

5.238 No badger setts were recorded within 100 m of any proposed infrastructure or within the Northern Cluster. The woodland and hedgerow habitats present provide foraging and breeding habitats for this species.

Pine marten

5.239 Pine marten scat was recorded along a gravel track in an ash plantation (c. 190 m NW of turbine T7) and on branches of a very mature oak tree in PAW habitats (c. 280 m NE of turbine T5) as an incidental species during bat surveys. No dens (breeding places) were recorded within 100 m of the Proposed Development. The woodlands provide foraging and breeding habitats for this species.

Red squirrel

5.240 Signs of foraging (split hazel nuts) were recorded in the Southern Cluster within conifer plantation habitat in and around turbine T5. No dreys (breeding places) were recorded within 100 m of the Proposed Development. The woodlands provide foraging and breeding habitats.

Red fox

5.241 Red fox *Vulpes vulpes* scat was widespread throughout the Southern Cluster. There are a wide variety of suitable habitats present for this opportunistic hunter.

Feral goats

5.242 Feral goats *Capra aegagrus hircus* were recorded during marsh fritillary surveys near turbine T1.

Bats

Desktop Data

5.243 The mean bat landscapes suitability index is the same for all bat species across the Proposed Development. The score is 22.89 (out of a maximum score of 100).

5.244 The data search yielded records of four bat species, namely, brown long-eared bat *Plecotus auratus*, Daubenton's bat *Myotis daubentonii,* Leisler's bat and soprano pipistrelle *Pipistrellus pygmaeus*. There is the potential for these species to be present at the Proposed Development.

5.245 BCI data show that five previously recorded bat roosts are located within 10 km from the Proposed Development. The closest roost is a common pipistrelle *Pipistrellus pipistrellus* roost located c. 2.3 km NE from the Main Wind Farm Site. The remaining roosts are for soprano pipistrelle bat (two separate roosts), brown long-eared bat (two separate roosts) and a mixed roost of soprano pipistrelle and Leisler's bat. Only the common pipistrelle roost

is likely to have any ecological connectivity to the Main Wind Farm Site i.e., the core sustenance zones (CSZ)[12] for common pipistrelle, as measured from the roost, nearly overlaps with the Project Site. The BCI data showed there were no known roosts adjacent to the Cable Corridor or Proposed Substation.

Field Surveys

Roost Assessment

5.246 Preliminary surveys identified seven structures of moderate suitability as a bat roost, six structures of low suitability as a bat roost and two roost structures of negligible suitability as a bat roost within the survey area. Of these, only four structures classed as having moderate roost suitability were confirmed as being used by roosting bats. This included a minor roost for a single Daubenton's bat, a minor roost for a single soprano pipistrelle and a mixed roost of minor importance (minor day roost for common and soprano pipistrelle, plus likely night roosts of both Natterer's *Myotis nattereri* and brown long-eared). Of the four roosts, the one of the greatest importance for bats is the ruin of Rosmead House, which hosts multiple roosts within the structure. This included a minor but regularly used day roost for soprano pipistrelle, a regular summer and autumn day roost and night roost for Natterer's bat and Daubenton's bat, and a regular night roost for brown long-eared bat. It was considered likely that the roost is also used as a maternity roost for Natterer's and Daubenton's bat.

5.247 There were 38 trees with potential roost features identified within the Proposed Development via ground-level tree surveys.

5.248 All the confirmed roost structures are outside the direct footprint of the Proposed Development and will not be destroyed. There is a minimum distance of c. 350 m from any confirmed roost structure to the nearest indicative turbine location.

5.249 There are several potential roost trees nearby to turbine T4; however, these are located in the PAW habitats, which will not be felled.

5.250 No swarming behaviour was recorded and no potential or confirmed roosts were identified along the Cable Corridor or Proposed Substation.

5.251 See **Appendix 5-3** found in Volume III of this EIAR for further information.

Ground-level Static Detector Survey

5.252 Eight bat species were recorded at the Main Wind Farm Site during ground-level static detector surveys conducted in 2022: brown-long eared bat, common pipistrelle, Daubenton's bat, Leisler's bat, Nathusius' pipistrelle *Pipistrellus nathusii*, Natterer's bat, soprano pipistrelle, and whiskered bat *Myotis mystacinus*. Bat activity was highest in summer (a mean of 984 bat passes per night) and lowest in autumn.

5.253 All four Irish 'high collision risk' species were recorded during surveys (common pipistrelle, Leisler's bat, Nathusius' pipistrelle and soprano pipistrelle). Common pipistrelle, Leisler's bat and soprano pipistrelle were most frequently recorded. Nathusius' pipistrelle and the remaining five 'low collision risk' species were recorded much less frequently.

[12] A CSZ as applied to bats, refers to the area surrounding a communal bat roost within which habitat availability and quality will have a significant influence on the resilience and conservation status of the colony using the roosts. If bat commuting and foraging habitats within the CSZ are affected by the Project, then this could affect bats using the roost. Core_Sustenance_Zones_Explained_04.02.16.pdf (bats.org.uk) [Last accessed 27/03/2024]

5.254 Soprano pipistrelle was the most frequently recorded species, with a peak activity (largest number of mean calls per night) recorded at location 2 in the summer season. The summer peak was not driven by one or two nights, but rather with a consistently large number of calls recorded.

5.255 Common pipistrelle was the next most frequently recorded species, with a peak activity (largest number of mean calls per night) recorded at location 7 and 2 in the summer season. The summer peak at location 7 was largely driven by many calls on deployment nights 11, 3 and 12. The summer peak at location was 2 was also driven largely by calls recorded on deployment nights 6 and 9.

5.256 Leisler's bat was the third most frequently recorded species, with a peak activity (largest number of mean calls per night) recorded at location 8 in the summer season. The summer peak was driven by many calls recorded on deployment nights 7 and 8.

5.257 Nathusius' pipistrelle was the most infrequently recorded 'high collision risk' species, with a peak activity (largest number of mean calls per night) recorded at location 1 in the summer season, although the number of calls was extremely low.

At-height Static Detector Surveys

5.258 All four 'high collision' risk species were recorded during 'at-height' surveys. Leisler's bat was the by far the most frequently recorded species, which is unsurprising, as it is the highest-flying Irish bat species. It is not possible to compare ground-level and at-height data in a direct way, as they were recorded during different years and the level of survey effort differs (a single static detector was used for the at-height surveys vs. eight for the ground-level surveys).

5.259 There were a few nights where some level of activity for lower collision risk species was recorded, namely for brown long-eared and Natterer's bat; however, activity levels were considerably lower.

Transect Activity Surveys

5.260 A total of three bat species were recorded during transect activity surveys: common pipistrelle, soprano pipistrelle and Leisler's bat. Flight lines were typically of bats commuting and foraging along treelines, hedgerows and woodland edges. Common and soprano pipistrelle were also observed foraging and flying around Rosmead House ruins, with common pipistrelle emitting social calls.

Bat activity relative to other survey sites

5.261 The habitats within the Main Wind Farm Site are considered to be of 'high risk' for bats, as defined by NatureScot (2021) guidance. The Main Wind Farm Site contains numerous suitable buildings, trees and other structures with moderate-high roost potential, confirmed roosts within or in the vicinity of the Main Wind Farm Site, suitable bat foraging habitat and connectivity to the wider landscape by a network of strong linear features.

5.262 No assessment of bat activity relative to other survey locations using the Ecobat tool was possible (see paragraph 5.122). The vulnerability of the species populations was used as an 'equivalent justified categorisation', which is permitted by NatureScot (2021) guidance when Ecobat activity levels are not available.

Other Protected Fauna

Desktop Data

Reptiles

5.263 The data search yielded records of one species of reptile (see **Appendix 5-7** found in Volume III of this EIAR), the common lizard *Zootoca vivpara,* c. 2 km SE of the Main Wind Farm Site in a back garden. This species is mainly associated with coastal and heathland habitats in Ireland (Farren et al., 2010), both of which are absent from the Proposed Development.

5.264 There were no desktop records for any reptile species along the Cable Corridor or the Proposed Substation.

Amphibians

5.265 The data search yielded records of two species of amphibian (see **Appendix 5-7** found in Volume III of this EIAR), the common frog and smooth newt. There is the potential for these species to be present within the Main Wind Farm Site, with both foraging (e.g. wet grasslands, drainage ditches and shallow streams) and breeding (e.g. drainage ditches and puddles in forestry tracks) habitats (Buckley, 2012) present.

5.266 There were desktop records for the same two species along the Cable Corridor as well but not the Proposed Substation.

Invertebrates

5.267 The data search yielded no records of rare or threatened invertebrates (see **Appendix 5-7** found in Volume III of this EIAR) for the Main Wind Farm Site, Proposed Substation or Cable Corridor.

5.268 There were desktop records for invasive New Zealand flatworm *Arthurdendyus triangulates* and Jenkin's spire snail *Potamopyrgus antipodarum* for the Main Wind Farm Site. The flatworm can be found under rocks and stones, and the spire snail can be found in freshwater habitats. Both of these are present at, or nearby to the Proposed Development.

Field Surveys

Reptiles

5.269 No reptiles were recorded during other ecological surveys.

Amphibians

5.270 Common frog was recorded during surveys in 2022 in a single pond (aquatic survey site P1; see **Figure 5-2**); however, there was some suitability for frogs at the rest of the pond sites.

5.271 Smooth newt was recorded in high densities at pond site P7 (see **Figure 5-2**); however, the rest of the sites were of lower suitability or unsuitable for this species. Despite high suitability, no smooth newt eDNA was detected at Newtown Lough.

Marsh Fritillary

5.272 A live marsh fritillary butterfly was recorded during static bat detector surveys near turbine T2 in June 2022.

5.273 Two transects were used to assess the condition of habitat in and around turbines T1 and T2 in the same month. There was an absence of Devil's bit scabious, which is the food plant for marsh fritillary caterpillars, near turbine T2. There was also a lack of structured vegetation, making it likely that the butterfly had flown towards the T2 location from another area. However, there were some areas near turbine T1 where habitats were assessed as being in either suitable (under grazed) or in good condition for marsh fritillary butterfly, with Devil's bit scabious present.

5.274 The larval web surveys found no caterpillars in the vicinity of turbine T2. However, 59 larval webs were found c. 190 m SW of turbine T1 (see **Figure 5-8**).

Other Invertebrates

5.275 Common butterfly and damselfly species were recorded during other surveys, including silver-washed fritillary *Argynnis paphia*.

Fisheries and Aquatic Ecology

Desktop Data

5.276 The desktop data available for fisheries and aquatic ecology is shown in full in **Appendix 5-7** found in Volume III of this EIAR. A summary is provided below.

5.277 European eel was the only fish species identified during the desktop study. White-clawed crayfish and Eurasian otter were also recorded.

Field Surveys

5.278 See **Appendix 5-4** found in Volume III of this EIAR for the full fisheries and aquatic ecology survey results and **Figure 5-2** for a drawing of where streams and rivers are located. A summary is provided below.

Habitats

5.279 The watercourses and aquatic survey sites in the vicinity of the Proposed Development are typically small, lowland depositing channels (FW2; Fossitt, 2000) which have been historically modified as part of arterial drainage works. The watercourses flow over areas of Visean limestone and calcareous shale[13]. Land use practices in the wider survey area are dominated by pastures with localised areas of broad-leaved forests, mixed forests, and land principally occupied by agriculture with significant areas of natural vegetation.

Q-sampling

5.280 No rare or protected macro-invertebrate species (according to national red lists) were recorded in the biological water quality samples taken from 12 wetted riverine sites. Biological water quality was calculated as good for four sites (A4, B3, B5 and B6), moderate

[13] Geological Survey of Ireland https://www.gsi.ie/en-ie/data-and-maps/Pages/default.aspx

for three sites (B4, B7 and B8), poor for four sites (sites A1, A3, B1, B9) and bad for one site (B2).

5.281 Given the dry nature of the stream at site A2, it was not possible to collect a biological water quality sample. However, a composite sweep sample was taken in the small pond and no macro-invertebrate species of conservation value greater than 'least concern', according to national red lists, were recorded.

Macrophytes and aquatic bryophytes

5.282 No rare or protected macrophytes or aquatic bryophytes were recorded at the 26 survey sites. Similarly, no examples of Annex I aquatic vegetation habitats were recorded during the surveys.

Pearl mussels

5.283 No freshwater pearl mussel eDNA was detected in the three riverine samples (A4, Athboy River; B5, D'arcy's Crossroads Stream; and B9, Stonyford River). These results were considered evidence of the species' absence within the survey area and are in keeping with the known distribution (absence) of the species in the wider survey area according to desktop data.

Salmonids

5.284 Salmonids were present at a total of seven survey sites, with Atlantic salmon present at five of these on the Athboy River (A4), D'arcy's Crossroads Stream (B5 & B6) and the Stonyford River (B7 & B9). Despite evident pressures (e.g. hydromorphology, siltation), these watercourses can be considered the most important salmonid habitats in the survey area. The Stonyford River is known to be a significant contributor of brown trout to the main Boyne channel (Mariani & Massa-Gallucci, 2012). Sites B3 on the D'arcy's Crossroads Stream and B6 on the Stonyford River were particularly high value salmonid nurseries. Except for site B7 (medium density), salmon were recorded at low densities. There was limited or no suitability for salmonids in the Kilskeer River, Killacroy Stream or Cavestown and Rosmead Stream due to poor flows and siltation pressures.

Lamprey

5.285 Lamprey ammocoetes (*Lampetra sp.)* were widespread in the vicinity of the Proposed Development and were recorded from a total of seven sites on the Athboy River (A4), D'arcy's Crossroads Stream (B3, B4 & B5) and the Stonyford River (B6, B7 & B9). These sites supported both salmonids and lamprey. However, ammocoetes were present in low to medium densities (≤5.3 per m^2) and this was reflective of the typically limited and sub-optimal larval habitat present in addition to low summer flows. While surveys did not distinguish between brook *Lampetra planeri* and river lamprey, there are no known records of river lamprey for Co. Westmeath or Co. Meath and the relevant catchment (NBDC, 2023; O'Connor, 2006) and so it is considered the species was most likely brook lamprey.

European eel

5.286 Despite widespread suitability, European eel were only recorded in low densities from sites A4 on the Athboy River and B6 on the Stonyford River. Eel eDNA was also recorded at Newtown Lough. As eel occurrence decreases significantly with increasing distance from the sea (Degerman *et al*., 2019), the paucity of eel observed in the Boyne_SC_050 and Boyne_SC_070 river sub-catchments can be partly explained by the distance between the

survey area and marine habitats (Chadwick *et al*., 2007) (>80 km nearest instream distance). The absence of eel from many sites also reflects the considerable hydromorphological pressures in the survey area which have reduced the overall quality of eel habitat through a reduction in habitat heterogeneity and instream refugia required by the species (Laffaille *et al*., 2003).

Other fish species

5.287 Three-spined stickleback *Gasterosteus arculaetus* was recorded at all sites, except for sites A4 on the Athboy River and B5 on D'arcy's Crossroads Stream. Ten-spined stickleback was recorded on the Kilskeer River (A3), Killacroy Stream (B1 and B2), Stonyford River (B6) and Cavestown and Rosmead Stream (B8). Stone loach *Barbatula barbatula* and minnow *Phoxinus phoxinus* were only recorded on the Stonyford River (B6 and B9).

White-clawed crayfish

5.288 A single juvenile, white-clawed crayfish was recorded at site A4 on the Athboy River. White-clawed crayfish eDNA was also detected from this site. However, no crayfish eDNA was detected from sites on the D'arcy's Crossroads Stream (site B5) and the Stonyford River (site B9). This species was not recorded from any other sites during the survey and no crayfish remains were identified in otter spraint sites.

Freshwater pearl mussel

5.289 No freshwater pearl mussel eDNA was detected. These results were considered as evidence of the species' absence within the survey area, in keeping with the known distribution (absence) of the species in the wider survey area based on desktop data.

Otter

5.290 Despite widespread suitability, otter signs were only recorded at a total of three sites: B6 on the Stonyford River, and B3 and B5 on the D'arcy's Crossroads Stream. No breeding (holts) or resting (couch) areas were identified. All these sites are within 1 km of the Proposed Development, with site B5 c.200 m from the western boundary.

Kingfisher

5.291 No evidence of kingfisher was recorded within 150 m of any aquatic survey site.

Invasive aquatic species

5.292 The non-native pathogen, crayfish plague was detected in D'arcy's Crossroads Stream (B5) and the Stonyford River (B9). No other aquatic invasive species were recorded.

Evaluation of Ecological Features

5.293 An evaluation of ecological features within the ZoI is provided in **Table 5-11** below.

5.294 Only those evaluated as an IEF are brought forward for impact assessment. These also include those protected by law or policy. Note that all habitats have been brought forward for assessment, to facilitate a fuller assessment of any net changes to biodiversity because of the Proposed Development, c.f. the EU Biodiversity Strategy 2020 and Irish National Biodiversity Action Plan 2017-2021, which emphasise the need to achieve no net loss of biodiversity.

Table 5-11: Evaluation of Ecological Features within ZoI

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
Designated Nature Conservation Sites	River Blackwater and River Boyne cSAC	NIS determined that the only source-receptor pathways were via hydrogeological connections to alkaline fen habitats, hydrological connections to mobile aquatic species, river lamprey, Atlantic salmon and otter, spread of invasive or non-native species, hedgerow planting in the cSAC, disturbance of otter and via possible supporting flora/fauna within the cSAC.	International	Part of European Natura 2000 network.	Y
	River Boyne and River Blackater SPA	NIS determined that the only source-receptor pathways are via downstream hydrological connections to riparian habitats that could be used by breeding or foraging kingfishers.	International	Part of European Natura 2000 network.	Y
	Lough Derravaragh SPA	NIS determined that the only source-receptor pathways are via ecological connections to mobile QIs whooper swans, which could be affected by collision (not disturbance/displacement or barrier effects).	International	Part of European Natura 2000 network.	Y
	Lough Glore pNHA	The only source-receptor paths are ecological: coot, common snipe, northern lapwing, Eurasian curlew, Eurasian teal, pochard and tufted duck and common kestrel are mobile and could travel between the pNHA and Proposed Development.	National	Non-statutory designated Irish conservation site.	Y

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
	Lough Ramor pNHA	The only source-receptor paths are ecological: great cormorant is mobile and could travel between the pNHA and Proposed Development.	National	Non-statutory designated Irish conservation site.	Y
	Royal Canal pNHA	The only source-receptor paths are ecological: otter is mobile and could travel between the pNHA and Proposed Development.	National	Non-statutory designated Irish conservation site.	Y
Habitats	FW1, FW2, PF3, WD1, WN2, WN6, WN7	See Table 5-6 for additional details.	County / Regional	Habitats are rare, Annex I type or PAW type, or important corridors / habitats for other receptors.	Y
	FL5, FL8, FW4, GS1, GS2, GS4, PB4, WD4, WD5, WL1, WL2, WL1 x WL2, WL1 x FW4, WS1		Local	Habitats are of natural or semi-natural and of value for biodiversity.	Y
	BC4, BL1, BL3, ED2, ED3, ED3 x WS1 x WS3, GA1, GA1 x ED2, GA2		Site	Habitats are either artificial or of low value for biodiversity.	Y

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
Birds	Black-headed gull	BoCCI 4: Amber list (qualifying criteria: moderate decline in breeding range of 58% and 55% over short and longer time periods, respectively; localized breeder with >50% breeding population in 10 or fewer sites); ROI population; 20,197 wintering individuals (2016/17: (Fitzgerald, Burke, & Lewis, 2021)) and 9,318 breeding pairs (2010-2012: (NPWS, 2022)); County Westmeath population: 325 wintering individuals (IWeBS) and 280 breeding pairs (estimated); Baseline surveys: Flight activity surveys: recorded as primary species with peak count of 1 bird (winter season 2019/20). Recorded as secondary species with peak count of 3 birds (breeding season 2020) and 2 birds (breeding season 2021). Wildfowl distribution surveys: recorded peak count of 1 bird (winter season 2019/20).	Local	Amber-listed, so protected as part of Westmeath County Council's and Meath County Council's policy on natural heritage (paragraph 12.10 and objective 35, respectively). Flight activity was generally low throughout the study period. The winter season peak count (N=1) is not significant within the context of the ROI (<0.01%) or County Westmeath population (0.31%). The breeding season peak count (N=3) is not significant within the context of the ROI (0.02%) or County Westmeath population (0.5%). Based on the above, the population within the study area is of local importance for both breeding and winter seasons.	Y

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
		Breeding walkover survey: recorded as peak count of 2 birds (breeding season 2020 and 2021). Breeding raptor survey: recorded as incidental with peak count of 1 bird (breeding season 2020).			
	Common kestrel	BoCCI 4: Red list (qualifying criteria: severe decline in breeding population of 53% over short time period); ROI population: 36 territorial pairs (Wilson-Parr & O'Brien, 2019) but this is likely to represent a massive underestimate as the Countryside Bird Survey 2011-2016 (Lewis, et al., 2019) estimates an ROI population of 13,500 individuals, so 6,750 pairs is the more likely estimate; County Westmeath population: 203 pairs (estimated); Lough Glore pNHA population: no information available; Baseline surveys:	Local	Red-listed, so protected as part of Westmeath County Council's and Meath County Council's policy on natural heritage (paragraph 12.10 and objective 35, respectively) and by non-statutory designated site, Lough Glore pNHA. Flight activity was reasonably high throughout the study period. As this species is a resident, it is likely that one pair of birds is resident at the Proposed Development. The peak count (N=2) is not significant within the context of the ROI (0.01%) or County	Y

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
		Flight activity surveys: recorded as primary target; peak count of 4 individuals (breeding 2019), 1 individual (winter 2019/20), 2 individuals (breeding 2020), 2 individual (winter 2020/21) and 2 individuals (breeding 2021); Breeding raptors surveys: confirmed breeding c. 800 m from turbine T4 in 2020. Confirmed breeding was recorded c.1.3 km NE of turbine T4 and a probable territory c. 1.2 km S of turbine T8 in 2021. In 2021, there was a probable territory c.1.7 km E of turbine T6. Winter walkover surveys: peak count of 2 birds (winter 2019/20) Breeding walkover survey: peak count of 1 bird (breeding 2020) Breeding woodcock survey: recorded as an incidental, peak count of 1 bird (breeding 2020) Wildfowl distribution survey: recorded as an incidental, peak count of 1 bird (breeding 2020 and winter 2020/21).		Westmeath population (0.98%). Based on the above, the population within the study area is of local importance for both breeding and winter seasons.	

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
	Common snipe	BoCCI 4: Red list (qualifying criteria: severe decline in breeding population of 50% over short time period and 78% over longer time period); ROI population: 550 wintering individuals (2016/17: (Fitzgerald, Burke, & Lewis, 2021)) and 4,275 breeding pairs (2008: (NPWS, 2022)). The winter population estimate is likely to be a massive underestimate due to the winter I-WeBS survey methodology, which is notoriously poor at detecting this cryptic species. Consequently, we have assumed that the true winter population is likely to be the same as the breeding population i.e. 8,550 individuals; Estimated County Westmeath population: 257 individuals. Lough Glore pNHA population: peak count of 0 individuals from last five years (2016/17 to 2020/21; IWeBS); Baseline surveys: Flight activity surveys: recorded as a primary target species with a peak count 6 birds	County / Regional	Red-listed, so protected as part of Westmeath County Council's and Meath County Council's policy on natural heritage (paragraph 12.10 and objective 35, respectively) and by non-statutory designated site, Lough Glore pNHA. Flight activity was generally low throughout the study period. The winter season peak count (N=6) is not significant within the context of the ROI (0.07%) but is for County Westmeath population (2.33%). The breeding season peak count (N=4) is not significant within the context of the ROI (0.05%) but it is for the County Westmeath population (1.56%). Likely one breeding pair present, but based on the most recent surveys, is c. 875	Y

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
		(winter 2019/21), 3 birds (winter 2020/21) and 3 birds (breeding 2021). Breeding walkover surveys: drumming indicating probable breeding (c. 360 m NW of turbine T1) in 2020. There was a probable snipe territory c. 875 m SE of turbine T4 in 2021. Winter walkover surveys: peak count 1 bird (winter 2019/20 and winter 2020/21). Wildfowl distribution surveys: peak count 3 (winter 2019/20), 6 (winter 2020/21) and 4 (breeding 2021).		m from the nearest source of disturbance, which is greater than 400 m, which is the minimum separation distance required to avoid disturbance (Pearce-Higgins et al., 2009). Based on the above, the population within the study area is of county / regional importance for both breeding and winter seasons.	
	Eurasian curlew	BoCCI 4: Red list (qualifying criteria: global conservation concern; severe decline in breeding population of 86% and 98% over shorter and longer time periods, respectively; severe decline in non-breeding population of 65% over longer time period; severe decline in breeding range of 73% and 78% over longer and shorter time periods, respectively); ROI population: 14,994 wintering individuals (2016/17: (Fitzgerald, Burke, & Lewis, 2021)) and 98 breeding pairs (2008: (NPWS, 2022));	County / Regional (winter only)	Red-listed, so protected as part of Westmeath County Council's and Meath County Council's policy on natural heritage (paragraph 12.10 and objective 35, respectively) and by non-statutory designated site, Lough Glore pNHA. Flight activity was very low throughout the study period and this species was recorded in the winter only.	Y

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
		County Westmeath population: 34 (IWeBS) – 450 wintering individuals (estimated) and 3 breeding pairs (estimated); Lough Glore pNHA population: peak count of 0 individuals from last five years (2016/17 to 2020/21; IWeBS); Baseline surveys: Flight activity surveys: recorded as a primary target species with a peak count of 19 birds (winter 2019/20) and 1 bird (winter 2020/21).		The winter season peak count (N=19) is not significant within the context of the ROI (0.13%) but is for County Westmeath population (4.2 – 55.88%), regardless of whether the county population is estimated or taken from IWeBS counts. Based on the above, the population within the study area is of county / regional importance for the winter season only (not recorded in breeding season).	
	Eurasian teal	BoCCI 4: Amber list (qualifying criteria: moderate decline in breeding range of 46% over longer time period); ROI population: 23,671 wintering individuals (2016/17: (Fitzgerald, Burke, & Lewis, 2021)) and 531 breeding pairs (2008: (NPWS, 2022)); County Westmeath population: 116 (IWeBS) – 710 (estimated) wintering individuals and 16 breeding pairs (estimated);	County / Regional	Amber-listed, so protected as part of Westmeath County Council's and Meath County Council's policy on natural heritage (paragraph 12.10 and objective 35, respectively) and by non-statutory designated site, Lough Glore pNHA. Flight activity was very low throughout the study period and this species was recorded in the winter only.	Yes

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
		Lough Glore pNHA population: peak count of 2 individuals from last five years (2016/17 to 2020/21; IWeBS); Baseline surveys: Flight activity surveys: recorded as a primary target with a peak count of 33 individuals (winter 2019/20). Recorded as secondary target with a peak count of 16 individuals (winter 2020/21). Winter walkover surveys: peak count of 37 individuals (winter 2019/20) and 35 individuals (winter 2020/21). Wildfowl distribution surveys: peak count of 50 individuals (winter 2019/20), 48 individuals (winter 2020/21) and 4 individuals (breeding 2021). Associated with loughs at edge of 500 m survey area. Breeding walkover surveys: peak count of 1 bird (breeding 2021).		The winter season peak count (N=50) is not significant within the context of the ROI (0.21%) but is for County Westmeath population (7.04 – 43.10%), regardless of whether the county population is estimated or taken from IWeBS counts. The same is true for the breeding population (N=1) i.e. not significant for the ROI population (0.09%) but significant for the County Westmeath population (3.1%). Based on the above, the population within the study area is of county / regional importance for both breeding and winter seasons.	
	Eurasian woodcock	BoCCI 4: Red list (qualifying criteria: severe decline in breeding range of 73% over longer time period);	County / Regional (breeding)	Red-listed, so protected as part of Westmeath County Council's and Meath County Council's policy on natural	Y

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
		ROI population: no reliable estimates are available (Fitzgerald, Burke, & Lewis, 2021; Lewis, et al., 2019; NPWS, Annex II: Bird species' status and trends reporting format for the period 2008-2012, 2022). This is because historically no national woodcock survey has been undertaken in Ireland and the crepuscular behaviour of this species did not lead to robust population estimates from other surveys. A 2021 woodcock survey has been now undertaken but no population results have yet been published; County Westmeath population: no reliable estimates are available; Baseline surveys: Flight activity surveys: recorded as primary target with a peak count of 2 birds (winter 2019/20) and 1 bird (breeding season 2022). Breeding woodcock surveys: recorded in 2019 displaying at a location c. 340 m NE from turbine T4, and c. 230 m SW and c. 290 m NE from turbines T5 and T7, respectively (two possible territories). In 2020, one confirmed breeding areas was identified for a minimum of one pair located c. 430 m west of	Local (Winter)	heritage (paragraph 12.10 and objective 35, respectively). Flight activity was at a very low level throughout the study period. It is difficult to assess the value of the winter and breeding season peak counts (N=1 and N=4, respectively) in the context of the ROI and County Westmeath population, as there are currently no reliable woodcock population estimates for Ireland. Possibly at least two breeding pairs are present, with one territory 0 m from turbine T3 (Northern Cluster) and the other c. 200 m from turbine T5 (Southern Cluster). Based on the above, the population within the study area is of county / regional importance for the breeding season as a precaution, but of	

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
		turbines T4 and T5. In 2021, there were two probable territories recorded c. 200 m NW of turbine T5 and 0 m from turbine T3 (minimum two pairs). Winter walkover surveys: peak count of 1 individually (winter 2019/20).		local importance for the non-breeding season	
	European golden plover	Annex I Birds Directive; BoCCI 4: Red list (qualifying criteria: severe decline in breeding population of 84% over longer time period); ROI population: 70,726 wintering individuals (2016/17; (Fitzgerald, Burke, & Lewis, 2021)) and 134 – 156 pairs (2002-2004; (NPWS, 2022)); County Westmeath population: 205 (IWeBS; likely an underestimate) – 2,122 (estimated) wintering individuals and 4 breeding pairs; Baseline surveys: Flight activity surveys: recorded as primary target with a peak count of 4 individuals (breeding 2019), 800 individuals (winter 2019/20), and 240 individuals (winter 2020/21).	National (non-breeding)	Afforded protection under Birds Directive; Red-listed, so protected as part of Westmeath County Council's and Meath County Council's policy on natural heritage (paragraph 12.10 and objective 35, respectively). Flight activity was focused almost entirely on the winter season, with one observation made in late August 2019 that was likely of birds on passage. Winter flight activity was high, with moderate to large flocks recorded. The peak winter count (N=800) is significant within the context of the ROI wintering population (1.13%)	Y

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
		Wildfowl distribution surveys: peak count of 65 individuals (winter 2019/20) and 89 individuals (winter 2020/21). Winter walkover surveys: peak count of 85 individuals (winter 2020/21).		and, the peak breeding count (N=4) is significant in the context of the ROI breeding population (1.49%). Note that the breeding season observations were suspected to be non-breeding birds arriving early to wintering grounds and so in reality, no birds from the breeding population were in the area. Based on above, the population within the study area is of national importance for the wintering season only.	
	Great cormorant	BoCCI 4: Amber list (qualifying criteria: localised breeder with >50% breeding population in 10 or fewer sites); ROI population; 2,987 wintering individuals (2016/17 (Fitzgerald, Burke, & Lewis, 2021)) and 4,366 breeding pairs (2012: (NPWS, 2022)); County Westmeath population: 59 - (IWeBS) 90 (estimated) wintering individuals and 131 breeding pairs (estimated);	County / Regional (Winter) Local (Breeding)	Amber-listed, so protected as part of Westmeath County Council's and Meath County Council's policy on natural heritage (paragraph 12.10 and objective 35, respectively) and by non-statutory designated site, Lough Ramor pNHA. Flight activity was very low throughout the study period.	Y

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
		Lough Ramor pNHA population: peak count of 0 individuals from last five years (2016/17 to 2020/21; IWeBS); Baseline surveys: Flight activity surveys: recorded as primary species with peak count of 1 individual (winter 2019/20). Recorded as secondary species with a peak count of 2 individuals (winter 2020/21) and 1 individual (breeding 2021). Wildfowl distribution surveys: peak count 1 bird (winter 2019/20) Winter walkover surveys: peak count of 1 bird (winter 2020/21).		The winter season peak count (N=2) is not significant within the context of the ROI (0.07%) but is for County Westmeath population (2.22 - 3.39%), regardless of whether the county population is estimated or taken from IWeBS counts. The breeding season peak count (N=1) is not significant for the ROI population (0.01%) or the County Westmeath population (0.38%). Based on the above, the population within the study area is of county / regional importance for the winter season but of local importance for the breeding season.	
	Hen harrier	Annex I Birds Directive; BoCCI 4: Amber list (qualifying criteria: moderate decline in breeding population of 29% over longer time period);	County / Regional	Afforded protection by Birds Directive; Amber-listed, s so protected as part of Westmeath County Council's and Meath County Council's policy on natural heritage	Y

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
		ROI population: 108 – 157 breeding pairs (Ruddock, et al., 2016) and 219 – 313 resident individuals (NPWS, 2021); County Westmeath population: 7 individuals (resident and wintering seasons; estimated); Baseline surveys: Flight activity surveys: recorded as primary target with a peak count of 1 individual (winter 2019/20 and breeding 2021); Breeding raptor surveys: no hen harrier were recorded during surveys.		(paragraph 12.10 and objective 35, respectively). Flight activity was at a very low level throughout the study period, consisting of two observations of birds commuting through the area (there was no evidence to suggest roosting occurred within 2 km of the Proposed Development). The peak count (N=1 for both seasons) is not significant in the context of the ROI resident population (0.46%) but it is in the context of the County Westmeath population (14.29%). Based on the above, the population within the study area is of county / regional importance.	
	Mallard	BoCCI 4: Amber list (qualifying criteria: moderate decline of winter population of 41% over short time period);	National (winter)	Amber-listed, so protected as part of Westmeath County Council's and Meath County Council's policy on natural	Y

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
		ROI population; 8,098 wintering individuals (2016/17: (Fitzgerald, Burke, & Lewis, 2021)) and 15,400 breeding pairs (2008-2011; (NPWS, 2022)); County Westmeath population: 226 (IWeBS) wintering individuals and 462 breeding pairs (estimated); Baseline surveys: Flight activity surveys: recorded as primary species with peak count 9 individuals (breeding season 2019) and 8 individuals (winter 2019/20) and 8 birds (breeding 2021). Secondary species with peak count of 10 individuals (breeding 2020), 180 individuals (winter 2020/21) Wildfowl distribution surveys: peak count of 7 individuals (winter 2019/20), 20 individuals (breeding 2020), 7 individuals (winter 2020/21) and 6 individuals (breeding 2021). Breeding walkover surveys: peak count of 6 individuals (breeding 2020) and 7 individuals (breeding 2021).	County / Regional (breeding)	heritage (paragraph 12.10 and objective 35, respectively). Flight activity was at a moderate level throughout the study period. The peak winter count (N=180) is significant in the context of the ROI population (2.22%). The peak breeding season count (N=20) is not significant in the context of the ROI population (0.06%), but it is in the context of the County Westmeath population (2.16%). Based on the above, the winter population within the study area is of national importance and the breeding population is of county / regional importance.	

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
		Winter walkover surveys: peak count of 4 individuals (winter 2020/21)			
	Merlin	Annex I Birds Directive; BoCCI 4: Amber list (qualifying criteria: moderate decline in breeding range of 40% over longer time period); ROI population: 11 territorial pairs (Wilson-Parr & O'Brien, 2019) but this is likely to represent a massive underestimate as the Article 12 report (NPWS, 2022) estimates an ROI population of 200 - 400 pairs, so 200 pairs have been assumed here; County Westmeath population: 6 pairs (estimated); Baseline surveys: Flight activity surveys: recorded as primary target with a peak count of 1 individual (winter 2019/20, winter 2020/21); Breeding raptor surveys: no merlin recorded during surveys.	County / Regional (winter)	Afforded protection by Birds Directive; Amber-listed, so protected as part of Westmeath County Council's and Meath County Council's policy on natural heritage (paragraph 12.10 and objective 35, respectively). Flight activity was at a very low level throughout the study period. All flights were recorded in winter, suggesting a few birds moving through the wider area while foraging (there was no evidence to suggest roosting occurred within 2 km of the Proposed Development). The peak winter count (N=1) is not significant within the context of the ROI population (0.25%) but is for the County	Y

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
				Westmeath population (8.33%). Based on the above, the winter population within the study area is of county / regional importance.	
	Mute swan	BoCCI 4: Red list (qualifying criteria: Irish population represents 100% of European population in non-breeding season); ROI population: 3,839 wintering individuals (2016/17: (Fitzgerald, Burke, & Lewis, 2021)) and 7,120 breeding individuals (2008-2011; (NPWS, 2022)); County Westmeath population: 347 wintering individuals (IWeBS) and 214 breeding individuals (estimated); Baseline surveys: Flight activity surveys: recorded as secondary target with a peak count of 3 individuals (winter 2020/21). Wildfowl distribution surveys: peak count of 3 individuals (breeding 2019) and 2 individuals (winter 2020/21).	County / Regional (breeding) Local (winter)	Amber-listed, so protected as part of Westmeath County Council's and Meath County Council's policy on natural heritage (paragraph 12.10 and objective 35, respectively). Flight activity was at a low level throughout the study period. The peak winter and breeding count (N=3) is not significant within the context of the ROI population (0.08% for winter and 0.04% for breeding). The winter peak count is not significant for the County Westmeath winter population (0.86%), but it is for the County Westmeath breeding population (1.40%).	Y

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
		Winter walkover surveys: peak count of 2 individuals (winter 2020/21).		Based on the above, the breeding population within the study area is of county / regional importance and the winter population is of local importance.	
	Northern lapwing	BoCCI 4: Red list (qualifying criteria: of global conservation concern; severe decline in breeding population of 74% over short time period and 95% over longer time period; severe decline in winter population of 67% over short time period and 58% over longer time period); ROI: 42,514 wintering individuals (2016/17: (Fitzgerald, Burke, & Lewis, 2021)) and 2,000 breeding pairs (2008: (NPWS, 2022)); County Westmeath population: 461 (IWeBS) wintering individuals and 60 breeding pairs (estimated); Lough Glore pNHA population: peak count of 3 individuals from last five years (2016/17 to 2020/21; IWeBS); Baseline surveys:	County / Regional	Red-listed, so protected as part of Westmeath County Council's and Meath County Council's policy on natural heritage (paragraph 12.10 and objective 35, respectively) and by non-statutory designated site, Lough Glore pNHA. Flight activity was generally low throughout the study period. The winter peak count (N=55) is not significant within the context of the ROI population (0.13%) but it is for the County Westmeath population (11.93%). The same is true for the breeding season peak count	Y

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
		Flight activity surveys: recorded as primary target with a peak count of 18 individuals (winter 2019/20), 2 individuals (breeding 2020), 40 individuals (winter 2020/21) and 1 individual (breeding 2021). Breeding walkover surveys: peak count 2 birds (breeding 2020) with confirmed breeding recorded (adult lapwing feeding a fledged chick at a small pond 1.2 km NE from turbine T4). Winter walkover surveys: peak count of 55 individuals (winter 2020/21).		(N=2) i.e. not significant in the context of the ROI population (0.05%) but significant for the County Westmeath population (1.67%). Likely one breeding pair present, but based on the most recent surveys, is c. 1.2 km from the nearest source of disturbance, which is far greater than 108 m, which is the minimum separation distance required to avoid disturbance (Hötker et al., 2006). Based on the above, the winter and breeding populations within the study area are of county / regional importance.	
	Peregrine falcon	Annex I Birds Directive: BoCCI 4: Green list; ROI population: 89 territorial pairs (Wilson-Parr & O'Brien, 2019) but this is likely to represent a massive underestimate as the	County / Regional	Afforded protection by Birds Directive. Flight activity was low throughout the study period.	Y

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
		Article 12 report (NPWS, 2022) estimates an ROI population of 515 pairs, so this has been assumed here; County Westmeath population: 16 pairs; Baseline surveys: Flight activity surveys: recorded as primary target with peak count of 1 individual (winter 2019/20), 1 individual (winter 2020/21) and 1 individual (breeding 2021); Breeding raptors surveys: no breeding birds were recorded. Winter walkover surveys: peak count 1 individual (winter 2020/21). Wildfowl distribution survey: peak count 1 (winter 2020/21 and breeding 2021).		The winter and breeding peak counts (N=1) are not significant within the context of the ROI population (0.10%) but it is for the County Westmeath population (3.13%). Based on the above, the winter and breeding populations within the study area are of county / regional importance.	
	Whooper swan	Annex I Birds Directive; BoCCI 4: Amber list (qualifying criteria: rare breeder; localized non-breeding population; Irish population represents 45% of European non-breeding population);	County / Regional (winter)	Afforded protection by Birds Directive; Amber-listed, so protected as part of Westmeath County Council's and Meath County Council's policy on natural heritage (paragraph 12.10 and objective 35, respectively).	Y

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
		ROI population: 14,467 wintering individuals (Burke et al., 2021); County Westmeath population: 328 wintering individuals (IWeBS); Baseline surveys: Flight activity surveys: recorded as primary target with a peak count of 28 individuals (winter 2019/20) and 11 individuals (winter 2020/21). Winter walkover surveys: peak count 7 individuals (winter 2020/21)		Flight activity was generally low throughout the study period. The peak winter count (N=28) is not significant within the context of the ROI population (0.19%) but it is within the context of the County Westmeath population (8.54%). Based on the above, the winter populations within the study area are of county / regional importance.	
	Yellowhammer	BoCCI 4: Red list (qualifying criteria: severe decline in non-breeding population of >50% over longer time period); ROI population: 217,252 individuals (2006-2016: (Lewis, et al., 2019)); County Westmeath population: 6,518 individuals (estimated); Baseline surveys:	Local	Red-listed, so protected as part of Westmeath County Council's and Meath County Council's policy on natural heritage (paragraph 12.10 and objective 35, respectively). The breeding season peak count (N=4) is not significant within the context of the ROI (<0.01%) or County	Y

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
		Breeding walkover surveys: peak count 1 individual (breeding 2019), 2 individuals (breeding 2020) and 2 individuals (breeding 2021). Breeding raptor surveys: recorded as incidental with peak count of 4 (breeding 2021). Breeding woodcock surveys: recorded as incidental with peak count of 2 (breeding 2021).		Westmeath (0.06%) populations. Based on the above, the populations within the study area are of local importance.	
	Eurasian coot	BoCCI 4: Amber list (qualifying criteria: unfavorable conservation status in Europe, although global population is concentrated outside Europe; moderate decline in non-breeding population of 35% over shorter time period; moderate decline in breeding range of 36% over longer time period; localized non-breeding populations); ROI population: 9,368 wintering individuals (2016/17: (Fitzgerald, Burke, & Lewis, 2021)) and 3,462 breeding pairs (2008: (NPWS, 2022));	Local (breeding)	Amber-listed, so protected as part of Westmeath County Council's and Meath County Council's policy on natural heritage (paragraph 12.10 and objective 35, respectively), and by non-statutory designated site, Lough Glore pNHA. There was no flight activity recorded throughout the study period and no coot were recorded in the winter by any surveys.	Y

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
		County Westmeath population: 3,635 individuals (IWeBS) and 104 breeding pairs (estimated); Baseline surveys: Breeding walkover surveys: confirmed breeding c. 700 m NE of turbine T3 (breeding 2021).		A single adult was recorded calling with chick begging calls also recorded, confirming one breeding territory and the presence of two adults. The peak breeding season count (N=2) is not significant in the context of the ROI (0.03%) or County Westmeath population (0.96%). Based on the above, the breeding populations within the study area are of local importance.	
	Shelduck	BoCCI 4: Amber list (qualifying criteria: moderate decline in non-breeding population of 30% over shorter time period; localized non-breeding populations); ROI population: 6,410 wintering individuals (2016/17: (Fitzgerald, Burke, & Lewis, 2021)) and 958 breeding pairs (2008: (NPWS, 2022));	Local (winter)	Amber-listed, so protected as part of Westmeath County Council's and Meath County Council's policy on natural heritage (paragraph 12.10 and objective 35, respectively). There was no flight activity recorded for this species, with a single observation made during a wildfowl distribution survey in the winter.	Y

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
		County Westmeath population: 1 (IWeBS; likely an underestimate) – 192 (estimated) wintering individuals and 29 breeding pairs; Baseline surveys: Wildfowl distribution surveys: peak count of 1 individual (winter 2019/20).		The peak winter count (N=1) is not significant within the context of the ROI (0.02%) or County Westmeath (0.52%) populations. Based on the above, the wintering populations within the study area are of local importance.	
	Eurasian wigeon	BoCCI 4: Amber list (qualifying criteria: moderate decline in non-breeding population of 38% and 44% over shorter and longer time periods, respectively; rare breeder; localized non-breeding populations); ROI population: 41,504 wintering individuals (2016/17: (Fitzgerald, Burke, & Lewis, 2021)); County Westmeath population: 141 (IWeBS) – 1,245 (estimated) wintering individuals; Baseline surveys: Flight activity surveys: recorded as primary species with a peak count of 42 individuals (winter 2019/20).	County / Regional (winter)	Amber-listed, so protected as part of Westmeath County Council's and Meath County Council's policy on natural heritage (paragraph 12.10 and objective 35, respectively). Flight activity was low throughout the study period. This species was recorded in the winter only. Based on the winter peak count (N=45), the population at the study area is not significant in the context of the ROI population (0.11%) but it is in the context of the County	Y

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
		Wildfowl distribution surveys: peak counts of 45 individuals (winter 2019/20)		Westmeath population, regardless of whether the population is based on IWeBS counts (31.91%) or is estimated (3.61%). Based on the above, the wintering populations within the study area are of local importance.	
	Lesser black-backed gull	BoCCI 4: Amber list (qualifying criteria: localised breeder with >50% breeding population in 10 or fewer sites); ROI population; 3,644 wintering individuals (2016/17: (Fitzgerald, Burke, & Lewis, 2021)) and 4,239 breeding pairs (2012: (NPWS, 2022)); County Westmeath population: 6 (IWeBS; likely an underestimate) – 109 (estimated) wintering individuals. The number of breeding birds is estimated to be 170 pairs (estimated); Baseline surveys: Flight activity surveys: recorded as primary species with peak count of 6 individuals	County / Regional	Amber-listed, so protected as part of Westmeath County Council's and Meath County Council's policy on natural heritage (paragraph 12.10 and objective 35, respectively). Flight activity was generally low throughout the study period. Based on the peak winter count (N=10), the population at the study area is not significant in the context of the ROI population (0.27%), but it is in the context of the County Westmeath population, regardless of whether the	Y

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
		(winter season 2019/20). Recorded as secondary species with peak count of 27 individuals (breeding season 2020), 9 individuals (winter 2020/21) and 41 individuals (breeding season 2021). Wildfowl distribution surveys: peak count of 2 individuals (winter 2019/20) and 10 individuals (winter 2020/21). Breeding walkover surveys: peak count of 5 individuals (breeding 2020) and 3 birds (breeding 2021). Winter walkover surveys: peak count of 2 individuals (winter 2020/21). Breeding raptor surveys: recorded as incidental with a peak count of 26 birds (breeding 2020) and 32 birds (breeding 2021).		population is based on IWeBS counts (166.67%) or is estimated (9.17%). The peak breeding season count (N=41) is also not significant in the ROI context (0.48%) but it is in the County Westmeath context (10.06%). Based on the above, the populations within the study area are of county / regional importance.	
	Barn owl	BoCCI 4: Red list (qualifying criteria: severe decline in breeding population of >50% over longer time period); ROI population: 46 territorial pairs (Wilson-Parr & O'Brien, 2019) but this is likely to represent a massive underestimate as the Article 12 report (NPWS, 2022) estimates an	County / Regional	Red-listed, so protected as part of Westmeath County Council's and Meath County Council's policy on natural heritage (paragraph 12.10 and objective 35, respectively).	Y

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
		ROI population of 400 pairs, so this has been assumed here; County Westmeath population: 12 pairs (estimated); Baseline surveys: Barn owl was heard and seen during a bat survey in 2022 near Rosmead House (c. 360 SW of turbine T8), with feathers nearby suggesting that this species nests or roosts in the ruins.		If a pair of barn owl nest in the ruins of Rosmead House (N=2), the population at the study area is not significant in the context of the ROI population (0.25%) but it is in the context of the County Westmeath population (8.33%). Based on the above, the populations within the study area are of county / regional importance.	
	Meadow pipit	BoCCI 4: Red list (qualifying criteria: species of global conservation concern); ROI population: 1,351,995 individuals (2011-2016: (Lewis, et al., 2019)); County Westmeath population: 40,560 individuals; Baseline surveys: Winter walkover surveys: peak count of 10 individuals (winter 2019/20).	Local	Red-listed, so protected as part of Westmeath County Council's and Meath County Council's policy on natural heritage (paragraph 12.10 and objective 35, respectively). Based on the winter peak count (N=10), the population at the study area is not significant in the context of the ROI population (<0.01%) or the County Westmeath population (0.02%).	Y

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
		Breeding walkover surveys: peak count of 3 individuals (breeding 2020) and 4 individuals (breeding 2021). Wildfowl distribution surveys: recorded as incidental with peak count of 1 individual (breeding 2021). Breeding raptor surveys: recorded as incidental with peak count of 6 individual (breeding 2021).		The same is true for the breeding peak count (N=6) i.e. it is not significant in the context of the ROI population (<0.01%) or the County Westmeath population (0.01%). Based on the above, the populations within the study area are of local importance.	
	Common gull	BoCCI 4: Amber list (qualifying criteria: moderate decline in breeding population of 25% over the longer time period); ROI population: 8,032 wintering individuals (2016/17: (Fitzgerald, Burke, & Lewis, 2021)) and 1,927 breeding pairs (2012: (NPWS, 2022); County Westmeath population: 241 wintering individuals (estimated) and 56 breeding pairs (estimated); Baseline surveys: Recorded as incidental with peak count of 2 individuals (breeding 2019).	County / Regional (breeding)	Amber-listed, so protected as part of Westmeath County Council's and Meath County Council's policy on natural heritage (paragraph 12.10 and objective 35, respectively). This species was recorded in the breeding season only. Based on the breeding season peak count (N=2), the population at the study area is not significant in the context of the ROI population (0.05%) but it is for the County	Y

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
				Westmeath population (1.79%). On this basis, the population is of county / regional importance for the breeding population only.	
	Grey wagtail	BoCCI 4: Red list (qualifying criteria: severe decline in breeding population of 50% over shorter time period); ROI population: 50,768 individuals (2011-2016: (Lewis, et al., 2019)); County Westmeath population: 1,523 individuals (estimated); Baseline surveys: Recorded as incidental with peak count of 2 individuals (breeding 2019, winter 2020/21 and breeding 2021). Thought to be possibly breeding.	Local	Red-listed, so protected as part of Westmeath County Council's and Meath County Council's policy on natural heritage (paragraph 12.10 and objective 35, respectively). Based on the breeding season peak count (N=2), the resident population at the study area is not significant in the context of the ROI population (<0.01%) or for the County Westmeath population (0.12%). On this basis, the population is of local importance for the resident population only.	Y
	Goldcrest	BoCCI 4: Amber list (qualifying criteria: species of European conservation concern	Local	Amber-listed, so protected as part of Westmeath County Council's and Meath County	Y

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
		where the global population is concentrated inside of Europe); ROI population: 601,806 individuals (2011-2016: (Lewis, et al., 2019)); County Westmeath population: 18,054 individuals (estimated); Baseline surveys: Recorded as incidental with peak count of 1 individual (breeding 2019) with no count data recorded for other seasons when it was observed (breeding 2020, winter 2020/21 and breeding 2021).		Council's policy on natural heritage (paragraph 12.10 and objective 35, respectively). Based on the breeding season peak count (N=1), the resident population at the study area is not significant in the context of the ROI population (<0.01%) or for the County Westmeath population (<0.01%). On this basis, the population is of local importance for the resident population only.	
	Greenfinch	BoCCI 4: Amber list (qualifying criteria: moderate decline in breeding population of 48% over the shorter time period); ROI population: 536,730 individuals (2011-2016: (Lewis, et al., 2019)); County Westmeath population: 40,560 individuals (estimated); Baseline surveys:	Local	Amber-listed, so protected as part of Westmeath County Council's and Meath County Council's policy on natural heritage (paragraph 12.10 and objective 35, respectively). Based on the breeding season peak count (N=2), the resident population at the study area is not significant in the context of the ROI population (<0.01%)	Y

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
		Recorded as incidental with peak count of 2 individuals (breeding 2019) with no count data recorded for other seasons when it was observed (breeding 2020, winter 2020/21 and breeding 2021).		or for the County Westmeath population (0.01%). On this basis, the population is of local importance for the resident population only.	
	House martin	BoCCI 4: Amber list (qualifying criteria: species of European conservation concern where the global population is concentrated inside of Europe); ROI population: 606,043 individuals (2011-2016: (Lewis, et al., 2019)); County Westmeath population: 18,181 individuals (estimated); Baseline surveys: Recorded as incidental with peak count of 25 individuals (breeding 2019) with no count data recorded for other seasons when it was observed (breeding 2020 and breeding 2021).	Local	Amber-listed, so protected as part of Westmeath County Council's and Meath County Council's policy on natural heritage (paragraph 12.10 and objective 35, respectively). Based on the breeding season peak count (N=25), the resident population at the study area is not significant in the context of the ROI population (<0.01%) or for the County Westmeath population (0.14%). On this basis, the population is of local importance for the resident population only.	Y
	House sparrow	BoCCI 4: Amber list (qualifying criteria: species of European conservation concern	Local	Amber-listed, so protected as part of Westmeath County Council's and Meath County	Y

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
		where the global population is concentrated outside of Europe); ROI population: 2,266,646 individuals (2011-2016: (Lewis, et al., 2019)); County Westmeath population: 40,560 individuals (estimated); Baseline surveys: Recorded as incidental with peak count of 2 individuals (breeding 2019) with no count data recorded for other seasons when it was observed (breeding 2020, winter 2020/21 and breeding 2021).		Council's policy on natural heritage (paragraph 12.10 and objective 35, respectively). Based on the breeding season peak count (N=2), the resident population at the study area is not significant in the context of the ROI population (<0.01%) or for the County Westmeath population (<0.01%). On this basis, the population is of local importance for the resident population only.	
	Linnet	BoCCI 4: Amber list (qualifying criteria: species of European conservation concern where the global population is concentrated inside of Europe); ROI population: 459,892 individuals (2011-2016: (Lewis, et al., 2019)); County Westmeath population: 40,560 individuals (estimated); Baseline surveys:	County / Regional	Amber-listed, so protected as part of Westmeath County Council's and Meath County Council's policy on natural heritage (paragraph 12.10 and objective 35, respectively). Based on the winter season peak count (N=300), the resident population at the study area is not significant in the context of the ROI population (0.07%) but it is for	Y

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
		Recorded as incidental with peak count of 4 individuals (breeding 2019), 25 individuals (winter 2019/21), 300 individuals (breeding 2020) and 1 individual (winter 2020/21).		the County Westmeath population (2.17%). On this basis, the population is of county / regional importance for the resident population only.	
	Redwing	BoCCI 4: Red list (qualifying criteria: species of global conservation concern); ROI population: no reliable estimates are available (2011-2016: (Lewis, et al., 2019)); County Westmeath population: no reliable estimates are available; Baseline surveys: Recorded as incidental with no count data recorded (winter 2019/20 and winter 2020/21).	Local (wintering)	Red-listed, so protected as part of Westmeath County Council's and Meath County Council's policy on natural heritage (paragraph 12.10 and objective 35, respectively). It is difficult to assess the value of the winter population in the context of the ROI and County Westmeath population, as there are currently no reliable redwing population estimates for Ireland. This species favours open fields in lowland areas. While some of the Proposed Development contains these habitats, it is unlikely they	Y

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
				represent important winter habitat for this species. Based on the above, the population within the study area is of local importance for the winter season as a precaution.	
	Sand martin	BoCCI 4: Amber list (qualifying criteria: species of European conservation concern where the global population is concentrated outside of Europe); ROI population: 460,223 individuals (2011-2016: (Lewis, et al., 2019)); County Westmeath population: 13,807 individuals (estimated); Baseline surveys: Recorded as incidental with peak count of 25 individuals (breeding 2019), 20 individuals (breeding 2020) and 21 individuals (breeding 2021). A breeding colony was recorded at O'Reilly Concrete Clonmellon quarry. Also, recorded in winter 2020/21 with a peak count of 2 individuals.	Local	Amber-listed, so protected as part of Westmeath County Council's and Meath County Council's policy on natural heritage (paragraph 12.10 and objective 35, respectively). Based on the breeding season peak count (N=5), the resident population at the study area is not significant in the context of the ROI population (<0.01%) or for the County Westmeath population (0.18%). On this basis, the population is of local importance for the resident population only.	Y

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
	Skylark	BoCCI 4: Amber list (qualifying criteria: species of European conservation concern where the global population is concentrated outside of Europe); ROI population: 1,351,995 individuals (2011-2016: (Lewis, et al., 2019)); County Westmeath population: 40,560 individuals (estimated); Baseline surveys: Recorded as incidental with peak count of 1 individual (breeding 2019) and a possibly breeding pair (breeding 2021). Recorded in breeding 2020 and winter 2020/21 but no counts were made.	Local	Amber-listed, so protected as part of Westmeath County Council's and Meath County Council's policy on natural heritage (paragraph 12.10 and objective 35, respectively). Based on the breeding season peak count (N=2), the resident population at the study area is not significant in the context of the ROI population (<0.01%) or for the County Westmeath population (<0.01%). On this basis, the population is of local importance for the resident population only.	Y
	Starling	BoCCI 4: Amber list (qualifying criteria: species of European conservation concern where the global population is concentrated outside of Europe); ROI population: 2,066,904 individuals (2011-2016: (Lewis, et al., 2019)); County Westmeath population: 62,007 individuals (estimated);	Local	Amber-listed, so protected as part of Westmeath County Council's and Meath County Council's policy on natural heritage (paragraph 12.10 and objective 35, respectively). Based on the winter season peak count (N=400), the resident population at the	Y

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
		Baseline surveys: Recorded as incidental with peak count of 60 individuals (breeding 2019) and 400 individuals (winter 2019/20), with no counts made for breeding 2020, winter 2020/21 and breeding 2021 seasons, despite the species being present.		study area is not significant in the context of the ROI population (0.02%) or for the County Westmeath population (0.65%). On this basis, the population is of local importance for the resident population only.	
	Swallow	BoCCI 4: Amber list (qualifying criteria: species of European conservation concern where the global population is concentrated outside of Europe); ROI population: 4,936,488 individuals (2011-2016: (Lewis, et al., 2019)); County Westmeath population: 14,8095 individuals (estimated); Baseline surveys: Recorded as incidental with peak count of 35 individuals (breeding 2019) with no count data recorded for other seasons when it was observed (breeding 2020 and breeding 2021).	Local	Amber-listed, so protected as part of Westmeath County Council's and Meath County Council's policy on natural heritage (paragraph 12.10 and objective 35, respectively). Based on the breeding season peak count (N=35), the resident population at the study area is not significant in the context of the ROI population (<0.01%) or for the County Westmeath population (0.02%). On this basis, the population is of local importance for the resident population only.	Y

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
	Swift	BoCCI 4: Red list (qualifying criteria: severe decline in breeding population of 56% over shorter time period); ROI population: 51,728 individuals (2011-2016: (Lewis, et al., 2019)); County Westmeath population: 1,552 individuals (estimated); Baseline surveys: Recorded as incidental with peak count of 7 individuals (breeding 2021) with no count data recorded for other seasons when it was observed (breeding 2021).	Local	Red-listed, so protected as part of Westmeath County Council's and Meath County Council's policy on natural heritage (paragraph 12.10 and objective 35, respectively). Based on the breeding season peak count (N=7), the resident population at the study area is not significant in the context of the ROI population (0.01%) or for the County Westmeath population (0.45%). On this basis, the population is of local importance for the resident population only.	Y
	Willow warbler	BoCCI 4: Amber list (qualifying criteria: species of European conservation concern where the global population is concentrated outside of Europe); ROI population: 1,721,483 individuals (2011-2016: (Lewis, et al., 2019)); County Westmeath population: 51,645 individuals (estimated);	Local	Amber-listed, so protected as part of Westmeath County Council's and Meath County Council's policy on natural heritage (paragraph 12.10 and objective 35, respectively). Based on the breeding season peak count (N=6), the resident population at the study area is	Y

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
		Baseline surveys: Recorded as incidental with peak count of 6 individuals (breeding 2019) with no count data recorded for other seasons when it was observed (breeding 2021).		not significant in the context of the ROI population (<0.01%) or for the County Westmeath population (0.01%). On this basis, the population is of local importance for the resident population only.	
	All other bird species	Green-listed, so detailed population level data not presented.	Site	Green-listed and/or not listed under Nelson et al. (2019), so not requiring further assessment.	N
Terrestrial Mammals (Excluding Bats)	Badger	Wildlife Act 1976 (as amended); Red list: Least Concern; ROI population: 84,000 individuals (Marnell, Looney, & Lawton, 2019); County Westmeath population: 2,520 individuals (estimated); Baseline surveys: no badger setts were recorded within 100 m of any proposed infrastructure, but at least three, large active badger sett complexes were recorded in the Southern Cluster. A latrine was recorded NW of turbine T7 along a forestry track.	Local	Afforded legal protection under Wildlife Act 1976 (as amended). No badger setts were recorded near any proposed infrastructure, but the setts were active (fresh bedding and excavations), which is further reinforced by the presence of snuffle pits and a latrine. Badger activity therefore appears to be relatively high in the Southern Cluster and assuming a typical badger family size of 3.8 per	Y

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
				sett (Byrne et al., 2012), there are approximately 11.4 badgers present, which is not significant in the context of the ROI population (0.01%) but is in the context of the County Westmeath population (4.5%). This species has the best possible conservation status i.e. it is common and widespread. Based on the above, the population within the study area is of local importance.	
	Pine marten	Annex V Habitats Directive; Wildlife Act (1976 and as amended, 2000); Red list: Least Concern; ROI population: 3,000 individuals (Marnell, Looney, & Lawton, 2019) but thought to be significantly underestimated; County Westmeath population: 90 individuals (but likely underestimated);	County / Regional	Afforded legal protection under Habitats Directive and Wildlife Act 1976 (as amended). No pine marten dens were recorded near any proposed infrastructure; however, this species is present within the study area and uses the woodland habitats, which are widespread and common. This species has the best	Y

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
		Baseline surveys: no dens were recorded within 100 m of any proposed infrastructure. Scats were recorded along a forestry track and on a mature tree in the Southern Cluster. It is likely that they forage within the woodland habitats, hunting red squirrels and other prey.		possible conservation status i.e. is common and widespread. Assuming a local population of two individuals (based on the number of scats recorded), then the population is not of national importance (0.07%); however, it is likely of regional / county importance (22.2%). Based on the above, the population within the study area is of regional / county importance.	
	Red squirrel	Wildlife Act (1976 and as amended, 2000); Red list: Least Concern; ROI population: 40,000 individuals (Marnell, Looney, & Lawton, 2019); County Westmeath population: 1,200 individuals; Baseline surveys: no dreys were recorded within 100 m of proposed infrastructure. Split	Local	Afforded legal protection under Wildlife Act 1976 (as amended). No red squirrel dreys were recorded near any proposed infrastructure; red squirrel signs were recorded in the Northern Cluster, so this species does use the woodland habitats within the study area. These habitats are widespread and common in	Y

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
		hazel nuts were recorded in the Northern Cluster in forestry near turbine T5.		the wider area. This species has the best possible conservation status i.e. is common and widespread. Based on the above, the population within the study area is of local importance.	
	Eurasian otter	Annex II and IV Habitats Directive; Wildlife Act (1976 and as amended, 2000); Red list: Least Concern; ROI population: 16,000-22,000 individuals (Marnell, Looney, & Lawton, 2019); County Westmeath population: 480–660 individuals (estimated); River Boyne and River Blackwater cSAC population: no information available; Royal Canal pNHA population: no information available; Baseline surveys: Otter spraint sites were recorded at aquatic survey site B6 on the Stonyford River, which bounds the Southern	County / Regional importance (population near Proposed Development – no downstream populations recorded)	Afforded legal protection under Habitats Directive and Wildlife Act (976 (as amended). Otters are a QI species for the River Blackwater and River Boyne cSAC and it is likely that in-situ populations are present at D'arcys Crossroads and the Stonyford River. If the number of aquatic survey sites with otter signs represents a likely estimate of the population at the Proposed Development (N=3), then this population is not significant in the context of the ROI population (0.02%) but it is in the context of the County	Y

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
		Cluster (there is no downstream connectivity between the Proposed Development and site B6). Spraints were also recorded at survey sites B3 and B5 on D'arcy's Crossroads Stream, with no downstream connectivity to the Proposed Development. Those three aquatic survey sites are all at least 1 km from the Proposed Development (direct-line distance). No breeding (holts) areas were identified in the 150 m vicinity of any of the survey sites. No otter holts, couches or latrines were recorded near any proposed infrastructure.		Westmeath population (6.25%). No otters were recorded at any downstream survey sites, so no estimates of downstream populations are possible.	
	Irish hare	Wildlife Act (1976 and as amended, 2000); Red list: Least Concern; ROI population: 223,000 individuals (Marnell, Looney, & Lawton, 2019); County Westmeath population: 6,690 individuals (estimated); Baseline surveys: none recorded but desktop records and suitable habitat present.	Local	Afforded legal protection under Wildlife Act 1976 (as amended). No hares were recorded during surveys. Suitable foraging and breeding habitat is present within the study area in the form of wetter areas of grassland with rushes and scrub present. Much of this habitat is also present within the wider landscape. This species has the best possible conservation status	Y

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
				i.e. is common and widespread. Based on the above, the population within the study area is of local importance.	
	West European hedgehog	Wildlife Act (1976 and as amended, 2000); Red list: Least Concern; ROI population: there is no population estimate available (Marnell, Looney, & Lawton, 2019); County Westmeath population: no estimate available; Baseline surveys: none recorded but desktop records and suitable habitat present.	Local	Afforded legal protection under Wildlife Act 1976 (as amended). While no hedgehogs were recorded during surveys, there are desktop records available and suitable habitat (e.g. hedgerows and woodland edges) is present within the study area. These habitats are widespread and common in the wider area. This species has the best possible conservation status i.e. is common and widespread. Based on the above, the population within the study area is of local importance.	Y
	All other mammal species	Not protected under Wildlife Act (1976 and as amended 2000)	Site	Afforded no legal protection and/or have best possible	N

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
				conservation status – widespread and common, so do not require further assessment	
Bats	Common pipistrelle	Annex IV Habitats Directive; Wildlife Act (1976 and as amended, 2000); Red list: Least Concern; ROI population: 1 – 2 million individuals (Marnell, Looney, & Lawton, 2019)); County Westmeath population: 30,000 – 40,000 individuals (estimated); Baseline surveys: recorded during transect surveys at both turbine clusters during every season (peak count of 2 and 36 calls at transects 1 and 2 in spring, respectively). Tree line, forest edge and field edge habitats are used for foraging. Farm buildings and ruins are used for foraging and commuting. Recorded by ground-level detectors across all seasons and turbine locations. The mean bat passes/night across all turbine locations was 63, 274 and 62 for spring, summer, and autumn, respectively.	Local	Afforded legal protection under Habitats Directive and Wildlife Act 1976 (as amended. Moderate levels of activity within the study area and evidence that linear habitats were used for foraging and commuting. No roosts are present within the works footprint. Based on the above, the population within the study area is of local importance.	Y

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
		The species was also recorded by the at-height detector in June and August 2023. No roosts were recorded for this species.			
	Soprano pipistrelle	Annex IV Habitats Directive; Wildlife Act (1976 and as amended, 2000); Red list: Least Concern; ROI population: 0.54 – 1.2 million individuals (Marnell, Looney, & Lawton, 2019)); County Westmeath population: 16,200 – 36,000 individuals (estimated); Baseline surveys: recorded during transect surveys at both turbine clusters during every season (peak count of 5 and 26 calls at transects 1 and 2 in spring, respectively). Tree line, hedgerows and field edge habitats are used for foraging. Farm buildings and ruins are used for foraging and commuting. Recorded by ground-level detectors across all seasons and turbine locations. The mean bat passes/night across all turbine locations	Local	Afforded legal protection under Habitats Directive and Wildlife Act 1976 (as amended). Moderate levels of activity within the study area and evidence that linear habitats were used for foraging and commuting. Two minor day roosts are present within the wider area. Based on the above, the population within the study area is of local importance.	Y

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
		was 139, 423 and 123 for spring, summer, and autumn, respectively. The species was also recorded by the at-height detector in June and August 2023. Two minor days roosts were recorded but are located at a minimum of c.350 m from the Proposed Development.			
	Leisler's bat	Annex IV Habitats Directive; Wildlife Act (1976 and as amended, 2000); Red list: Least Concern; ROI population: 81,000 – 103,000 individuals (Marnell, Looney, & Lawton, 2019)); County Westmeath population: 2,430 – 3,090 individuals (estimated); Baseline surveys: recorded during transect surveys during spring and summer seasons only (peak count of 7 and 2 calls at transects 1 and 2 in summer, respectively). This species was recorded foraging low in open fields, which is unusual for this typically high-flying species.	Local	Afforded legal protection under Habitats Directive and Wildlife Act 1976 (as amended). Moderate levels of activity within the study area but no evidence species used the linear habitats present for commuting/foraging. High levels of at-height activity compared to other species. No roosts recorded. Based on the above, this species is of local importance.	Y

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
		Recorded by ground-level detectors across all seasons and turbine locations. The mean bat passes/night across all turbine locations was 64, 274 and 12 for spring, summer, and autumn, respectively. The species was also recorded by the at-height detector in June and August 2023 (most-frequently recorded species at-height). No roosts were recorded.			
	Nathusius's pipistrelle	Annex IV Habitats Directive; Wildlife Act (1976 and as amended, 2000); Red list: Least Concern; ROI population: 10,000 – 18,000 individuals (Marnell, Looney, & Lawton, 2019) or 100 x occupied 1 km^2 cells (NPWS, 2019); County Westmeath population: 300 – 540 individuals (estimated) or 3 x occupied 1 km^2 cells (estimated); Baseline surveys: this species was not recorded during transect surveys.	County / Regional	Afforded legal protection under Habitats Directive and Wildlife Act 1976 (as amended). Very low levels of activity within study area. No evidence linear habitats were used for foraging or commuting. No roosts recorded. The number of grid cells species likely present in is reasonably low. Based on the above, the population within the study	Y

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
		Recorded by ground-level detectors for summer and autumn seasons only, and not all turbine locations. The mean bat passes/night across all turbine locations was <1 for summer, and autumn, respectively (no recordings were made in spring). The species was also infrequently recorded by the at-height detector in June and August 2023. No roosts were recorded.		area is of county / regional importance.	
	Brown-long eared bat	Annex IV Habitats Directive; Wildlife Act (1976 and as amended, 2000); Red list: Least Concern; ROI population: 64,000 – 115,000 individuals (Marnell, Looney, & Lawton, 2019); County Westmeath population: 1,920 – 3,450 individuals (estimated); Baseline surveys: not recorded during transect surveys.	Local	Afforded legal protection under Habitats Directive and Wildlife Act 1976 (as amended). Very low levels of activity within the study area and no evidence the habitats represent important foraging or commuting features for this species. Two minor night roosts were present in wider area.	Y

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
		Recorded by ground-level detectors across all seasons and turbine locations. The mean bat passes/night never exceeded 6 across all turbine locations and seasons. The species was also infrequently recorded by the at-height detector in August 2023 only. Two minor night roosts were recorded but are located at a minimum of c.350 m from the Proposed Development.		Based on the above, the population within the study area is of local importance.	
	Daubenton's bat	Annex IV Habitats Directive; Wildlife Act (1976 and as amended, 2000); Red list: Least Concern; ROI population: 81,000 – 103,000 individuals (Marnell, Looney, & Lawton, 2019); County Westmeath population: 2,430 – 3,090 individuals (estimated); Baseline surveys: not recorded during transect surveys. Recorded by ground-level detectors across all seasons and turbine locations. The mean	Local	Afforded legal protection under Habitats Directive and Wildlife Act 1976 (as amended). Very low levels of activity within the study area – no evidence the habitats represent important foraging or commuting features for this species. While there is a suspected maternity roost present within the wider area, this is located c. 350 m from the Proposed Development.	Y

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
		bat passes/night never exceeded 3 across all turbine locations and seasons. The species was not recorded by the at-height detector. One suspected maternity roost was recorded but is located at a minimum of c.350 m from the Proposed Development.		Based on the above, the population within the study area is of local importance.	
	Natterer's bat	Annex IV Habitats Directive; Wildlife Act (1976 and as amended, 2000); Red list: Least Concern; ROI population: no estimates available (Marnell, Looney, & Lawton, 2019); although NPWS has records of 207 x occupied 10 km^2 cells); County Westmeath population: no estimates available; although NPWS has record 7 x occupied 10 km^2 (estimated); Baseline surveys: not recorded during transect surveys. Recorded by ground-level detectors across all seasons but only for some turbine	Local	Afforded legal protection under Habitats Directive and Wildlife Act 1976 (as amended). Very low levels of activity within the study area and no evidence the habitats represent important foraging or commuting features for this species. Some likely night roosts and a suspected maternity roost are present but located in wider area and not near works footprint. Based on the above, the population within the study area is of local importance.	Y

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
		locations. The mean bat passes/night never exceeded 2 across all turbine locations and seasons. The species was recorded by the at-height detector in June 2023 at very low levels. One suspected combined maternity and night roost was recorded, with two other likely night roosts, but all are located at a minimum of c.350 m from the Proposed Development.			
	Whiskered bat	Annex IV Habitats Directive; Wildlife Act (1976 and as amended, 2000); Red list: Least Concern; ROI population: no estimates of numbers available (Marnell, Looney, & Lawton, 2019) but there is an estimate of 185 x occupied 1 km^2 cells (NPWS, 2019); County Westmeath population: 6 x occupied 1 km^2 cells (estimated); Baseline surveys: not recorded during transect surveys.	County / Regional	Afforded legal protection under Habitats Directive and Wildlife Act 1976 (as amended). Very low levels of activity within the study area, with no evidence the habitats represent important foraging or commuting features for this species. No roosts recorded. The number of occupied grid cells is reasonably low. Based on the above, the population within the study area is of county / regional importance.	Y

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
		Recorded by ground-level detectors only for some turbine locations and not consistently between seasons. The mean bat passes/night never exceeded 1 across all turbine locations and seasons. The species was not recorded by the at-height detector. No roosts were recorded.			
Other protected fauna	Common frog	Annex V Habitats Directive; Wildlife Act (1976 and as amended, 2000); Red list: Least Concern; ROI population: no estimates available but thought to be stable or increasing (King, et al., 2011); but there is an estimate of 612 x occupied 10 km^2 cells (NPWS, 2019); County Westmeath population: no estimates available; 11 x occupied 10 km^2 cells (inferred). Baseline surveys: recorded during aquatic surveys in 2022 in a single pond; however, there was some suitability for frogs at the rest	Local	Afforded legal protection under Habitats Directive and Wildlife Act 1976 (as amended). While frogs were only found in a single pond, it is likely damp habitats afford breeding and foraging opportunities for this species throughout the Proposed Development. This species has the best possible conservation status. Based on the above, the population within the study area is of local importance.	Y

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
		of the pond sites and drainage ditches and wet grassland habitats are also suitable for this species.			
	Smooth newt	Wildlife Act (1976 and as amended, 2000); Red list: Least Concern; ROI population: no estimates available but thought to be stable (King, et al., 2011); County Westmeath population: no estimates available; Baseline surveys: recorded in high densities at pond site P7; however, the rest of the sites were of lower suitability or unsuitable for this species. Despite high suitability, no smooth newt eDNA was detected at Newtown Lough.	Local	Afforded legal protection under Wildlife Act 1976 (as amended). While recorded in a single pond site, it is likely suitable foraging and breeding habitat is available within the study area in the form of damp grassland, drainage ditches and ephemeral puddles. Much of this habitat is also available within the wider landscape. This species has the best possible conservation status i.e. it is common and widespread. Based on the above, the population within the study area is of local importance.	Yes
	Marsh fritillary	Annex II Habitats Directive; Annex II Bern Convention;	County / Regional	Afforded legal protection under Habitats Directive, Bern Convention and Wildlife Act 1976 (as amended).	Y

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
		Red list: Vulnerable; ROI population: 248 x occupied 1 km^2 grid squares (NPWS, 2019). County Westmeath population: 7 x occupied 1 km^2 grid squares (estimated). Baseline surveys: recorded in discrete area within Northern Cluster with 59 larval webs present over 2.4 ha c. 190 m SW of turbine T1.		Many larval webs were recorded in a discrete area of breeding habitat. This species has a poor conservation status and has a relatively low number occupied grid squares within Ireland. Based on the above, the population at the study area is of county / regional importance.	
Fisheries and Aquatic Ecology	Atlantic salmon	Annex II and V of Habitats Directive; Red list status: Vulnerable; ROI population: 250,000 individuals (King, et al., 2011) and 25,315 x occupied 1 km^2 cells (NPWS, 2019): County Westmeath population: 750 individuals or 760 x 1 occupied km^2 cells (estimated); River Boyne and River Blackwater cSAC population: no estimates available;	County / Regional (both populations at Proposed Development and downstream)	Afforded legal protection under Habitats Directive; listed as Vulnerable on red-list, so protected as part of Westmeath County Council's and Meath County Council's policy on natural heritage (paragraph 12.10 and objective 35, respectively). This species is a QI for the River Boyne and River Blackwater cSAC. The only sites where this species was present were within the cSAC, so they are part of the cSAC population.	Y

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
		Baseline surveys: recorded in low densities at sites A4, B5, B7 and B9, and at medium densities at site B7. Sites A4 and B9 are downstream of the Proposed Development. Site B6 provides good nursery habitat.		If the number of aquatic survey sites with salmon presence represents a likely estimate of the population at the Proposed Development (N=3), then this salmon population is not significant in the context of the ROI population (0.4%) but it is for the County Westmeath population (42.86%). If the number of aquatic survey sites with salmon presence downstream represents a likely estimate of the downstream population (N=2), then the downstream salmon population is also not significant in the context of the ROI population (0.27%) or the County Westmeath population (28.57%). Based on the above, the Proposed Development population within the study area and the population	

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
				downstream are both of county / regional importance.	
	Brown trout	Red list status: Least Concern; ROI population: no estimates available (King, et al., 2011); County Westmeath population: no estimate available; Baseline surveys: recorded in low densities at sites A4, B3, B4, B5, B6 and B9. Recorded at moderate densities at site B7. Sites A4 and B9 are downstream of the Proposed Development. Sites B3 and B6 provide good nursery habitat.	Site	This species has the best possible conservation status. Brown trout also act as host species for pearl mussel species. However, there are no pearl mussels recorded in the catchment. Based on the above, the population within the study area is of site importance only.	N
	Brook lamprey	Annex II of Habitats Directive; Red list status: Least Concern; ROI population: no estimates available (King, et al., 2011) but 1,221 x occupied 1 km^2 cells (NPWS, 2019); County Westmeath population: no estimate available but 37 x occupied 1 km^2 cells (estimated);	County / Regional (Proposed Development and downstream populations)	Afforded legal protection under Habitats Directive. If the number of aquatic survey sites with brook lamprey presence represents a likely estimate of the Proposed Development population (N=5), then the Proposed Development brook lamprey population is not significant in the context of the	Y

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
		Baseline surveys: *Lampetra* ammocetes recorded in low densities at sites B3, B4, B5 and B7. Recorded in moderate densities at sites A4, B6 and B9. A4 and B9 are downstream of the Proposed Development. While surveys did not distinguish between brook and river lamprey, there are no known records of river lamprey for Co. Westmeath and Co. Meath and the relevant catchment (NBDC, 2023; O'Connor, 2006) and so it is considered the species was most likely brook lamprey.		ROI population (0.41%) but it is for the County Westmeath population (13.51%). If the number of aquatic survey sites with brook lamprey presence downstream represents a likely estimate of the downstream population (N=2), then the downstream brook lamprey population is not significant in the context of the ROI population (0.16%) but it is for the County Westmeath population (5.41%). Based on the above, the Proposed Development population within the study area and the population downstream are both of county / regional importance.	
	European eel	Red list status: Critically Endangered; ROI population: no estimates available (King, et al., 2011);	County / Regional (Proposed Development and	Listed as 'Critically Endangered' on red-list, so protected as part of Westmeath County Council's and Meath County Council's policy on natural heritage	Y

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
		County Westmeath population: no estimate available; Baseline surveys: recorded in low densities at sites A4, B5, B6, B7 and B9.	downstream population)	(paragraph 12.10 and objective 35, respectively). This species has a very poor conservation status and is found near the Proposed Development and downstream of it also. Given that the Proposed Development is located at considerable distance from the coast, it is unlikely that eel populations are of greater importance than county / regional level. Based on the above, the Proposed Development population within the study area and the population downstream are both of county / regional importance.	
	White-clawed crayfish	Annex II and V of Habitats Directive; Wildlife Act (1976 and as amended, 2000); ROI population: 860 x occupied 1 km^2 grid cells (NPWS, 2019);	County / Regional (downstream population only)	Afforded legal protection under Habitats Directive and Wildlife Act 1976 (as amended). If the number of aquatic survey sites with crayfish	Y

Feature Type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
		County Westmeath population: 26 x occupied 1 km^2 grid cells (estimated); Baseline surveys: single individual recorded at site A4, along with eDNA. This site is downstream of the Proposed Development.		presence represents a likely estimate of the downstream population (N=1), then the downstream crayfish population is not significant in the context of the ROI population (0.12%) but it is for the County Westmeath population (3.85%). Based on the above, the population downstream is of county/regional importance.	
	Three-spined stickleback, stone loach and minnow	Red-list status for three-spined stickleback and minnow are of 'Least Concern' and stone loach is a non-native.	Site	Afforded no legal protection and/or have best possible conservation status - widespread and common, so do not require further assessment.	N

POTENTIAL IMPACTS ON BIODIVERSITY

Do Nothing Scenario

5.295 The Proposed Development comprises commercial conifer forestry plantation and agricultural lands that are currently managed through a combination of intensively managed agroforestry and agricultural practices. If the Proposed Development does not proceed, the area is likely to continue to be used for forestry and agricultural purposes. This means that it is likely that agricultural run-off will continue to be emitted to the watercourses in the surrounding area and livestock will continue to put pressure on the hydraulic conditions via modification to riverbanks. Discharges and pollution to surface waters, along with human induced changes in hydraulic conditions are listed as 'high' ranking threats and pressures to the River Blackwater and River Boyne cSAC (Biodiversity Europa, 2023). The Cable Corridor will continue to be used as a road and the Proposed Substation field will continue to be used for agriculture.

5.296 Taking the above into account, the likely significant effects are described in the following sections.

Potential Construction Phase Impacts

5.297 The construction phase will mainly result in habitat loss/disturbance to facilitate construction of infrastructure including excavation of cabling trenches during the installation of the underground grid connection. Felling of vegetation will also be undertaken to implement turbulence buffers and bat mitigation buffers around turbines.

5.298 Timing of construction works affects the level and type of impact, especially if undertaken during a critical life stage or season for an ecological feature.

5.299 The duration of any construction effects for non-habitat features is likely to be no greater than short-term as the construction phase is anticipated to take 18-24 months.

5.300 Likely sources of direct and indirect effects during construction phase are as follows.

5.301 Sources of direct effects:

- Clearance of vegetation, soil and rock for access roads, hardstands and turbine bases;
- Clearance and/or trimming of woodland, treelines and hedgerows to facilitate site infrastructure and turbulence/bat mitigation buffers;
- Creation of temporary infrastructure e.g. site compound, blade set-down areas and crane pads;
- Excavation of trenches for cable ducting; and
- Placement of materials required for infrastructure works.

5.302 Sources of indirect effects:

- Stockpiling of materials on-site;
- Dust and changes in air quality;
- Collection/drainage of surface water runoff;
- Pollution and changes in hydrology;
- Spreading non-native/invasive plants; and
- Construction activity (including noise, light, and the presence of construction workers) disturbing birds and mammals.

Designated Sites

5.303 SACs (both cSAC and full) and SPAs are considered fully in the Natura Impact Statement (NIS) also submitted with this Planning Application. The same is true for Lough Derravaragh Ramsar site, which overlaps with the SPA of the same name. The NIS shown in **Appendix 15.11** found in Volume III of this EIAR confirmed that, with mitigation measures, the Proposed Development, either alone or in combination with any other plan or project, will not undermine the conservation objectives or have an adverse effect on the integrity of any Natura 2000 site.

5.304 None of the NHAs or pNHAs that overlap with SACs or SPAs are partially located outside those sites, and there are no additional qualifying features. Therefore, the NHAs and pNHAs have been indirectly but fully considered within the NIS, with the same conclusion as for the Natura 2000 sites.

5.305 The impact assessment in this Chapter is therefore restricted to NHAs and pNHAs that do not overlap with SACs or SPAs. Those with connectivity to the Proposed Development, and which therefore require consideration, are Lough Glore pNHA, Lough Ramor pNHA and Royal Canal pNHA.

Direct Effects

5.306 The Proposed Development is not located within or adjacent to any nationally designated site (NHA or pNHA). Therefore, construction works will not directly impact on any of these sites designated for nature conservation.

5.307 Any differences between the range of turbine permutations assessed will result in negligible changes to direct effects for designated sites. This is because the location of the turbines is independent from the range of turbine permutations assessed.

Indirect Effects

5.308 Lough Glore pNHA has an ecological connection via coot, common snipe, northern lapwing, Eurasian curlew, pochard, Eurasian teal, tufted duck and common kestrel. As there are not predicted to be any significant effects on these species (see section on Birds below), there are no significant effects predicted for Lough Glore pNHA.

5.309 Lough Ramor pNHA has an ecological connection via great cormorant. As there are not predicted to be any significant effects on these birds (see section on Birds below), there are no significant effects predicted for Lough Ramor pNHA.

5.310 Royal Canal pNHA has a remote upstream hydrological connection. Thus, there is the potential for ex situ populations of mobile otter within this designated site to be affected by the Proposed Development.

5.311 In the absence of mitigation and without consideration of dilution effects, construction activities could result in continuous, low-level sedimentation/pollution and/or larger scale sedimentation/pollution incidents could occur.

5.312 Reduction in water quality could occur via sedimentation, which can smother fish eggs or reduce the suitability of spawning locations. This could affect prey availability for otters.

5.313 A second way water quality could be reduced is via acidification due to the presence and felling of conifers, because the soils from conifer plantations pose a greater risk to aquatic life than ordinary soils (Ormerod, Donald and Brown 1989).

5.314 Water quality may also be reduced via the release of wastewater from site welfare facilities, as well as toxic hydrocarbons and cement or concrete from construction activities, which could poison riparian habitats, plants and animals.

5.315 Thus, in the absence of mitigation, construction works could result in *significant, negative indirect* sediment/pollution-mediated effects on ex-situ populations of otter from the Royal Canal pNHA *at the national scale*.

5.316 It is unlikely any of the invasive species recorded during surveys could be spread to any pNHA as they are upstream of the Proposed Development.

5.317 Any differences between the range of turbine permutations assessed will result in negligible changes to the indirect effects predicted for designated sites.

Habitats and Flora

Direct Effects

5.318 Construction of wind farm infrastructure will result in direct habitat loss that is considered permanent (35-year lifespan of Proposed Development). Some habitats will also be temporarily lost due to the construction of infrastructure required to accommodate construction of the wind farm e.g. site compounds. For details of habitat loss pertaining to habitats, see **Table 5-12**.

5.319 There will be no loss of Annex I habitats or PAW habitats (the WD1 and WN6 habitats predicted to be lost are not of PAW type). There are no rare or threatened plant species within the study area and so none are predicted to be lost.

5.320 There will be no permanent loss of flower beds and borders BC4, other artificial lakes and ponds FL8, eroding/upland rivers FW1, depositing/lowland rivers FW2, drainage ditches FW4, dry calcareous and neutral grassland GS1, scattered trees and parklands WD5 and wet willow-alder-ash woodland WN6 habitats.

5.321 Most of the terrestrial habitats projected to be lost either temporarily or permanently are of lower value and are common in the wider landscape. These include habitats such as stone walls and other stoneworks BL1, buildings and artificial surfaces BL3, spoil and bare ground ED2, recolonising bare ground x scrub x ornamental/non-native shrub mosaic ED3 x WS1 x WS3, improved agricultural grassland GA1, improved agricultural grassland x spoil and bare ground mosaic GA1 x ED2, amenity grassland GA2 and conifer plantation WD4.

5.322 Other habitats have higher biodiversity value, either due to their natural or semi-natural nature, plus ability to provide important habitat for animals. In the absence of mitigation, enhancement or compensation, the loss of mixed broadleaved woodland WD1, oak-ash-hazel woodland WN2, bog woodland WN7, recolonising cutover bog PB4, treelines WL1, hedgerows WL2, hedgerows x drainage ditch mosaic WL1 x FW4, hedgerow x treeline mosaic WL1 x WL2, dry and calcareous grassland GS1, dry meadows and grassy verges GS2, wet grassland GS4 and scrub WS1 habitats will have a *significant negative effect* at the *local scale*.

5.323 Note that no cutover trenches containing pockets of Annex I transition mire and quaking bog within PB4 cutover bog or WN7 bog woodland will be lost.

5.324 The loss of lower-value commercial conifer plantation WD4 and plantation-type mixed broadleaved woodland WD1 could provide a positive benefit to biodiversity, as other habitats that are of greater value to biodiversity will be created. Thus, the loss of conifer plantation WD4 plus plantation-type mixed broadleaved woodland WD1 habitats and creation of open habitats is likely to have a *significant, positive permanent effect* at the *local scale*.

5.325 No riparian (FW1 or FW2) habitats will be lost. Likely effects on ecology relating to water quality within watercourses are detailed below (section Fisheries and Aquatic Ecology).

5.326 Some hedgerow x drainage ditch mosaic WL1 x FW4 will be lost but will be replaced following construction. This is a very small length (6.43 m). The loss of hedgerow x drainage dich mosaic will have a *temporary, significant negative effect* at the *local scale*.

5.327 The overwhelming majority of habitats within the Proposed Development occur as large, contiguous areas that are also part of the wider landscape. Therefore, the Proposed Development is not likely to significantly affect any habitats which could be acting as ecological stepping-stones or corridors for mobile species, given their widespread abundance both inside and outside the development footprint. The exceptions are linear hedgerows, treelines (and hedgerow x treeline mosaics) and watercourses, all of which act as ecological corridors. Without compensation, the loss of these linear hedgerow and treeline ecological corridors, will have a *significant negative effect* at the *local scale*, and could be contrary to Article 10 of the Habitats Directives. There will be no loss of riparian habitats and so there will be no effect on riparian habitats acting as ecological corridors.

5.328 While there will be some differences in the total amounts of habitats lost between different turbine permutations, these are minimal and are typically of <0.1 ha per habitat type. Consequently, any differences between the range of turbine permutations assessed will result in negligible changes to the direct effects predicted for IEF habitats.

Indirect Effects

5.329 Potential indirect effects on habitats include smothering due to sediment wash-out from cleared areas, deposition areas or dewatering of excavations. The effects of this on water quality of aquatic habitats is considered below under ‘Fisheries and Aquatic Ecology’. Of the terrestrial habitats within the study area, Annex I transition mire and fen PF3 habitat is sensitive to this impact, so in the absence of mitigation, there could be *significant effects* at the *county/regional scale* for this habitat type.

5.330 Compaction and excavation of soil adjacent to hedgerows WL1 / treelines WL2 habitats has potential to cause damage and disease of plants. Dust can also smother photosynthetic activity, although it is unlikely dust production will reach levels that will have a discernible effect on plant growth. Without mitigation such as root protection areas, compaction and excavation could have *significant negative effects* at the l*ocal scale* on hedgerow WL1 and treeline WL2 habitats.

5.331 Without biosecurity measures, invasive or non-native plants could spread, which could have a negative effect on sensitive habitats. Japanese knotweed (Third Schedule-listed under EC (Birds and Habitats) Regulations 2011) is located within an abandoned plot of land next to the R552 road, along the Cable Corridor. Japanese knotweed spreads predominantly via vegetative growth, with small fragments able to regenerate easily. The main mechanism through which it operates is via light exclusion and the secretion of chemicals that inhibit the growth of other plants, displacing native flora. It is highly unlikely that there is the potential for this species to be spread, as the underground cable will be buried within the existing road and the Japanese knotweed is located >8 m from the road (rhizomes can extended horizontally underground 7 m (Pridham et al., 1966), which is less than the distance to the road, so should not be within the soil under the road) and is separated by a hedgerow, so will not be disturbed by the proposed works. However, in the absence of mitigation, this cannot be fully discounted.

5.332 Other invasive or non-native species such as cherry laurel, winter heliotrope and snowberry are also at risk of being spread by construction activity. While these are not subject to the same legal restrictions as Japanese knotweed, it is good practice to avoid their spread.

5.333 Of the species mentioned, cherry laurel is likely to have the greatest effect on terrestrial habitats due to its tendency to outcompete other native species in native woodlands (Kelly et al., 2013; O'Flynn et al., 2014). Some cherry laurel was recorded adjacent to the Cable Corridor within a hedgerow and at TDR nodes 1 (planted as hedgerow along the N52 slip road) (see **Appendix 5-9** found in Volume III of this EIAR). Thus, without mitigation this species could be spread via the movement of soil infected with seeds and viable roots.

5.334 Snowberry and winter heliotrope are classed as having a low risk of impact (Kelly et al., 2013) and are mainly found within hedgerows and verges. Snowberry was found along hedgerows along a proposed access track to the northern part of the Southern Cluster (site entrance 2) and occasionally at TDR nodes (hedgerow at node 9). Snowberry can form dense thickets, outcompeting native plants. It spread predominantly through vegetative growth in its roots. Winter heliotrope was found at one TDR node (managed verge) outside Delvin. Winter heliotrope can form dense stands excluding native vegetation.

5.335 Accidentally spreading (i.e. in the absence of mitigation) Japanese knotweed, cherry laurel winter heliotrope, and snowberry could have *significant negative effects* at the *local scale* for habitats that are in the same general area as them e.g. hedgerows WL1, amenity grassland GA2, treelines WL2 and conifer plantation WD4 habitats.

5.336 Any differences between the range of turbine permutations assessed will result in negligible changes to the indirect effects predicted for IEF habitats. This is because the mapped invasive species are not located near to proposed turbine locations. Similarly, any differences in hard standings will be minimal and will not translate into appreciable differences in smothering of habitats or excavation/compaction of soil next to hedgerows.

Table 5-12: Habitat Loss

Fossitt Code	Fossitt Name	EU Annex I or PAW Affiliation?	Area (ha) / Length (m)[14]			Where Loss Will Occur
			Total (baseline)	Permanent Loss	Temporary Loss	
BC4	Flower beds and borders	No	0.03 ha	-	-	None predicted.
BL1	Stone walls and other stoneworks	No	0.04 ha / 507.89 m	-	-	None predicted.
BL3	Buildings and other artificial surfaces	No	13.11 ha / 83.35 m	-0.05 ha	-2.64 ha	Cable Corridor, Southern Cluster.
ED2	Bare ground	No	0.24 ha	-0.01 ha	-0.02 ha	Northern Cluster.
ED3	Recolonising bare ground	No	336.96 m	-	-	None predicted
ED3 x WS1 x WS3	Recolonising bare ground x scrub x ornamental / non-native shrub mosaic	No	0.87 ha	-0.06 ha	-	Cable Corridor.
FL5	Eutrophic lake	No	0.11 ha	-	-	Southern Cluster.
FL8	Other artificial lakes and ponds	No	0.04 ha	-	-	None predicted.
FW1	Upland / eroding river	No	116.00 m	-	-	None predicted.

[14] Values with a minus sign represent a loss

Fossitt Code	Fossitt Name	EU Annex I or PAW Affiliation?	Area (ha) / Length (m)[14]			Where Loss Will Occur
			Total (baseline)	Permanent Loss	Temporary Loss	
FW2	Lowland / depositing river	No	2,462.91 m	-	-	None predicted.
FW4	Drainage ditches	No	381.55 m	-	-	None predicted.
GA1	Improved agricultural grassland	No	175.52 ha	-5.31 ha	-10.06 ha	Cable Corridor, Northern Cluster, Southern Cluster, Substation.
GA1 x ED2	Improved agricultural grassland x bare ground mosaic	No	0.13 ha	-	-0.05 ha	Northern Cluster.
GA2	Amenity grassland	No	3.67 ha	-	-0.15 ha	Cable Corridor.
GS1	Dry and calcareous grassland	No	1.48 ha	-	-0.21 ha	Southern Cluster
GS2	Dry meadows and grassy verges	No	0.24 ha	-	-0.09 ha	Cable Corridor.
GS4	Wet grassland	No	2.19 ha	-	-0.15 ha	Cable Corridor.
PB4	Cutover bog (recolonizing)	No	1.31 ha	-0.12 ha	-0.07 ha	Northern Cluster
PF3	Transition mire and quaking bog	**Yes – H7140**	2.11 ha	-	-	None predicted.
WD1	(Mixed) broadleaved woodland	**Yes - PAW**	52.46 ha	-11.36	-3.12 ha	Cable Corridor, Northern Cluster, Southern Cluster. Will not lose the PAW type.
WD4	Conifer plantation	No	26.58 ha	-2.30 ha	-0.30 ha	Southern Cluster.

Fossitt Code	Fossitt Name	EU Annex I or PAW Affiliation?	Area (ha) / Length (m)[14]			Where Loss Will Occur
			Total (baseline)	Permanent Loss	Temporary Loss	
WD5	Scattered trees and parklands	No	12.84 ha	-	-	None predicted.
WL1	Hedgerows	No	10,734.11 m	-402.62 m	-53.60 m	Along Cable Corridor, Northern Cluster, Southern Cluster and at Proposed Substation.
WL1 x FW4	Hedgerow x drainage ditch mosaic	No	182.89	-6.43 m	-	Northern Cluster.
WL1 x WL2	Hedgerow x tree line mosaic	No	1,059.39 m	-20.74 m	-65.478 m	Northern Cluster.
WL2	Tree lines	No	6,861.52 m	-61.66 m	-37.23 m	Cable Corridor, Northern and Southern Cluster.
WN2	Oak-ash-hazel woodland	**Yes – PAW**	7.32 ha	-0.02 ha	-0.04	Southern Cluster. Will not lose the PAW type.
WN6	Wet willow-alder-ash woodland	No	0.22 ha	-	-	None predicted.
WN7	Bog woodland	No	2.30 ha	-0.02 ha	-	Northern Cluster
WS1	Scrub	No	3.57 ha	-0.01 ha	-0.18 ha	Cable Corridor, Southern Cluster.

Birds

Direct Effects

5.337 Potential direct construction effects include nest damage or destruction, habitat loss and disturbance/displacement.

Nest damage or destruction

5.338 No nests for IEF bird species were recorded by surveys. It is possible that common snipe, Eurasian woodcock and yellowhammer are breeding within 500 m from the Proposed Development. Damage or destruction to active bird nests could contravene Section 22 of the Wildlife Act 1976 (as amended). However, good practice measures will avoid the likelihood of damage, destruction or disturbance to occupied bird nests during the construction phase, if confirmed breeding.

5.339 Any differences between the range of turbine permutations assessed will result in negligible changes to the direct effects of nest damage or destruction predicted for IEF birds.

Habitat loss

5.340 Construction of the Proposed Development will lead to a total loss of 36.33 ha of habitats. Most of the habitats to be lost are commercial conifer plantation WD4 (2.59 ha), plantation-type mixed broadleaved woodland WD1 (14.48 ha) and improved agricultural grassland GA1 (15.37 ha) habitats, which are generally of low value to biodiversity.

5.341 As the grid connection will be almost entirely buried underground within or immediately adjacent to existing roads, only a minimal amount of bounding habitat (mostly hedgerow WL1) will be lost. At the Proposed Substation site, only low value improved agricultural grassland GA1 and a small amount of higher value hedgerow WL1 habitats will be lost. There is not predicted to be any permanent habitat loss at the TDR nodes, consisting almost entirely of trimming and/or temporary removal of street furniture.

5.342 Based on the results of the surveys between June 2019 and September 2021 none of the habitats due to be lost are of particular importance for sensitive IEF bird groups such as raptors, waders or wintering wildfowl because:

- No aggregations of swans or geese were recorded within the Proposed Development,
- Other wildfowl, wader and raptor species were generally recorded in low numbers, preferring to use other habitat available in the wider area,
- No hen harrier or merlin were recorded roosting during surveys, and
- No evidence was recorded of breeding raptors, waders, or wildfowl near proposed infrastructure, except for the below.

5.343 There was evidence of confirmed breeding for the following sensitive IEF bird species:

- Common kestrel has been recorded breeding c. 1.5 km NE of turbine T6 according to the latest survey results, recognising that territories have been in different locations for different years (all territories were at least 1 km from the Proposed Development),
- Eurasian coot were recorded breeding c. 700 m NE of turbine T3 on a single occasion,
- Northern lapwing have been recorded breeding c. 1.2 km NE from turbine T4 once in 2020,
- Common snipe were recorded drumming (breeding display flight) in an area located c. 875 m SE of turbine T4, according to the latest survey results, recognising that a territory has also been recorded c. 360 m NW of turbine T1 previously, and

- Eurasian woodcock are thought to have at least two breeding territories c. 200 m NW of turbine T5 and 0 m from turbine T3, according to the latest survey results, recognising that two territories have been recorded in previous years in different locations.

5.344 Therefore, the only species close enough to the development footprint that could suffer direct habitat loss are breeding Eurasian woodcock and common snipe (loss of conifer plantation and loss of damp, grassland habitats, respectively). Thus, in the absence of compensation, the loss of breeding habitat could have a *significant, long-term effects* on breeding Eurasian woodcock and common snipe at the *county / regional scale*.

5.345 Eurasian coot, northern lapwing and common kestrel do not breed at the Proposed Development and it is unlikely that the habitats present comprise an important part of their foraging areas.

5.346 Barn owl is suspected to breed within the ruins of Rosmead House; however, this is c. 360 m from turbine T8 and will not be removed during construction. No key foraging habitats (e.g. tussocky grassland) for this species will be removed. Accordingly, no effects of direct habitat loss are predicted for this species.

5.347 The loss of habitats such as hedgerows WL1 and improved agricultural grasslands GA1 means that breeding passerine IEFs such as yellowhammer could suffer a loss of breeding or foraging habitats. Any open grassland IEF species, such as skylark and meadow pipit could also lose breeding/foraging habitat if these habitats are lost due to in situ compensatory woodland planting.

5.348 In the absence of compensation, there could be *significant, long-term effects* on the *local scale* for yellowhammer, skylark and meadow pipit.

5.349 The loss of woodland habitats could displace the woodland bird assemblage (goldcrest, greenfinch, house sparrow, linnet, redwing, willow warbler); however, conifer loss would happen as part of the existing agroforestry practices anyway and any permanent loss of forestry due to the Proposed Development would be replaced ex situ and temporary loss replaced in situ. So, overall, the effect on woodland birds is likely to be *neutral*, except for goldcrest, a woodland specialist. However, the effects of habitat loss on goldcrest are *unlikely* to be *significant* due to the very low numbers using the Proposed Development.

5.350 The timing of vegetation removal in the works corridor could remove habitat for grey wagtail, meadow pipit, skylark and yellowhammer if breeding and in the absence of mitigation, there could be *significant, long-term effects* on the *local scale* for yellowhammer and meadow pipit. No breeding habitats (streams and rivers) for grey wagtail will be lost so it is *unlikely* there will be any *significant effects* on this species. Hedgerows will be replaced in situ, so the effect on yellowhammer is likely to be neutral.

5.351 No significant habitat loss effects during construction are predicted for IEFs black-headed gull, common kestrel, Eurasian curlew, Eurasian teal, European golden plover, great cormorant, hen harrier, mallard, merlin, mute swan, northern lapwing, peregrine falcon, whooper swan, Eurasian coot, shelduck, Eurasian wigeon, lesser black-backed gull, barn owl, .common gull, grey wagtail, goldcrest, greenfinch, house martin, house sparrow, linnet, redwing, sand martin, skylark, starling, swallow, swift and willow warbler,

5.352 Foraging and nesting habitats for hen harrier, merlin and common kestrel could improve within the Proposed Development due to forest clearance (both due to the Proposed Development itself and as part of existing agroforestry practices). If this is the case, then there is likely to be a significant, positive effect on these species.

5.353 While there will be some differences in the total amounts of habitat lost within the range of turbine permutations assessed, these are very minor. Any differences between the range

of turbine permutations assessed will result in negligible changes to the direct habitat loss effects predicted for IEF birds.

Disturbance/displacement

5.354 Potential effects of noise and visual disturbance could lead to temporary displacement or disruption of foraging/roosting/breeding birds. The significance of the effect depends on the timing of potentially disturbing activities, the extent of spatial/temporal displacement and the availability of suitable displacement habitats in the surrounding area. Behavioural sensitivity to disturbance also varies between species.

5.355 Significant disturbance/displacement effects are unlikely to occur along the Cable Corridor or Proposed Substation, with underground cables proposed to be buried within or adjacent to existing roads or heavily modified cultivated habitats (e.g. agricultural grasslands), and the Proposed Substation to be located within the same. Any disturbance/displacement from construction activities while the cable is being buried within the road is unlikely to be significantly greater than that from typical traffic levels. The Cable Corridor does not pass through any sites designated for their ornithological interest.

5.356 Potential effects due to the Proposed Development itself are likely to be greatest during the breeding season (predominantly between March and August, depending on the species under consideration). However, significant effects for most IEF bird species are unlikely. This is because they were not recorded breeding (or probably breeding) within the relevant ZoI, all were recorded in low numbers and all the habitats found within the Proposed Development occur frequently in the wider area. Exceptions are outlined below.

5.357 To avoid disturbing the following bird species, buffers are required:

- Common snipe: a buffer of 400 m is required in the breeding season (Pearce-Higgins et el., 2009),
- Eurasian woodcock: no published buffer exists, but a 500 m separation distance is likely sufficient as the maximum buffer required for other wader species is 500 m (Goodship & Furness, 2022),
- Northern lapwing: a buffer of 108 m is required (Hötker et al., 2006),
- Eurasian coot: as for Eurasian woodcock, no published buffer exists, but a 500 m separation distance is likely sufficient (Goodship & Furness, 2022),
- Common kestrel: a buffer of 200 m is required (Goodship & Furness, 2022), and
- Barn owl: a buffer of 100 m is required (Goodship & Furness, 2022).

5.358 Thus, disturbance/displacement of breeding northern lapwing, Eurasian coot, common kestrel and barn owl is unlikely to occur as breeding activity was already located beyond the buffers required to avoid disturbance from construction activities for each of these species.

5.359 For common snipe and Eurasian woodcock, there is evidence of confirmed breeding nearer to the Proposed Development than the recommended disturbance buffers detailed above. Thus, without mitigation, there could be *significant, short-term effects* of construction-related disturbance to breeding common snipe and Eurasian woodcock at the *county / regional scale*.

5.360 Many of the other breeding IEF bird species are not sensitive to construction related disturbance (grey wagtail and yellowhammer) or breed in open habitats away from where most construction activity will occur (meadow pipit and skylark).

5.361 Disturbance to foraging and roosting wintering birds is considered even less likely due to the low numbers of sensitive birds recorded within and surrounding the Proposed Development (e.g. whooper swan where only two birds were seen within 500 m of the

Proposed Development over two years of surveys) and so no significant effects are likely. Many of these species are in any event, not vulnerable to construction related disturbance in the winter (black-headed gull, common kestrel, common snipe, Eurasian curlew, Eurasian teal, Eurasian woodcock, European golden plover, great cormorant, mallard, mute swan, northern lapwing, peregrine falcon, yellowhammer, Eurasian coot, shelduck, Eurasian wigeon, lesser black-backed gull, grey wagtail, goldcrest, greenfinch, house sparrow, linnet, starling and redwing), or occur in open habitats away from where most construction activity will occur (meadow pipit or skylark), or were not recorded roosting (hen harrier and merlin), or where roosts are located well beyond the development footprint (barn owl).

5.362 The potential effects associated with construction activities are only likely to occur for as long as the construction phase continues and are thus generally *short-term* in nature. The exception is if the local population becomes extinct during the period of disturbance and replacement through recruitment or re-colonisation does not occur. None of the species recorded with breeding populations are rare enough for this to be a risk.

5.363 Based on the above, unmitigated disturbance/displacement effects during construction are *unlikely* to be *significant* for the following IEF bird species: black-headed gull, common kestrel, common snipe, Eurasian curlew, Eurasian teal, European golden plover, great cormorant, hen harrier, mallard, merlin, mute swan, northern lapwing, peregrine falcon, whooper swan, yellowhammer, Eurasian coot, shelduck, Eurasian wigeon, lesser black-backed gull, barn owl, meadow pipit, common gull, grey wagtail, goldcrest, greenfinch, house martin, house sparrow, linnet, sand martin, skylark, starling, swift, redwing and willow warbler. The exception is for common snipe and Eurasian woodcock during the breeding season, as mentioned above.

5.364 Even though significant effects are not likely, the risk of construction disturbance will be further mitigated by avoiding sensitive areas through the implementation of appropriately defined buffer zones and by timing construction activities to avoid periods where sensitive species are present (if and where possible), such as the breeding season. A range of good practice measures will be implemented to mitigate for potential construction disturbance effects (see paragraph 5.676).

5.365 The range of turbine permutations assessed will not result in any qualitative differences regarding disturbance or displacement effects on birds. i.e. the same construction processes will take place regardless. While there might be small differences in the dimensions of the hardstands, we have assessed the worst-case scenario (i.e. have measured distances to nests / territories using the largest hardstanding area). Therefore, any differences between the range of turbine permutations assessed will result in negligible changes to the direct disturbance/displacement effects predicted for IEF birds.

Indirect Effects

5.366 If the construction of the Proposed Development led to pollution of wetland habitats and/or dewatering of groundwater-dependent habitats within nearby designated sites for birds, it could result in indirect habitat loss for qualifying bird species. The same is true for wetland sites that could be used by bird species from nearby designated sites, even if those wetland sites are not designated themselves.

5.367 As concluded by **Chapter 7**, with embedded mitigation measures in place there will be no significant effects on any wetland site and so there can be no significant indirect effects on any bird species as a result.

5.368 Any differences between the range of turbine permutations assessed will result in negligible changes to the indirect effects assessment for IEF birds i.e. differences in the range of

turbine permutations will not significantly affect the amount of potential pollution or dewatering that could occur.

Terrestrial Mammals (Excluding Bats)

Direct Effects

5.369 Direct effects on mammals during construction of the Proposed Development include impacts on dwellings (resting, hibernating or breeding sites), where the dwelling could be destroyed and/or both adults and juveniles could be killed or injured. Tree/vegetation removal could affect arboreal species (e.g. pine marten and red squirrel) and ground works such as excavation or piling could affect ground-dwelling species (e.g. badger and hedgehog).

5.370 No mammal dwellings were recorded within the vicinity of the works footprint, so there is unlikely to be disturbance during sensitive periods. The ZoI for significant effects is 50 m for red squirrel dreys (NatureScot, 2020), 100 m for pine marten dens (VWT, 2015) and 50 m for active badger setts. Therefore, there are *no likely direct effects* for badger, red squirrel or pine marten.

5.371 Irish hares do not inhabit single dwellings, but rest in 'forms' (VWT, 2023). Young hares hide in long grass in the day and are fed at dusk. As construction will be undertaken during daylight hours, the risk of disturbance is limited to physical disturbance of the young, rather than the mother. As young hares can move freely, it is unlikely they will suffer mortality from construction activities. Direct effects on Irish hare are assessed as *not significant*.

5.372 Hedgehogs hibernate under whatever materials and hiding places they can find, using dead leaves, twigs, feathers and log piles (VWT, 2023). During hibernation, hedgehogs enter a state of torpor from October/November to March/April. This immobility makes them very vulnerable to disturbance. *Significant direct effects* to hedgehogs could occur *at the local scale* via destruction of hibernacula and direct mortality, if construction takes place during the winter months (i.e. in the absence of mitigation).

5.373 There are only very small differences between the range of turbine permutations assessed regarding the amount of habitat due to be lost, so there will not be any significant differences regarding destruction of mammal breeding or resting places. Therefore, any differences between the range of turbine permutations assessed will result in negligible changes to the direct effects predicted for IEF mammals (excluding bats).

Indirect Effects

5.374 Indirect effects on mammals during construction could result in the loss of potential foraging, commuting and sheltering habitat.

5.375 Tree removal may reduce habitat availability for arboreal pine marten and red squirrels but could offer new foraging opportunities for badger, Irish hare and hedgehog. It is *unlikely* that the loss of conifer plantation or plantation-type mixed broadleaved woodland will result in *significant effects* on pine marten and red squirrel. Significant effects are only likely if the populations are at carrying capacity and use conifer plantation and plantation-type mixed broadleaved woodlands preferentially over other woodland habitats in the area. Pine marten hunt over a large area and there are abundant displacement habitats available both within and outside the study area, and it is likely the PAW habitats are preferred foraging areas, as they are more diverse and more likely to support more prey. There are also abundant woodland habitats for red squirrel as well. The removal of any other habitats used by badger, hedgehog and Irish hare are also widespread and common in both the study area

and wider landscape. Therefore, *no significant indirect effects* due to the loss of potential foraging, commuting and sheltering habitat are *likely*.

5.376 Disturbance from noise, vibration, machinery movement and increased human presence could also displace foraging individuals or cause breeding mammals to abandon natal sites.

5.377 No badger, pine marten and red squirrel dwellings were recorded within 100 m of the development footprint. There are also abundant displacement foraging habitats for these species in the wider area. As explained in the previous section under direct effects, breeding Irish hares are unlikely to suffer any significant effects due to disturbance from construction activities.

5.378 Hibernating hedgehogs could be disturbed by construction activities, causing them to wake from hibernation prematurely. This could cause mortality, especially if sufficient food is unavailable. For hedgehog, in the absence of mitigation, there could be *significant indirect effects* due to disturbance *at the local scale*. For badger, pine marten, red squirrel and Irish hare, *no significant effects* are *likely*.

5.379 Any differences between the range of turbine permutations assessed will result in negligible changes to the indirect effects predicted for IEF terrestrial mammals (excluding bats) as there will be very small differences in the areas of potential foraging habitats predicted to be lost and no qualitative differences in construction activities.

Bats

Direct Effects

5.380 Direct effects on bats during construction of the Proposed Development include vegetation removal or removal/modification of existing structures, which could result in a loss of potential roost sites.

5.381 No confirmed bat roosts were recorded within the Proposed Development within the works footprint. So, no direct effects on potential bat roosts are likely.

5.382 Along the Cable Corridor, cables will be laid within existing road network, with only the area at the Proposed Substation requiring excavation outside of this. Where cables will go over bridges, there is the potential for bats to be disturbed at aquatic surveys sites; however, no roosts were identified and so *no direct effects* on potential bat roosts are *likely*. No other potential bat roosts are located within the works footprint along the Cable Corridor.

5.383 Along the TDR, the only accommodation works that could potentially affect bat roosts is the trimming of trees. No structures with bat roost potential will be affected. There are no trees requiring trimming along the TDR that were classed as having potential bat roost features. Again, no direct effects on bat roosts are likely.

5.384 The differences in the range of turbine permutations assessed will only give rise to small differences in the total amounts of habitats lost. The worst-case scenario has been assessed i.e. the greatest amount of habitat loss. As there are no predicted losses to bat roosts for the worst-case scenario, any differences between the range of turbine permutations assessed will result in negligible changes to the direct effects predicted for IEF bats.

Indirect Effects

5.385 Indirect effects could include the loss of foraging/commuting habitats or features. If lighting is used for night-time working, this could also disturb roosting and foraging bats. However, limited night-time working is proposed as part of embedded mitigation measures, so no

disturbance is likely (see paragraph 5.690). Further, the species utilising the Proposed Development most (common pipistrelle, soprano pipistrelle and Leisler's bat) are less sensitive to light pollution than the less commonly recorded species including brown long-eared bat and *Myotis* species.

5.386 Surveys confirmed that linear features such as forest edges, hedgerows, treelines and watercourses were used by commuting and foraging bats but they were only used regularly by common pipistrelle, Leisler's bat and soprano pipistrelle. The removal of such features could disrupt connectivity *significantly* throughout the Proposed Development.

5.387 In the absence of mitigation / compensation, vegetation removal has the potential for *significant indirect effects* on common pipistrelle, Leisler's bat and soprano pipistrelle at the *local scale*.

5.388 As the range of turbine permutations assessed will result in very small differences in the total amounts of habitat lost and will not result in qualitative differences in e.g. light pollution, any differences between the range of turbine permutations assessed will result in negligible changes to the indirect effects predicted for IEF bats.

Other Protected Fauna

Direct Effects

5.389 Direct effects on amphibians such as common frog and smooth newt include destruction of breeding sites and mortality from construction activities.

5.390 Breeding smooth newt habitats will not be destroyed as they were recorded in a pond outside the works footprint. It is unlikely there will be significant mortality effects for adult smooth newt.

5.391 Spawning common frog could be affected when breeding opportunistically in wet habitats. In the absence of mitigation, *significant negative effects* for spawning common frog could occur at the *local scale*. It is *unlikely* there will be *significant* mortality effects for adult smooth newt.

5.392 Breeding marsh fritillary could be directly affected if their breeding sites are destroyed, or they suffer mortality from construction activities. However, the Proposed Development has been designed to avoid the breeding area for this species (there is a c. 190 m separation distance between proposed infrastructure and the breeding area), regardless of whichever turbine permutation is chosen. Therefore, it is *unlikely* that any s*ignificant negative direct effects* will occur for this species.

5.393 Any differences between the range of turbine permutations assessed will result in negligible changes to the direct effects predicted for IEF 'other protected fauna' because the same separation distance will be enforced for marsh fritillary regardless of the turbine permutation chosen and there will only very small differences in the amounts of wet habitats predicted to be lost between the range of turbine permutations assessed.

Indirect Effects

5.394 Indirect effects on amphibians and marsh fritillary could include loss of foraging habitats. For amphibians, habitats that could be used for foraging include drainage ditches FW4, eutrophic ponds FL5 and wetter parts of improved agricultural grassland GA1 and wet grassland GS4. All these habitats are widely available in the study area and wider landscape. Marsh fritillary butterfly can feed on a variety of flowering plants, so a wide variety of abundant displacement habitats are available. Therefore, it is *unlikely* that any

significant negative effects will occur for common frog, smooth newt or marsh fritillary butterfly.

5.395 Any differences between the range of turbine permutations assessed will result in negligible changes to the indirect effect assessment for IEF 'other protected fauna' because there will only be very small differences in the amounts of habitats predicted to be lost between the range of turbine permutations assessed.

Fisheries and Aquatic Ecology

Direct Effects

5.396 Direct effects include the loss of natural watercourses due to watercourse crossings and the placement of culverts, water quality degradation, the diversion of natural watercourses, increased suspended solids/hydrocarbons/cement leachate within watercourses inside the Proposed Development and the loss of freshwater habitats due to removal or blockage of watercourses.

5.397 There are no IEF aquatic features located within the Proposed Development boundary and so direct effects on Atlantic salmon, brook lamprey, European eel and white-clawed crayfish are *unlikely*.

5.398 There are no otter holts within 150 m of any aquatic survey site, so no direct effects of disturbance to breeding/resting otters are predicted.

5.399 There are no kingfisher nests within 150 m of any aquatic survey site, so no direct effects of disturbance to breeding kingfisher are predicted.

5.400 Any differences between the range of turbine permutations assessed will result in negligible changes to the direct effect assessment for IEF fish and aquatic ecology as the turbine locations and the rest of the Proposed Development will stay the same regardless of the turbine permutation chosen.

Indirect Effects

5.401 Indirect effects include the release of suspended solids (which could be acidic due to presence of conifer plantation), hydrocarbons or cerement leachate, which could reach downstream receptors such as Atlantic salmon, brook lampreys and white-clawed crayfish via hydrological connections. This could reduce the water quality, which could have negative effects on aquatic receptors.

5.402 Salmonids require very high levels of water quality to complete their life cycles. High levels of suspended solids can increase turbidity (inhibits respiration) and siltation (affects riverbed substrate composition, reducing spawning and fry survival). Suspended solids typically contain phosphorous or hydrocarbons that can lead to eutrophication and reduced oxygen levels (a cause of death for all salmonid and lamprey life stages). The release of even small amounts of hydrocarbons (e.g. fuel spills) can reduce oxygen levels, affecting salmonid and lamprey populations. Acidification of streams because of conifer plantations and associated forestry operations (Ormerod, Donald and Brown 1989) can also result in the reduction of invertebrate (Ormerod, Rundle, et al. 1993) and fish populations (Harrison, et al. 2014).

5.403 Habitat availability and quality are linked with survival rates of salmon fry and parr (Kalleberg, 1958), with small amounts of debris entering a watercourse important for vulnerable life stages of salmon and lamprey potentially leading to negative impacts on juvenile survival and habitat use.

5.404 Accidental fuel spills, which could occur during construction, can release hydrocarbons, which can bioaccumulate in salmonids (McCain, et al., 1990), leading to loss of condition. As salmonids are known to avoid areas containing hydrocarbons (Maynard & Weber, 1981), fuel spills can lead to effective loss of habitat and/or migration routes. Fuel spills are unlikely to occur ate all, and even if one did occur, it is unlikely to be a scale which would have an appreciable effect on salmonid habitats. However, this risk cannot be completely discounted and mitigation measures are outlined at paragraph 5.629.

5.405 Acidification of watercourses could also occur if felling of conifer plantation occurs near watercourses. Changes in pH could lead to fish kills and a reduction in recruitment, leading to population declines.

5.406 A decrease in fish stocks can also lead to reduced prey availability to otter and kingfisher.

5.407 Unmitigated secondary effects are therefore *likely* to be *significant* at the *county / regional scale* for Atlantic salmon, river lamprey, white-clawed crayfish, European eel, and otter.

5.408 The effects on kingfisher are discussed in the context of the River Boyne and River Blackwater SPA population only (none were recorded within 500 m of the Proposed Development) (see **Appendix 5-2** found in Volume III of this EIAR).

5.409 Any differences between the range of turbine permutations assessed will result in negligible changes to the indirect effects predicted for IEF fish and aquatic ecology, as the effects described above are independent from the turbine permutation chosen.

Potential Operational Phase Impacts

5.410 Direct effects are likely to occur due to the operation of the turbines, hardstands, access tracks and Proposed Substation only. Some mitigation measures will also act as sources of operational phase impacts. This includes bat mitigation buffers, where the area surrounding certain turbines must be kept free from any forestry / woodland / hedgerows / treelines throughout the entire operational phase.

5.411 The grid connection will be buried underground and avoids sensitive IEFs. Once installed, there are no likely significant operational impacts from the grid connection.

5.412 The proposed lifespan of the Proposed Development is 35 years and so operational effects will be long-term.

5.413 Potential effects resulting from the operational phase are as follows.

5.414 Direct effects:

- Collision with turbines and barotrauma for bats, and
- Collision with turbines for birds.

5.415 Indirect effects:

- Collection/drainage of surface water runoff,
- Disturbance effects due to operational activities and servicing (a few visits per year with a small number of human personnel),
- Displacement effect of operating turbines, and
- Displacement effects of Proposed Substation lighting.

Designated Sites

5.416 European sites including SACs and SPAs are considered fully in the Natura Impact Statement (NIS) also submitted with this Planning Application. The same is true for the only

Ramsar site, Lough Derravaragh, which overlaps with the SPA of the same name. No adverse effects on the integrity of SACs and SPAs were identified and therefore, in an EIA sense, there are no likely significant effects on these designated sites.

5.417 Nationally designated sites (not included within an SAC and SPA) that are within the ZoI with connectivity are Lough Glore pNHA, Lough Ramor pNHA and Royal Canal pNHA.

Direct Effects

5.418 The Proposed Development is not located within any NHAs or pNHAs, so no significant direct effects are likely.

5.419 There are no NHAs or pNHAs within the ZoI designated for bats, so no significant effects due to collision with turbines are predicted for any of these sites.

5.420 Lough Glore pNHA and Lough Ramor pNHA are designated for birds, so there could be significant effects due to collision with turbines for coot, common snipe, northern lapwing, Eurasian curlew, Eurasian teal, pochard, tufted duck and common kestrel for Lough Glore pNHA. The same is true for great cormorant for Lough Ramor pNHA.

5.421 There were not enough flight lines to be able to carry out collision risk modelling for common snipe or great cormorant, which suggests that collision risk is *not significant* for these species and that it is *unlikely* that there will be any *significant direct effects* on Lough Ramor pNHA due to collision with wind turbines.

5.422 Eurasian coot migrates exclusively at night (Wernham et al., 2002) and so the absence of diurnal observations does not mean there are no flight lines, as nocturnal flight activity surveys were not carried out. Similarly, Eurasian teal, pochard and tufted duck are known to make local movements at night (Dirksen et al, 2000).

5.423 However, Lough Glore pNHA is 11.9 km distant from the Proposed Development, there is a wide arc of approach directions to the Lough, there are relatively small numbers of coot at the pNHA (see Table 5-11 for information on populations), the number of days on which the birds migrate to/from the Lough is low, the rotor swept area is relatively small, and the risk that migrating coot collide with a wind turbine at the Proposed Development is very low. The same is true for migrating teal, pochard and tufted duck, except that these species have been recorded as wind farm fatalities much less often (Dürr, 2023) and may migrate during the day.

5.424 This suggests that collision risk is *not significant* for these species and that it is *unlikely* that there will be any *significant direct effects* on Lough Glore pNHA due to collision with wind turbines.

5.425 For Eurasian curlew, northern lapwing and common kestrel, the number of predicted collisions per year is 2.64, 4.69 and 2.06. There is no information on the populations of Eurasian curlew and common kestrel present at Lough Glore pNHA. For Eurasian curlew, the absence of population data is because none were recorded at the pNHA i.e. the most recent pNHA population estimates are zero. If there are no curlew at the pNHA, then there can be no effects of collision.

5.426 For common kestrel, it is not clear from the site synopsis whether the population is a breeding, resident or winter population; there is also no information population sizes. For breeding kestrel, it is *unlikely* that there will any *significant effects* on the pNHA population, as kestrels tend to maintain breeding territories no larger than 7 km^2 (Garrett et al., 2011) and the distance between the pNHA and the Proposed Development is greater than this. This also suggests that the breeding population at the pNHA is likely to be a single pair, based on the size of the pNHA and the fact that the majority of the pNHA consists of lake

habitats, which are not used by foraging kestrel (the wetland margins are of more importance). There therefore, could be some effects of collision on resident or wintering kestrel from the pNHA.

5.427 However, there is only evidence of two birds being killed by wind turbine strike in Ireland between 2007 and 2019 (NPWS, 2019). Although there may be other, unpublished reports of collisions of this species, it seems that kestrel collisions in Ireland at least, are relatively uncommon events relative to all recorded bird collisions in Europe (0.01%). On this basis, it is *unlikely* that there will be any significant effects of collision on the Lough Glore pNHA population.

5.428 Assuming a peak count of three northern lapwing at Lough Glore (see **Table 5-11** for information on populations), the effects of collision could be significant in the context of the pNHA population. However, is likely to represent a large overestimate of collision risk for this pNHA population as the pNHA is right on the edge of the core 12 km (Gillings and Fuller, 1999) winter foraging range for northern lapwing. Therefore, any connectivity with the pNHA is likely to be weak and it is *unlikely* that there will be *significant effects* on the pNHA population due to collision.

5.429 Any differences between the range of turbine permutations assessed will result in negligible changes to the direct effect assessment for designated sites.

Indirect Effects

5.430 No significant direct effects on otters are predicted (see section on Mammals below) and so therefore there can be no effects on Royal Canal pNHA.

5.431 The main source of indirect effects on NHAs or pNHAs during the operational phase is due to come from ground exposed by felling to create bat mitigation buffers. It will take up to one to two years for the bare ground to re-vegetate and so there is the risk of short-term run-off. Sedimentation could then occur at nearby watercourses, which could be transported downstream to pNHAs. Run-off could also occur if drainage associated with turbine hardstands and access tracks is poorly designed and/or constructed. Continued forestry operations could also mean that discharges could be heavy for some years, especially after felling and replanting.

5.432 Accidental hydrocarbon release is also possible via accidental spillage from service vehicles entering the Proposed Development Site. It is unlikely that toxic materials such as cement or concrete will enter any watercourses, however in the absence of mitigation, this cannot be guaranteed.

5.433 If conifers are felled and left near to watercourses or drainage ditches, acidification could occur, which could reach pH sensitive receptors downstream. Thus, similar effects could occur to mobile aquatic receptors from Royal Canal pNHA as described in paragraph 5.310. While it is considered unlikely that any pollutants will reach the Royal Canal pNHA itself, as this is upstream of the Proposed Development, it is precautionary to assume that unmitigated downstream effects could be *significant* at the *national scale* for mobile ex-situ otter.

5.434 Any differences between the range of turbine permutations assessed will result in negligible changes to the indirect effects predicted for designated sites as there are negligible differences in the amount of sedimentation, run-off and release of pollutants regardless of the turbine permutation chosen.

Habitats and Flora

Direct Effects

5.435 Potential direct effects relate to the clearance of vegetation to mitigate for collision impacts on bat species. These effects have already been assessed under construction phase impacts.

Indirect Effects

5.436 It is *unlikely* there will be any *significant, indirect, operational effects* on any non-groundwater terrestrial habitats during the operational phase.

5.437 The only habitat nearby the Proposed Development that could be groundwater-dependent is transition mire and quaking bog PF3 habitat (Annex I) and bog woodland WN7 (non-Annex I). While these habitats at the Proposed Development are thought to be largely surface-water fed, it is precautionary to assume that there may be some groundwater-dependency. In the absence of mitigation, there is the potential for inappropriate drainage to affect the hydrological levels of this habitat type, which could have a *long-term*, *negative effect* at the *county / regional scale*.

5.438 Any differences between the range of turbine permutations assessed will result in negligible changes to the indirect effect assessment for IEF habitats, as the type of turbine permutation chosen will not result in appreciable differences in hydrology.

Birds

Direct Effects

5.439 Potential direct effects include:

- Disturbance / displacement and barrier effects, and
- Collision with wind turbines.

5.440 There is only a single temporary met mast within the Proposed Development Site, which will be removed prior to construction of the Proposed Development, so the turbines present the only risk of collision mortality for birds. No operational effects are likely for the Cable Corridor, which will be buried underground and located almost entirely within or adjacent to the existing road network. The Proposed Substation will also be a low, stationery object and so is considered to present a negligible source of collision to birds. The remaining Proposed Development elements are considered in further detail below.

Disturbance / displacement and barrier effects

5.441 The operation of wind turbines and associated human activities for maintenance purposes (including maintenance of vegetation-free areas surrounding turbines as part of the mitigation for potential operational effects on bats) both have the potential to cause disturbance and displace birds from the Site. Disturbance effects during the operational phase may be less than during the construction phase, as species may become habituated to wind turbines and disturbance due to human activities would be considerably reduced.

5.442 Studies have shown that, in general, species are not displaced beyond 500 m to 800 m from wind turbines (e.g. Drewitt & Langston, 2006; Goodship & Furness, 2022), and references therein; Pearce-Higgins et al., 2009; Hötker et al., 2006) and, in some cases, birds do not appear to have been displaced at all (e.g. Devereux et al., 2008; Douglas et al., 2011; Fielding & Haworth, 2013; Whitfield et al., 2010).

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

5.444 Disturbance/displacement and barrier effects during operation may affect species in the breeding season or roosting and foraging species outside of the breeding season, within the relevant parts of the study area, i.e. close to the proposed wind turbines. Disturbance relating to the Proposed Substation and access tracks is less likely to be significant during operation.

5.445 As such, the assessment concentrates on common snipe and Eurasian woodcock, which breed within the Proposed Development. Whilst other IEF bird species may suffer some disturbance/displacement from wind turbines whilst foraging, effects are not likely to be significant given the wide availability of more optimal, alternative foraging habitats located outside the Proposed Development, the fact that relatively small numbers are within 'the displacement zone' and the lack of breeding and/or communal roosting within or nearby the Proposed Development (see paragraph 5.337).

5.446 Other species (such as black-headed gull, common kestrel, common snipe, Eurasian curlew, Eurasian teal, European golden plover, great cormorant, hen harrier, mallard, merlin, mute swan, northern lapwing, peregrine falcon, whooper swan, yellowhammer, Eurasian coot, shelduck, Eurasian wigeon, lesser black-backed gull, barn owl, meadow pipit, skylark, common gull, grey wagtail, house martin, sand martin, swallow, swift, as well as the woodland bird assemblage in general, such as goldcrest, greenfinch, house sparrow, linnet, starling, redwing and willow warbler) are therefore not considered in further detail here.

5.447 Any differences between the range of turbine permutations assessed will result in negligible changes to the direct disturbance/displacement and barrier effects assessment for IEF birds.

Common snipe and Eurasian woodcock

5.448 In the absence of mitigation/compensation, there could be *significant, negative, long-term* disturbance/displacement effects at the *county/regional scale* for foraging common snipe and Eurasian woodcock. This is a precautionary assumption, as even though displacement habitats in the wider landscape are widely available, they may be less suitable than those within the Proposed Development and could already be at carrying capacity.

5.449 Also of importance are the potential impacts of disturbance/displacement on nesting common snipe and Eurasian woodcock.

5.450 While no confirmed nests were recorded during surveys, common snipe were recorded drumming (breeding display flight) in an area located c. 875 m SE of turbine T4, according to the latest survey results, recognising that a territory has also been recorded c. 360 m NW of turbine T1 previously.

5.451 Eurasian woodcock are thought to have at least two breeding territories c. 200 m NW of turbine T5 and 0 m from turbine T3, according to the latest survey results, recognising that two territories have also been recorded in previous years in different locations.

5.452 As mentioned before, there is an evidence-based upper limit of 400 m for displacement to nesting common snipe (Pearce-Higgins et al., 2009). No evidence-based upper limit for displacement exists for Eurasian woodcock, but it is likely to be no more than 500 m, as the maximum evidence-based upper limit for displacement for other wader species is 500 m (Goodship & Furness, 2022). Thus, disturbance/displacement of breeding common snipe and Eurasian woodcock could occur, as breeding activity was located inside the ZoI for disturbance from operational activities. In the absence of compensation, there could be *negative, long-term effects* at the *county / regional scale* for both common snipe and Eurasian woodcock.

5.453 Hötker *et al.* (2006) found that ten out of 13 wind farm studies assessed had evidence for a barrier effect on wader movements, although this was statistically non-significant. The flight lines recorded for common snipe at the Proposed Development are infrequent. Consequently, common snipe does not seem to be making regular flights across the Proposed Development. Also, the layout of the turbines at the Proposed Development indicates that the energetic costs for avoiding turbines will be minimal. Overall, this suggests that it is unlikely that barrier effects will occur for common snipe and Eurasian woodcock. If these species start breeding elsewhere within the Proposed Development, then barrier effects could occur, although they are likely to be only *negligible* and at the *local scale*, as the turbine layout is dispersed and not oriented in a linear fashion, and so any energetic costs that could be incurred are likely to be minimal.

5.454 Whilst acknowledging that there are knowledge gaps regarding disturbance/displacement and barrier effects in the scientific community generally, considering the habitats present and the concentration of flights within one area of the Proposed Development, it is *likely* that any barrier effects on common snipe and Eurasian woodcock during the operation of the Proposed Development will *not be significant*.

5.455 Any differences between the range of turbine permutations assessed will result in negligible changes to the direct disturbance/displacement and barrier effects assessment for IEF common snipe and Eurasian woodcock as it is the presence of the turbines themselves that could give rise to such effects, rather than the precise turbine permutation chosen.

Collision with wind turbines

5.456 Collision of a bird with turbine rotors is almost certain to result in the death of the bird. In low density populations (e.g. raptors) this could have a greater negative effect on the local population than in higher density populations (e.g. passerines) because a higher proportion of the local population would be affected in a low-density population (Beston et al., 2016). Larger birds such as raptors also live longer and have much slower reproductive rates than passerines, which can also increase the significance of the impact of collisions on the relevant population. The frequency and likelihood of a collision occurring depends on several factors which include aspects of the size and behaviour of the bird (including their use of a site), the nature of the surrounding environment, and the structure and layout of the wind turbines.

5.457 Collision risk is perceived to be higher for birds that spend much of the time in the air, such as foraging raptors and those that have regular flight paths between feeding and breeding/roosting grounds (e.g. wildfowl). The risk of bird collisions at wind farms is greatest in areas where large concentrations of birds are present (such as on major migration routes), and in poor flying conditions, such as rain, fog, strong winds that affect birds' ability to control flight manoeuvres, or on dark nights when visibility is reduced (Langston & Pullan, 2003; Drewitt & Langston, 2006) and references therein). Birds may also be more susceptible if the wind farm is in an area of high prey density. For diurnal foraging raptors,

the proximity of structures on which to perch can increase the likelihood of collision with wind turbines (e.g. Percival, 2005, and references therein).

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

5.459 It is also recognised that habitat changes due to the Proposed Development and ongoing forestry management can change levels of risk e.g. birds of open ground may colonise recently felled areas and birds which favour old growth forests will colonise if there is no felling.

5.460 Passerines nesting within a wind farm site would be expected to be regularly flying between wind turbines and could therefore be expected to be most at risk of collision. However, passerines tend to fly below Potential Collision Height (PCH) and evidence suggests that passerines collide with wind turbines relatively infrequently compared to other groups (e.g. Dürr (2023) showed that since 2002-2023, collisions from passerines make up 31% of all collision recorded in Europe). Moreover, most of the passerine species' populations concerned are of low or negligible conservation value or are relatively large and have high reproductive rates (i.e. a 'fast' life history). Collision is therefore mainly considered in relation to species of high sensitivity, e.g. target raptor species, and species not particularly manoeuvrable in flight, such as geese and swans. Moreover, populations of birds which have a favourable conservation status (stable or increasing) are likely to be able to compensate for small increases in mortality due to improved survival or reproductive success in the remaining population (known as density dependent factors). For such populations, mortality from a wind farm may have no effect on the breeding population size the following year. The converse is true for species with unfavourable conservation status.

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

- European golden plover,
- Eurasian curlew,
- common kestrel,
- northern lapwing,
- mallard,
- peregrine falcon, and
- whooper swan.

5.462 For all other primary target species (common snipe, Eurasian woodcock, black-headed gull, great cormorant, hen harrier, merlin, mute swan), the number of flights within the Collision Risk Zone (CRZ), i.e. flights through the Wind Farm Polygon (WP) at PCH, was so low that CRM was not warranted and collision risk is considered negligible i.e the effect of collision will be *not significant* for these species.

5.463 Due to the lack of regular flight lines across the viewsheds a random (bird occupancy method) CRM was considered suitable (Band et al., 2007) and used for all IEF birds subject to modelling.

5.464 The results of the CRM are described below for each of the species modelled, along with an assessment of whether predicted collision rates are likely to be significant. Further information about predicted collision rates is provided in the avian CRM report (**Appendix 5-8** found in Volume III of this EIAR).

Rationale for prediction of effect

5.465 Without application of methods such as Population Viability Analysis (PVA) it is not fully known to what extent the populations of target species can sustain additional levels of mortality. In accordance with NatureScot (2018), we have presented the predicted mortality over the 35-year lifespan of the Proposed Development in the context of each species' population size, recent population trends and ecology, as well as empirically documented cases of collision. Significant negative effects are only likely where the number of predicted deaths due to the Proposed Development are likely to result in appreciable differences to projected rates of population decline or recovery.

5.466 Note that recent background trends may not continue over the lifespan of the Proposed Development, even if the Proposed Development did not go ahead. This is because population declines or increases may eventually plateau, depending on the drivers for the population trend. However, in absence of detailed population modelling, we have assumed that the recent trend will continue.

5.467 Any differences between the range of turbine permutations assessed will result in negligible changes to the direct collision effects assessment for IEF European golden plover, Eurasian curlew, common kestrel, northern lapwing, mallard, peregrine falcon, and whooper swan. This is because the differences in potential collision heights are very small.

5.468 However, the very minor differences are presented in **Appendix 5-8** for full transparency, with the worst-case results presented here (i.e. the highest predicted collision estimates) and any differences between the range of turbine permutations assessed will result in negligible changes to the predicted collision risk for IEF birds.

European golden plover

5.469 Forty-seven European golden plover collisions have been reported at European wind farms between 2002-2023, none of which were in GB or Ireland (Dürr, 2023). While the Dürr database clearly does not perfectly reflect reality (not all wind farm projects and countries carry out post-construction monitoring in the same way, with the same intensity, with the same level of detail and with the same degree of honesty), it represents the best estimate we have of the empirical effects of collision on European birds. Therefore, although there may be other, unpublished reports of collisions of this species, European golden plover collisions nevertheless appear to be a relatively uncommon event relative to all recorded bird collisions in Europe (0.24%).

5.470 The European golden plover flight activity survey data for the Proposed Development are shown on drawings within the baseline survey reports (**Appendix 5-8** found in Volume III of this EIAR). Flight activity was moderate, with 42 flight lines recorded across the two years of surveys and were generally not associated with the proposed turbine locations, although many of these flight lines were within the 500 m buffer for the turbines.

5.471 Collision risk analysis has been carried out on flight activity data from the 2019 breeding season and 2019/20 non-breeding season. Based on these data, 11 European golden plover flight lines (involving 2,789 flights) were recorded at PCH within the CRZ during surveys.

5.472 Assuming an avoidance rate of 99.8%, there was a mean annual collision rate of 3.047 collisions (approximately one collision every 0.3 years) predicted based on a 99.8% avoidance rate. As outlined in **Appendix 5-8** found in Volume III of this EIAR, a 99.8% avoidance rate reflects the empirical evidence from four UK wind farms. This evidence represents the most robust and appropriate data available and shows the default 98% avoidance rate is likely to be too low for European golden plover.

5.473 This has been assessed in the context of the ROI and county/regional wintering populations (there are no designated sites within the ZoI for European golden plover). For information on the populations see **Table 5-11**.

5.474 If realised, the predicted collision rate of 3.047 birds per year would result in a likely maximum of 107 deaths over the 35-year lifespan of the Proposed Development.

5.475 Based on current population trends for wintering golden plover (-17.5% decline over the last five years; Kennedy et al., 2023), the ROI population could be smaller by tens of thousands of birds over the next 35 years under a 'do nothing scenario' i.e. without the Proposed Development.

5.476 By the same token, the county / regional population could be smaller by thousands of birds by the end of the same period.

5.477 Thus, the likely maximum number of deaths due to the Proposed Development would only result in a marginal increase in the rate of population decline for this species at both the ROI and county / regional scale and would not hinder any conservation actions undertaken for the recovery of the population.

5.478 As European golden plover estimates come from IWeBS counts, which focus on wetland sites, it is likely that population estimates have been underestimated. This is because European golden plover are not found exclusively on wetlands and forage on farmlands as well (Gillings and Fuller, 1999). This therefore means that the true proportion of birds affected by the Proposed Development on European golden plover populations are likely to be even lower.

5.479 While the Irish population of European golden plover is declining, the global population is increasing (BirdLife International, 2016). This therefore suggests that the species is undergoing range shifts, likely due to climate change (e.g. Pearce-Higgins et al., 2010). The Proposed Development could marginally compensate for Irish population declines by helping ameliorate the effects of climate change.

5.480 Therefore, collision would not have an appreciable effect on the wintering population of European golden plover at the national or county / regional scale, and so *no significant effects are likely*.

Eurasian curlew

5.481 Fourteen Eurasian curlew collisions have been reported at European wind farms between 2002-2023, none of which were in GB or Ireland (Dürr, 2023). Although there may be other, unpublished reports of collisions of this species, Eurasian curlew collisions nevertheless appear to be an uncommon event relative to all recorded bird collisions in Europe (0.07%).

5.482 Collision risk analysis has been carried out on flight activity data using data from the 2019/20 non-breeding season. Based on these data, two Eurasian curlew flight lines (involving 33 flights) were recorded at PCH within the CRZ during surveys.

5.483 Assuming a 98% avoidance rate, there was a mean annual collision rate of 0.41 (approximately one collision every 2.47 years) predicted. This has been assessed in the context of the ROI and county/regional population. There is no population information for the Lough Glore pNHA population, so no quantitative estimate is possible, as it would appear there are no curlew are now present in the pNHA population. For information on the populations see **Table 5-11**.

5.484 If realised, the predicted collision rate of 0.41 birds per year would result in a likely maximum of 14 deaths over the 35-year lifespan of the Proposed Development.

5.485 Based on current population trends for wintering Eurasian curlew in Ireland (-9.4% decline over the last five years; Kennedy et al., 2023), the ROI population could be smaller by thousands of birds over the next 35 years under a 'do nothing scenario' i.e. without the Proposed Development.

5.486 By the same token, the county / regional population could be smaller by hundreds of birds by the end of the same period. The current population decline is thought to be caused by declining breeding success in Europe (Woodward et al., 2021), which may be exacerbated in Ireland due to an eastwards range shift associated with milder winters, although this is unclear (Austin and Rehfisch, 2005).

5.487 Thus, the likely maximum number of deaths due to the Proposed Development would only result in a marginal increase in the rate of population decline for this species at both the ROI and county / regional scale and would not hinder any conservation actions undertaken for the recovery of the population.

5.488 Therefore, collision would not have an appreciable effect on the wintering population of Eurasian curlew at the national or county / regional scale, and so *no significant effects are likely*.

Common kestrel

5.489 Eight hundred and sixty-seven common kestrel collisions have been reported at European wind farms between 2002-2023 (Dürr, 2023), with two in GB (both in Scotland). There is only evidence of two birds being killed by wind turbine strike in Ireland between 2007 and 2019 (NPWS, 2019). Although there may be other, unpublished reports of collisions of this species, it seems that kestrel collisions in Ireland at least, are relatively uncommon events relative to all recorded bird collisions in Europe (0.01%).

5.490 Collision risk analysis has been carried out on flight activity data using data from the 2019, 2020 and 2021 breeding seasons and 2019/20 and 2020/21 non-breeding seasons. Based on these data, 28 kestrel flight lines (involving 30 flights) were recorded at PCH within the CRZ during surveys.

5.491 Assuming a 95% avoidance rate, there was a mean annual collision rate of 0.57 (approximately one collision every 1.76 years) predicted. This has been assessed in the context of the ROI and county/regional population. There is no population information for the Lough Glore pNHA population, so no quantitative estimate is possible and as explained in paragraph 5.420, birds at the Proposed Development are unlikely to be from the pNHA population. For information on the populations see **Table 5-11**.

5.492 If realised, the predicted collision rate of 0.57 birds per year would result in a maximum of 20 deaths over the 35-year lifespan of the Proposed Development.

5.493 Based on current population trends for common kestrel in Ireland (-53% decline in the breeding population over the last 20 years; Gilbert et al., 2021), the ROI population could be smaller by tens of thousands of birds over the next 35 years under a 'do nothing scenario' i.e. without the Proposed Development.

5.494 By the same token, the county / regional population could be smaller by hundreds of birds by the end of the same period.

5.495 Thus, the likely maximum number of deaths due to the Proposed Development would only result in a marginal increase in the rate of population decline for this species at both the ROI and county / regional scale and would not hinder any conservation actions undertaken for the recovery of the population.

5.496 Therefore, collision would not have an appreciable effect on the population of common kestrel at the national or county / regional scale, and so *no significant effects are likely*.

Northern lapwing

5.497 Thirty-one northern lapwing collisions have been reported at European wind farms between 2002-2023, none of which were in GB or Ireland (Dürr, 2023). Although there may be other, unpublished reports of collisions of this species, northern lapwing collisions nevertheless appear to be an uncommon event relative to all bird collisions recorded in Europe (0.16%).

5.498 Collision risk analysis has been carried out on flight activity data using data from the 2019/20 non-breeding season and 2020 breeding season. Based on these data, four northern lapwing flight lines (involving 28 flights) were recorded at PCH within the CRZ during surveys.

5.499 Assuming a 98% avoidance rate, there was a mean annual collision rate of 0.25 (approximately one collision every 4.06 years) predicted. This has been assessed in the context of the ROI, county/regional population and Lough Glore pNHA population. For information on the populations see Table 5-11. For designated sites, a precautionary assumption has been made that all birds flying through the Proposed Development are from the relevant designated site population.

5.500 If realised, the predicted collision rate of 0.25 birds per year would result in a maximum of 9 deaths over the 35-year lifespan of the Proposed Development.

5.501 Based on current population trends for wintering (-6.5% decline over the last five years; Kennedy et al., 2023) and breeding northern lapwing in Ireland (-74% decline over the last 20 years; Gilbert et al., 2021), the ROI population could be smaller by tens of thousands (wintering population) and thousands (breeding population) of birds over the next 35 years under a 'do nothing scenario' i.e. without the Proposed Development.

5.502 By the same token, the county / regional population could be smaller by hundreds of birds by the end of the same period for both wintering and breeding populations.

5.503 Thus, the likely maximum number of deaths due to the Proposed Development would only result in a marginal increase in the rate of population decline for this species at both the ROI and county / regional scales and would not hinder any conservation actions undertaken for the recovery of the population.

5.504 Therefore, collision would not have an appreciable effect on the wintering and breeding population of northern lapwing at the national or county / regional scale, and so *no significant effects are likely*.

5.505 As explained in paragraph 5.420, Lough Glore pNHA is likely to be outside of the core foraging range for wintering lapwing. Therefore, it is unlikely that birds recorded at the Proposed Development are from population at Lough Glore pNHA and so *no significant effects* are likely.

Mallard

5.506 Four hundred and five mallard collisions have been reported at European wind farms between 2002-2023, none of which were in GB or Ireland (Dürr, 2023). Although there may be other, unpublished reports of collisions of this species, it seems that mallard collisions in Ireland at least, are relatively uncommon events.

5.507 Collision risk analysis has been carried out on flight activity data using data from the 2019/20 non-breeding season. Based on these data, four mallard flight lines (involving 19 flights) were recorded at PCH within the CRZ during surveys.

5.508 Assuming a 98% avoidance rate, there was a mean annual collision rate of 0.19 (approximately one collision every 5.32 years) predicted. This has been assessed in the context of the ROI and county/regional population. There are no national designated sites

for mallard (international designated sites have been assessed in the NIS shown in **Appendix 15-11** found in Volume III of this EIAR). For information on the populations see Table 5-11.

5.509 If realised, the predicted collision rate of 0.19 birds per year would result in a maximum of 7 deaths over the 35-year lifespan of the Proposed Development.

5.510 Based on current population trends for wintering (-11.3% decline over the last five years; Kennedy et al., 2023) mallard in Ireland, the ROI population could be smaller by thousands of birds over the next 35 years under a 'do nothing scenario' i.e. without the Proposed Development.

5.511 By the same token, the county / regional population could be smaller by hundreds of birds by the end of the same period.

5.512 Thus, the likely maximum number of deaths due to the Proposed Development would only result in a marginal increase in the rate of wintering population decline for this species at both the ROI and county / regional scale and would not hinder any conservation actions undertaken for the recovery of the population.

5.513 This species is not amber-listed on the basis of its breeding population i.e. the breeding population has not undergone moderate declines. This means that any effects of collision on the breeding population at ROI or county / regional scales are not likely to be appreciable, because density-dependent effects, such as availability of food resources, are more likely to affect the breeding population for this species.

5.514 Therefore, collision would not have an appreciable effect on the wintering or breeding population of mallard at the national or county / regional scale, and so *no significant effects are likely*.

Peregrine falcon

5.515 Forty-six peregrine collisions have been reported at European wind farms between 2002-2023, one of which was in GB (in Scotland) (Dürr, 2023). There is no evidence of this species being killed by wind turbine strike in Ireland between 2007 and 2019 (NPWS, 2019). Although there may be other, unpublished reports of collisions of this species, peregrine falcon collisions nevertheless appear to be an uncommon event.

5.516 Collision risk analysis has been carried out on flight activity data using data from the 2019/20 and 2020/21 non-breeding seasons and 2021 breeding season. Based on these data, eight peregrine flight lines (involving eight flights) were recorded at PCH within the CRZ during surveys.

5.517 Assuming a 98% avoidance rate, there was a mean annual collision rate of 0.08 (approximately one collision every 12.53 years) predicted. This has been assessed in the context of the ROI and county/regional population. There are no national designated sites for peregrine (international designated sites have been assessed in the NIS shown in **Appendix 15-11** found in Volume III of this EIAR). For information on the populations see **Table 5-11**.

5.518 If realised, the predicted collision rate of 0.08 birds per year would result in a maximum of 3 deaths over the 35-year lifespan of the Proposed Development.

5.519 Based on current population trends for peregrine falcon in Ireland (+24.9% increase over the 10-year period from 2002-2012; NPWS, 2022), the ROI population could be bigger by thousands of birds over the next 35 years under a 'do nothing scenario' i.e. without the Proposed Development.

5.520 By the same token, the county / regional population could be bigger by scores of birds by the end of the same period.

5.521 As the population is increasing, any deaths are likely to be compensated by increased survival or breeding success in the survivors, and therefore there can be no appreciable effect on the resident population or the rate of population increase for this species at both the ROI and county / regional scale.

5.522 Therefore, collision would not have an appreciable effect on the population of peregrine falcon at the national or county / regional scale, and so *no significant effects are likely*.

Whooper swan

5.523 Ten whooper swan collisions have been reported at European wind farms between 2002-2023, with none in GB or Ireland (Dürr, 2023), so appears to be a relatively uncommon event relative to the total number of collisions recorded in Europe (0.05%).

5.524 Collision risk analysis has been carried out on flight activity data using data from the 2019/20 and 2020/21 non-breeding seasons. Based on these data, five whooper swan flight line (involving 25 flights) were recorded at PCH within the CRZ during surveys.

5.525 Assuming a 99.5% avoidance rate, there was a mean annual collision rate of 0.29 (approximately one collision every 3.40 years) predicted. This has been assessed in the context of the ROI and county/regional population. There are no national designated sites for whooper swan (international designated sites have been assessed in the NIS shown in **Appendix 15.11** found in Volume III of this EIAR). For information on the populations see **Table 5-11**.

5.526 If realised, the predicted collision rate of 0.29 birds per year would result in a maximum of 14 deaths over the 35-year lifespan of the Proposed Development.

5.527 Based on current population trends for wintering whooper swan in Ireland (+24.9% increase over the last five years; Burke et al., 2021), the ROI population could be bigger by tens of thousands of birds over the next 35 years under a ‘do nothing scenario’ i.e. without the Proposed Development.

5.528 By the same token, the county / regional population could be bigger by thousands of birds by the end of the same period.

5.529 As the population is increasing, any deaths are likely to be compensated by increased survival or breeding success in the survivors, and therefore there can be no appreciable effect on the resident population or the rate of population increase for this species at both the ROI and county / regional scale.

5.530 Therefore, collision would not have an appreciable effect on the wintering population of whooper swan at the national or county / regional scale, and so *no significant effects are likely*.

Indirect Effects

5.531 If hydrocarbon spills during the operation of the Proposed Development led to pollution of wetland habitats and/or dewatering of groundwater-dependent habitats within nearby designated sites for birds, it could result in indirect habitat loss for qualifying bird species. The same is true for wetland sites that could be used by bird species from nearby designated sites, even if those wetland sites are not designated themselves.

5.532 As concluded by **Chapter 7**, with embedded mitigation measures in place there will be no significant effects on any wetland site and so there can be no significant indirect effects on any bird species as a result.

5.533 Any differences between the range of turbine permutations assessed will result in negligible changes to the indirect effects assessment for IEF birds, as the potential for hydrocarbon spills or dewatering is independent from the turbine permutation chosen.

Terrestrial Mammals (Excluding Bats)

Direct Effects

5.534 Inappropriately timed vegetation removal for bat mitigation buffers could result in direct impacts on breeding or resting sites for arboreal (red squirrel and pine marten) or ground-dwelling mammals (badger and hedgehog). As shown in paragraph 5.235 onwards, there were no mammal breeding or resting sites recorded during the surveys within or in any proximity to the bat mitigation buffers. If vegetation within the buffers requires removal (e.g. re-vegetation of Sitka spruce saplings), then it is unlikely that it will be suitable for breeding Irish hare, which prefer grassland or bracken habitats.

5.535 Therefore, it is *unlikely* there will be any *significant direct effects* on badger, red squirrel, pine marten or hedgehog.

5.536 Inappropriately timed vegetation removal could cause significant effects on hedgehog at the local scale if it destroys occupied hibernacula in the absence of mitigation.

5.537 Any differences between the range of turbine permutations assessed will result in negligible changes to the direct effects predicted for IEF mammals, as the timing of vegetation removal is independent from the turbine permutation chosen.

Indirect Effects

5.538 Mammals including badgers are tolerant of operational wind farms, with little disturbance/displacement from the turbines themselves or personnel because most are nocturnal and most personnel are active during the day, thereby avoiding direct contact. Similarly, many mammals are thought to habituate to low levels of noise from operational turbines (Helldin et al., 2012).

5.539 Of more importance is vegetation removal for bat mitigation buffers, which could result in short-term displacement of foraging, commuting, or sheltering mammals in any adjacent areas. However, given the fact that PAW habitats are likely to be preferentially used (and will not be felled), plus an abundance of suitable displacement habitats in the wider area, this is unlikely to occur.

5.540 Hibernating hedgehogs could be disturbed by vegetation removal activities, causing them to wake from hibernation prematurely. This could cause mortality, especially if sufficient food is unavailable. For hedgehog, there could be *significant indirect effects* due to disturbance *at the local scale*. For badger, pine marten, red squirrel and Irish hare, *no significant effects are likely*.

5.541 Any differences between the range of turbine permutations assessed will result in negligible changes to the indirect effects predicted for IEF mammals as there are likely no significant differences in the levels of noise, levels of personnel present or amount of foraging/commuting/sheltering habitat predicted to be lost regardless of the turbine permutation chosen.

Bats

Direct Effects

5.542 Potential direct effects include:

- collision with wind turbines; and
- barotrauma (injuries to internal air cavities and blood vessels caused by sudden changes in air pressure behind a moving blade).

5.543 Bat species likely to be at risk from these two effects relates to the likelihood that the species will fly at PCHs in an open landscape. The probability of direct impacts is higher when a turbine is located near a habitat feature such as a hedgerow, treeline or forest edge. NatureScot (2021) guidance requires that vegetation is cleared to reduce the proximity of such habitat features to operational wind turbines, reducing the probability of direct effects on bats. The potential for any likely effects must be considered within the context of this 'good-practice' mitigation. The extent of bat mitigation felling areas is shown in **Figure 5-9**. Felling will take place in the construction phase (see paragraph 5.380 for effects on bats), with smaller scale vegetation removal required throughout the operational phase (see below for indirect effects on bats).

5.544 In the absence of Ecobat, the overall risk presented to each species by collision was calculated by adapting Table 3b from NatureScot (2021) guidance, substituting Ecobat activity category for vulnerability of bat species populations. This is acceptable, with the guidance stating that an equivalent justification instead of Ecobat category can be used.

5.545 An assessment of direct effects is provided for each bat species recorded during surveys below.

5.546 Any differences between the range of turbine permutations assessed will result in negligible changes to the direct collision effects assessment for IEF bats. This is because the differences in potential collision heights are very small.

Common and soprano pipistrelle

5.547 Common pipistrelle and soprano pipistrelle populations are thought to be at high risk of direct effects from operational turbines (NatureScot, 2021). Both species typically use woodland/plantation edge, scrub, treelines and hedgerows for foraging and commuting. Some of the proposed infrastructure is close to or involves the removal or trimming of these features. In Europe, 3,401 and 494 fatalities were recorded for common pipistrelle and soprano pipistrelle between 2002-2023, respectively, with 46 and 52 recorded in the UK (Dürr, 2023). Therefore, relative to all recorded bat collisions in Europe, common and soprano pipistrelle collisions are relatively uncommon (0.37% and 0.41%, respectively). Mathews et al. (2016) found that both pipistrelle species were most recorded as fatalities at operational wind farms in the UK (34.59% and 39.1% of total fatalities, respectively).

5.548 The overall risk was calculated based on species' population vulnerability to wind farms and the site risk level (based on habitat features present and the size of the Proposed Development).

5.549 Overall, common pipistrelle and soprano pipistrelle populations are classified as having 'medium vulnerability' to wind farm developments, which is assumed to be equivalent to Ecobat activity category of 'moderate – 3'. Combined with a site risk level of 'high - 4', this gave an overall risk assessment of 'medium - 12' for common pipistrelle and soprano pipistrelle.

5.550 Some of the infrastructure proposed for the Proposed Development is close to or overlaps with features used for foraging and commuting.

5.551 Across all turbines, the season with the highest common and soprano pipistrelle activity levels was summer. Turbines T1, T2, T7 and T8 had the highest common pipistrelle activity but turbines T3, T4, T5, T6 and T7 had lower common pipistrelle activity. Turbines T2 and T8 had the highest soprano pipistrelle activity but turbines T1, T3-T7 had lower soprano pipistrelle activity. There was also a low level of 'at-height' flight activity.

5.552 Without mitigation, operational phase impacts are *likely* to have *significant effects* on common and soprano pipistrelle populations *at the local level*.

Nathusius' pipistrelle

5.553 Nathusius' pipistrelle populations are thought to be at high risk of direct effects from operational turbines (NatureScot, 2021). This species regularly flies in the open at height, especially during bat migration, which occurs prior to hibernation in late autumn. In Europe, 1,792 fatalities were recorded between 2002-2023 (Dürr, 2023), with one recorded in the UK. Therefore, relative to all recorded bat collisions in Europe, Nathusius' pipistrelle collisions are relatively uncommon (0.008). Rydell et al. (2010) found that the species made up 13% of fatalities at operational wind farms in the UK.

5.554 The overall risk was calculated based on species' population vulnerability to wind farms and the site risk level (based on habitat features present and the size of the Proposed Development).

5.555 Overall, Nathusius' pipistrelle populations are classified as having 'high vulnerability' to wind farm developments, which is assumed to be equivalent to Ecobat activity category of 'high – 5. Combined with a site risk level of 'high - 4', this gave an overall risk assessment of 'high - 18' for Nathusius' pipistrelle.

5.556 There was no evidence this species used any vegetation features near the Proposed Development for commuting and foraging during dedicated transect surveys.

5.557 Across all turbines, the seasons with the highest Nathusius' pipistrelle activity levels were summer and autumn, although activity was very low. Turbines T1, T2, T4 and T8 had the highest activity and all other turbines had lower activity. There was also a low level of 'at-height' flight activity.

5.558 Without mitigation, operational phase impacts are *unlikely* to have *significant effects* on Nathusius' pipistrelle populations, given the very low levels of flight activity at the Proposed Development.

Leisler's bat

5.559 Leisler's bat populations are thought to be at high risk of direct effects from operational turbines (NatureScot, 2021). This species regularly flies over open habitats at height. In Europe, 813 fatalities were recorded between 2002-2023 (Dürr, 2023), with zero in the UK. Leisler's bat are much more common in Ireland than the UK and so this may not give a true picture of the level of fatalities in Ireland. For example, Mathews et al. (2016) found common noctule bats were among the most recorded bat fatalities at operational wind farms in the UK. While this is a different species to Leisler's bat, they exhibit similar patterns of flight behaviour to Leisler's bat and so collision risk is also likely to be similar.

5.560 The overall risk was calculated based on species' population vulnerability to wind farms and the site risk level (based on habitat features present and the size of the Proposed Development).

5.561 Overall, Leisler's bat populations are classified as having 'high vulnerability' to wind farm developments, which is assumed to be equivalent to Ecobat activity category of 'moderate-high – 4'. Combined with a site risk level of 'high - 4', this gave an overall risk assessment of 'high - 15' for Leisler's bat.

5.562 Proposed Development infrastructure is not close to any features used by foraging or commuting Leisler's bats. There is also a moderate level of 'at-height' activity.

5.563 Across all turbines, the season with the highest Leisler's bat activity levels was summer. Turbines T7 and T8 had the highest activity and all other turbines had lower activity.

5.564 Without mitigation, operational phase impacts are *likely* to have *significant effects* on Leisler's bat populations *at the local level*.

Daubenton's bat, Natterer's bat and whiskered bat

5.565 Populations of bats within the *Myotis* genus are thought to be at low risk of direct effects from operational turbines (NatureScot, 2021). In Europe, 12, six and eight fatalities were recorded for Daubenton's bat, Natterer's bat and whiskered bat, respectively between 2002-2023 (Dürr, 2023). Mathews et al. (2016) found *Myotis* species were among the least recorded bat fatalities at operational wind farms in the UK, with only a single Natterer's bat collision recorded between 2002-2023. Most Myotis bat species fly at heights of 20-30 m, prefer cluttered habitats and have high levels of manoeuvrability (Mathews et al., 2016; Rydell, et al., 2010).

5.566 Activity for these three species was very low across all turbine locations and seasons. Therefore, even without mitigation, operational phase impacts are *unlikely* to have *significant effects* on Daubenton's bat, Natterer's bat and whiskered bat populations.

Brown long-eared bat

5.567 Populations of brown long-eared bat are thought to be at low risk of direct effects from operational turbines (NatureScot, 2021). This species typically flies at low heights and close to vegetation. In Europe, nine fatalities were recorded between 2002-2023 (Dürr, 2023). Mathews et al. (2016) found brown long-eared bats were among the least recorded bat fatalities at operational wind farms in the UK, with only a single fatality recorded between 2002-2023.

5.568 Activity for brown long-eared bat was very low across all turbine locations and seasons. Therefore, even without mitigation, operational phase impacts are *unlikely* to have *significant effects* on brown long-eared bat populations.

Indirect Effects

5.569 Indirect effects due to operational lighting could disturb or displace roosting or foraging bats. However, the installation of lighting on the turbines themselves is to be minimal. There will be lighting poles at the Proposed Substation, which could displace light-sensitive bat species, although this is likely to be only for species foraging along hedgerows, as no known or suspected roosts were identified by desktop or field surveys.

5.570 Leisler's bat, and common and soprano pipistrelle, are less sensitive to light disturbance than the other species of bat recorded at the Proposed Development (Nathusius' pipistrelle, Natterer's bat, Daubenton's bat, whiskered bat and brown long-eared bat). These three species were the most frequently recorded bats.

5.571 Overall, indirect effects on bats are *unlikely* to be *significant*.

5.572 Any differences between the range of turbine permutations assessed will result in negligible changes to the indirect effect assessment for IEF bats as lighting will be independent from the turbine permutation chosen.

Other Protected Fauna

Direct and Indirect Effects

5.573 No direct or indirect impacts on common frog, smooth newt and marsh fritillary butterfly are predicted during the operational phase. This is because proposed infrastructure has been deliberately located to avoid the marsh fritillary butterfly breeding area and so no effects of habitat loss due to maintenance of bat felling buffers will occur. No known common frog and smooth newt breeding areas are located within the same.

5.574 Any differences between the range of turbine permutations assessed will result in negligible changes to the direct and indirect effect assessment for IEF 'other fauna'.

Fisheries and Aquatic Ecology

Direct Effects

5.575 No IEF aquatic habitats or species are located within the Proposed Development Site, therefore it is *unlikely* there will be any *significant direct effects* during the operational phase.

5.576 Any differences between the range of turbine permutations assessed will result in negligible changes to the direct effect assessment for IEF fish and aquatic ecology.

Indirect Effects

5.577 Potential indirect effects include release of suspended solids, cement, concrete or hydrocarbons into watercourses as described in paragraph 5.396 onwards, which could travel downstream to IEFs including Atlantic salmon, brook lamprey, European eel, white-clawed crayfish and otter. The same secondary effects therefore apply as described for the construction phase.

5.578 In the absence of mitigation, there *could be significant effects* on Atlantic salmon, brook lamprey, European eel, white-clawed crayfish and otter *at the county/regional scale*.

5.579 Any differences between the range of turbine permutations assessed will result in negligible changes to the indirect effects predicted for IEF fish and aquatic ecology, as the potential accidental release of pollutants into watercourses is independent from the turbine permutation chosen.

Potential Decommissioning Phase Impacts

5.580 Some effects are predicted to be like the effects described for the construction e.g. disturbance or displacement to IEF birds, bats and mammals via increased noise levels/light levels/presence of construction workers, ground clearance works and reinstatement. This is due to similar activities taking place as for the construction phase. Surface water quality could also be affected via ground disturbance, refuelling and accidental release of hazardous materials stored onsite, which could affect IEF designated sites and fish/aquatic ecology. Invasive plants could also be spread, which could affect habitats.

5.581 Other effects are also predicted to be like the construction phase (as similar activities will take place) but of slightly lower magnitude e.g. there will be no excavation of turbine

foundations, which will be left in situ and covered with soil for reinstatement, which will result in less habitats being lost. Building materials will not be required and access tracks will also remain, subject to planning permission.

5.582 For brevity, a full list of effects is given in paragraph 5.297 onwards for the construction phase and it can be assumed that the same effects will occur for the decommissioning phase.

5.583 Any differences between the range of turbine permutations assessed will result in negligible changes to the effects assessed for all IEF receptors during the decommissioning phase, as set out for the construction phase, because any differences in habitat loss, disturbance or displacement, or accidental pollution will be very small between the range of turbine permutations.

CUMULATIVE IMPACT ASSESSMENT

5.584 A full list of wind farms and other projects within 20 km of the Proposed Development are shown in **Appendix 1-1** found in Volume III of this EIAR, with details of data sources and search time periods given there. This 20 km search distance is recommended by Irish Wind Energy Association (IWEA) (2012) guidelines. A summary is provided in **Table 5-13** below.

Table 5-13: Other Developments within 20 km of the Proposed Development

Development Type	Name	Distance (km) / Direction	Details	Hydro – or Hydrogeological Connection
Wind Farm	Bracklyn Wind Farm	5 km / south	Consented 2022 (ABP PA25M.311565); 9 no. turbines	N – no downstream hydrological connection. Y - Potential remote hydrogeological connection as in same groundwater body.
	Ballivor Wind Farm	4.8 km / south	Pending approval (ABP PA25M.316212); 26 no. turbines	N – no downstream hydrological connection. Y - Potential remote hydrogeological connection as in same groundwater body.
	Dryderstown Single Turbine	6.7 km / southwest	Constructed (Westmeath County Council 12/2054); 1 no. turbine	N – no downstream hydrological connection. Y - Potential remote hydrogeological

Development Type	Name	Distance (km) / Direction	Details	Hydro – or Hydrogeological Connection
				connection as in same groundwater body.

Potential Construction Phase Cumulative Impacts

5.585 Likely cumulative effects resulting from the construction phase are limited to water quality changes to watercourses draining the Proposed Development. Thus, other existing or proposed projects could have an additive or incremental effect on water quality over the short term. In the absence of mitigation, these effects have the potential to be significant for both downstream nature conservation sites (e.g. the River Boyne and River Blackwater cSAC and River Boyne and River Blackwater SPA) and aquatic receptors (e.g. Atlantic salmon, brook lamprey, European eel, white clawed-crayfish and otter).

5.586 Significant negative cumulative effects to water quality could occur if any consented or proposed projects are constructed at the same time as the Proposed Development and without mitigation.

5.587 There are no operational, consented or proposed developments with hydrological connections to the Proposed Development (see **Table 5-13**). While there are some hydrogeological connections, most of these are remote and/or unlikely to have any impact on groundwater.

5.588 The projects considered most likely to be constructed at the same time as the Proposed Development are those in the planning system that are not yet consented.

5.589 Similarly, Westmeath and Meath both have county development plans that provide a framework for land use developments and activities with potential for construction and operation source effects throughout the two counties.

5.590 In terms of water quality, four sites (A4 on the Athboy River, B3 and B5 on the D'arcy's Crossraods Stream and B6 on the Stonyford River) achieved good status, three sites (B4 on D'arcy's Crossroads Stream, B7 on the Stonyford River and B8 on the Cavetown and Rosmead Stream) achieved moderate status and the other sites (A1 on unnamed drainage channel, A3 on Kilrush Lower Stream, B1 on the Killacroy Stream and B9 on the Stonyford River) achieved moderate-poor or poor status.

5.591 There are no Section 4 discharges to water linked to the watercourses that drain from the Proposed Development Site within a 40 km instream distance.

5.592 There are also no sites with an Industrial Emissions (IE) licence that drain to watercourses that drain from the Proposed Development Site within a 40 km instream distance.

5.593 Overall, considering the existing effects of diffuse water pollution and in the absence of mitigation for the Proposed Development, secondary cumulative effects on freshwater ecology are *likely* to be *significant* for Atlantic salmon, brook lamprey, European eel, white-clawed crayfish and otter at the *county / regional scale*. This is almost entirely due to the WCDP and the MCDP.

5.594 Natura 2000 sites are considered fully in the NIS (shown in **Appendix 15-11** found in Volume III of this EIAR). The conclusion of the NIS was that, with mitigation, there would not be an adverse effect on the integrity of any Natura 2000 sites because of the Proposed Development, individually or in combination with all other projects and plans. In EIA terms, this means there are no likely significant cumulative effects on Natura 2000 sites.

5.595 Any differences between the range of turbine permutations assessed will result in negligible changes to the cumulative effects assessed for all IEF receptors during the construction phase.

Potential Operational Phase Cumulative Impacts

5.596 Operational impacts will occur because of the turbines, hardstands, access track and Proposed Substation. As the grid connection will be located underground, there will be no operational impacts due to underground cabling/ducting.

5.597 The proposed lifespan of the Proposed Development is 35 years, therefore for ornithology and bat receptors, the duration of effects is likely to be long-term. As the footprint of the Proposed Development is within a landscape highly modified by agriculture and forestry, any effects due to habitat loss are fully reversible, as most habitats due to be lost are also highly modified e.g. improved agricultural grasslands, conifer plantation and plantation-type broadleaved woodland.

5.598 In the absence of mitigation, possible cumulative impacts include:

- deterioration of water quality within the catchment with potential for downstream effects on QI species and habitats within the River Boyne and River Blackwater cSAC and River Boyne and River Blackwater SPA,
- collision risk and barrier effects on sensitive bird populations,
- local habitat loss/indirect disturbance effects on birds and bats, and
- collision risk impacts on bat populations.

Water quality

5.599 There are several operational, consented and proposed developments with hydrogeological (but not with downstream hydrological) connections to the Proposed Development (see Table 5-13). Similarly, Westmeath and Meath both have county development plans that provide a framework for land use developments and activities with potential for construction and operation source effects throughout the two counties.

5.600 The main sources of effects on water quality due to the Proposed Development are likely be due to run-off from bare ground exposed by felling to create bat mitigation buffers. Any effects are likely to be short-term, as the areas will re-vegetate. If any infrastructure is poorly designed, engineered or constructed, increased runoff and sedimentation could occur from turbine hardstands and access tracks. Similarly, if reinstatement works along the Cable Corridor are not undertaken correctly, then they could pose a risk to watercourses and aquatic receptors. Service vehicles could also accidentally spill small volumes of hydrocarbons when accessing the operational Proposed Development.

5.601 Without mitigation for the Proposed Development, the Proposed Development alone could potentially have significant negative effects on downstream designated sites (River Boyne and River Blackwater cSAC and River Boyne and River Blackwater SPA) and receptors including Atlantic salmon, brook lamprey, European eel, white-clawed crayfish and otter (see paragraphs 5.311 and 5.396). The same is true when considered in combination with other projects or plans. There is potential for *significant negative effects* at the *county/regional scale* for Atlantic salmon, brook lamprey, white-clawed crayfish, European eel and otter.

5.602 Natura 2000 sites are considered fully in the NIS (shown in **Appendix 15-11** found in Volume III of this EIAR). The conclusion of the NIS was that, with mitigation, there will not be an adverse effect on the integrity of any Natura 2000 sites because of the Proposed

Development in combination with all other projects and plans. In EIA terms, this means there are no likely significant cumulative effects on Natura 2000 sites.

5.603 Any differences between the range of turbine permutations assessed will result in negligible changes to the cumulative effects assessed for all IEF fish and aquatic ecology receptors during the operational phase.

Birds

5.604 Likely significant cumulative impacts on birds are limited to those occurring due to the Proposed Development and other wind farms. These effects are:

- displacement,
- collision, and
- barrier effect.

5.605 There are two no. wind farm developments and a single turbine located in proximity to the Proposed Development (see **Chapter 2**); however, only some have details of collision risk assessments undertaken, as summarised below.

Bracklyn Wind Farm

5.606 According to the EIAR written in 2022 by Woodrow Sustainable Solutions Ltd, bird surveys carried out to inform the planning application recorded the following target species: common buzzard, common kestrel, common snipe, Eurasian sparrowhawk, European golden plover, Greenland white-fronted goose, lesser black-backed gull, mallard and northern lapwing.

5.607 Given the separation distance, there is no realistic potential for significant cumulative barrier effects or operational displacement upon IEF bird species. In terms of collision risk, quantitative assessment was undertaken, so quantitative cumulative collision risk assessment is also possible. The predicted numbers of collisions/year and the significance of effects were given as:

- Common buzzard 0.36 negligible effect and not significant at national scale,
- Common kestrel 0.22 effect of low significance on local population,
- Common snipe 0.013 negligible and not significant effect,
- Eurasian sparrowhawk negligible effect and not significant at national scale,
- European golden plover 4.30 negligible and not significant effect at the local scale,
- Greenland white-fronted goose 0.01 negligible and not significant effect,
- Lesser black-backed gull 0.995 negligible and not significant effect,
- Mallard 0.014 negligible and not significant effect, and
- Northern lapwing 0.057 negligible and not significant effect at the national scale.

5.608 Therefore, there is the potential for significant cumulative effects to occur in combination with the Proposed Development for bird species that are present both at the Proposed Development and Bracklyn Wind Farm (common kestrel, common snipe, European golden plover, mallard and northern lapwing).

Ballivor Wind Farm

5.609 According to the EIAR written in 2023 by MKO, bird surveys carried out to inform the planning application recorded the following target species: European golden plover, hen harrier, kingfisher, merlin, peregrine falcon, whooper swan, barn owl, common kestrel, northern lapwing, common snipe, Eurasian woodcock, common buzzard, long-eared owl and Eurasian sparrowhawk.

5.610 Given the separation distance, there is no realistic potential for significant cumulative barrier effects or operational displacement upon IEF bird species. In terms of collision risk, quantitative assessment was undertaken, so quantitative cumulative collision risk assessment is also possible. The predicted numbers of collisions/year and the significance of effects were given as:

- European golden plover 15.527 long-term slight negative,
- Hen harrier 0.003 long-term imperceptible,
- Kingfisher no effect as never recorded at PCHs,
- Merlin 0.014 negligible,
- Peregrine falcon 0.224 long-term slight negative,
- Whooper swan 1.342 long-term slight negative,
- Barn owl no effect as never recorded at PCHs,
- Common kestrel 2.21 long-term slight negative,
- Northern lapwing 0.145 long-term slight negative for breeding population and 2.64 long-term slight negative for wintering population,
- Common snipe 0.237 long-term imperceptible,
- Eurasian woodcock no effect as never recorded at PCHs,
- Common buzzard 2.48 long-term slight negative,
- Long-eared owl no effect as never recorded at PCHs, and
- Eurasian sparrowhawk 0.097 long-term imperceptible.

5.611 Therefore, there is the potential for significant cumulative effects to occur in combination with the Proposed Development for bird species that are present both at the Proposed Development and Ballivor Wind Farm (European golden plover, peregrine falcon, whooper swan, common kestrel, northern lapwing and common snipe)).

Dryderstown Single Turbine

5.612 According to the Further Information Request response document written in 2013 by Jennings O'Donovan & Partners, bird surveys carried out to inform the further information request response recorded a single flight line of common kestrel and Eurasian sparrowhawk.

5.613 Given the separation distance, there is no realistic potential for significant cumulative barrier effects or operational displacement upon IEF bird species. In terms of collision risk, qualitative assessment was undertaken for the Dryderstown turbine impact assessment. A quantitative cumulative collision risk assessment is therefore not possible. Predicted risk of collision effects was described as low risk, as it is just a single turbine. Therefore, it is unlikely that any significant cumulative effects will occur in combination with the Proposed Development.

Cumulative collision risk

5.614 Where collision risk has been analysed quantitatively, the number of collisions per year can be summed together to obtain an estimate of cumulative collision risk. This is the most usable approach for assessing cumulative collision risk and is recommended by NatureScot (2018) guidance; however, may not reflect biological realism and can leave to individual errors being compounded (Humphreys et al., 2016).

5.615 The approach of summing together the number of collisions has been undertaken in below in **Table 5-14** for IEF birds present at the Proposed Development where collision risk modelling has been undertaken. It must be acknowledged that these cumulative estimates are likely to over-represent collision risk, as all flights within 500 m of the turbines were included for collision risk modelling. Similarly, assessment is based on adult rather than juvenile survival (lower survival rates mean that any deaths due to collision with turbines is

likely to have less of an effect on a population) and so the realised risk to avian populations is likely to be less. Avoidance rates used are highly precautionary and the default 98% avoidance rate used (see **Appendix 5-8** found in Volume III of this EIAR) is not based on empirical evidence. Again, this is likely to produce an overestimate of true collision risk.

5.616 For all the avian IEFs mentioned above (European golden plover, Eurasian curlew, common kestrel, northern lapwing, mallard, peregrine falcon and whooper swan), it is *unlikely* there will be any cumulative significant effects due to the operation of the Proposed Development. Consequently, with respect to all bird species, the Proposed Development would not be contrary to Ireland's obligations under the Birds Directive, Regional Policy Objective 7.22 (targets for, *inter alia*, protected species), nor WCDP Policy CPO 12.13 (Protect, manage and enhance…biodiversity) and MCDP HER Obj 35 (No significant adverse impact…on bird species protected by law).

5.617 Cumulative effects on SPAs are fully considered within the NIS shown in **Appendix 15-11** found in Volume III of this EIAR. The conclusion from the NIS was that, with mitigation, there would not be an adverse effect on the integrity of any Natura 2000 sites because of the Proposed Development in combination with all other projects and plans. In EIA terms, this means there are no likely significant cumulative effects on Natura 2000 sites.

5.618 Any differences between the range of turbine permutations assessed will result in negligible changes to the direct cumulative collision effects assessment for IEF birds. This is because the differences in potential collision heights are very small.

Bats

5.619 Likely significant cumulative impacts on bats are limited to those occurring due to the Proposed Development and other wind farms. These effects are:

- collision, and
- barotrauma.

5.620 Potential cumulative operational effects need to be considered in light of bat mitigation buffers, which will be created during the construction phase. This will ensure there is a minimum separation distance of 50 m from blade tip to any likely commuting or foraging habitat feature. Bat mitigation buffers will be maintained over the lifespan of the Proposed Development.

5.621 There are two no. wind farm developments and one single turbine located in proximity to the Proposed Development (see **Chapter 2**) with details of collision risk assessments undertaken for each wind farm summarised below.

Bracklyn Wind Farm

5.622 According to the EIAR written in 2022 by Woodrow Sustainable Solutions Ltd, common pipistrelle, soprano pipistrelle, Natterers' bat, Leisler's bat and whiskered bat were all recorded by surveys. They concluded that without mitigation, operational impacts would be *significant at the county / regional level* for Leisler's bat, common pipistrelle, soprano pipistrelle and Nathusius' pipistrelle. Impacts on *Myotis* species and brown long-eared bat were considered to be *not significant*.

Ballivor Wind Farm

5.623 According to the EIAR written in 2023 by MKO Leisler's bat, common pipistrelle, soprano pipistrelle and Nathusius' pipistrelle were all recorded by surveys. They concluded that without mitigation, there would be a *low level of collision risk* for Leisler's bat and soprano pipistrelle. They concluded the same for Nathusius' pipistrelle in the spring and summer,

but the species was not recorded in autumn. Common pipistrelle was assigned a *low risk* in spring and autumn, and a *medium risk* in summer.

Dryderstown Single Turbine

5.624 According to the Further Information Request response document written in 2013 by Jennings O'Donovan & Partners, they concluded it was unlikely that the turbine would result in significant impacts to bats.

Cumulative risk to bats

5.625 Without mitigation, the additive effects of the Proposed Development in-combination with the other two wind farms and single turbine, are likely to have a cumulative effect on some local bat populations (most likely high-collision risk species such as Leisler's bat and common, soprano and Nathusius' pipistrelle). However, due to the implementation of bat mitigation buffers at the Proposed Development, any significant cumulative effects from collision risk will be mitigated against. It can be difficult to predict bat behaviour post-construction (Richardson et al., 2021), and so as a precaution, it is predicted that there still may be residual effects of *low significance* on *local populations* of high collision-risk species (Leisler's bat and common, soprano and Nathusius' pipistrelle).

5.626 Any differences between the range of turbine permutations assessed will result in negligible changes to the direct cumulative collision effects assessment for IEF bats. This is because the differences in potential collision heights are very small.

Potential Decommissioning Phase Cumulative Impacts

5.627 These will be like construction phase and/or of lower magnitude.

Table 5-14: Cumulative Collision Risk

Species	Number of collisions / year					Cumulative significance
	Proposed Development	Bracklyn Wind Farm	Ballivor Wind Farm	Dryderstown Single Turbine	Cumulative	
European golden plover	3.047	4.3	15.527	-	22.874	Naively, the cumulative collision risk could result in 22.9 deaths per year when all four wind farms are operating simultaneously. This is due to a high predicted collision risk for Ballivor Wind Farm. However, given that the collision risk for the Proposed Development itself is thought to be an overestimate and based on the low number of recorded casualties in Ireland and Europe between 2002-2023, it is likely that the cumulative risk is also an overestimate. As outlined for the section on operational impacts on golden plover for the Proposed Development alone, the background population trend means that tens of thousands of birds are predicted to be lost within ROI and thousands of birds at the county / regional scale over the next 35 years, even if the Proposed Development did not go ahead. In the scenario that all four wind farms were operational for 80% of the 35-year lifespan of the Proposed Development (given that Bracklyn and Ballivor could be constructed before the Proposed Development), there would only be a marginal increase in the rate of population decline at the ROI scale, which would not lead to appreciable effects. The same is also true for the county / regional scale. Furthermore, as explained previously, the global golden plover population is increasing, and it is highly likely the Irish population decreases are due to climate-change induced range shift. On this basis, the four renewable energy projects discussed here are likely to marginally contribute to ameliorating climate change, which could help reverse the population decline of this species. Therefore, it is *unlikely* that there will be any appreciable increase to the population trends for this species and therefore *no significant cumulative effects* at the national or county / regional scales are predicted.

Species	Number of collisions / year					Cumulative significance
	Proposed Development	Bracklyn Wind Farm	Ballivor Wind Farm	Dryderstown Single Turbine	Cumulative	
Eurasian curlew	0.41	-	-	-	0.41	As there are no additional collisions predicted for Eurasian curlew from other projects, the same conclusion can be made as for the Proposed Development alone i.e. cumulative collision effects are *unlikely* to be *significant* at the national or county / regional scale for the winter population
Common kestrel	0.57	0.22	2.21	Low risk	3	Naively, the cumulative collision risk could result in 105 deaths over the 35-year lifespan of the Proposed Development. This is only in the unlikely scenario that all four wind farm projects are operational for the same period. As mentioned for the Proposed Development alone, the background population trend suggests that there will be tens of thousands of birds lost at the ROI scale and hundreds at the county / regional scale. Thus, there will be only a marginal increase in the rate of decline at the ROI scale due to cumulative collision risk. The same is also true for the county / regional scale. Also, given that the collision risk for the Proposed Development itself is thought to be an overestimate and based on the low number of recorded casualties in Ireland and Europe between 2002-2023, it is likely that the cumulative risk is also an overestimate. It is *unlikely* that there will be appreciable increases in the rates of decline and *no significant cumulative effects* on the national scale or county / regional scales are predicted.
Northern lapwing	0.25	0.021 breeding, 0.03 wintering, 0.057 annual	0.145 breeding, 2.64 wintering	-	2.911 breeding, 0.425 wintering	Naively, the cumulative collision risk could result in 15 and 102 deaths over the 35-year lifespan for the Proposed Development for the wintering and breeding population, respectively. This is only in the unlikely scenario that all four wind farm projects are operational for the same period. As mentioned for the Proposed Development alone, the background population trend suggests that there will be tens of thousands of wintering birds and thousands of breeding birds lost at the ROI scale. It

Species	Number of collisions / year					Cumulative significance
	Proposed Development	Bracklyn Wind Farm	Ballivor Wind Farm	Dryderstown Single Turbine	Cumulative	
						is likely there will be hundreds of wintering birds and breeding birds lost at the county / regional scale. Thus, there will be only a marginal increase in the rate of decline at the ROI scale for wintering and breeding birds due to cumulative collision risk. The same is true for wintering birds at the regional / county scale. There could be an appreciable increase in the rate of decline at the county / regional scale for the breeding population, but this is only if all four wind farms were operational for the 35-year lifespan of the Proposed Development, which is unlikely. Also, given that the collision risk for the Proposed Development itself is thought to be an overestimate and based on the low number of recorded casualties in Ireland and Europe between 2002-2023, it is likely that the cumulative risk is also an overestimate. On this basis, it is *unlikely* that there will be any appreciable increases in the rate of population decline and no *significant cumulative effects* of collision on breeding or wintering populations at the national or county / regional scale are predicted.
Mallard	0.19	0.014	-	-	0.204	Naively, the cumulative collision risk could result in 7 deaths over the 35-year lifespan of the Proposed Development. This is only in the unlikely scenario that all four wind farm projects are operational for the same period. As mentioned for the Proposed Development alone, the background population trend suggests that there will be thousands of birds lost at the ROI scale and hundreds at the county / regional scale. Thus, there will be only a marginal increase in the rate of decline at the ROI and county / regional scales due to cumulative collision risk. Also, given that the collision risk for the Proposed Development itself is thought to be an overestimate and based on the low number of recorded casualties in Ireland and Europe between 2002-2023, it is likely that the cumulative risk is also an overestimate.

Species	Number of collisions / year					Cumulative significance
	Proposed Development	Bracklyn Wind Farm	Ballivor Wind Farm	Dryderstown Single Turbine	Cumulative	
						It is *unlikely* that there will be appreciable increases in the rates of decline and *no significant cumulative effects* on the national scale or county / regional scales are predicted.
Peregrine falcon	0.08	Insufficient activity to model	0.224	-	0.304	Naively, the cumulative collision risk could result in 11 deaths over the 35-year lifespan of the Proposed Development. This is only in the unlikely scenario that all four wind farm projects are operational for the same period. As mentioned for the Proposed Development alone, the positive background population trend suggests that there will be thousands of birds added to the ROI population and hundreds to the county / regional population. Density-dependent effects, such as competition for resources will likely be more important in checking the population numbers for this species compared to collision risk. This means any deaths due to the Proposed Development are likely to be compensated by increased survival or breeding success in the survivors, and therefore there can be no effect on the resident population or the rate of population increase. Also, given that the collision risk for the Proposed Development itself is thought to be an overestimate and based on the low number of recorded casualties in Ireland and Europe between 2002-2023, it is likely that the cumulative risk is also an overestimate. It is *unlikely* that there will be appreciable increases in the rates of decline and *no significant cumulative effects* on the national scale or county / regional scales are predicted.
Whooper swan	0.29	Insufficient activity to model	1.342	-	1.632	Naively, the cumulative collision risk could result in 57 deaths over the 35-year lifespan of the Proposed Development. This is only in the unlikely scenario that all four wind farm projects are operational for the same period. As mentioned for the Proposed Development alone, the positive background population trend suggests that there will be tens of

Species	Number of collisions / year					Cumulative significance
	Proposed Development	Bracklyn Wind Farm	Ballivor Wind Farm	Dryderstown Single Turbine	Cumulative	
						thousands of birds added to the ROI population and thousands to the county / regional population. Density-dependent effects, such as competition for resources will likely be more important in checking the population numbers for this species compared to collision risk. This means any deaths due to the Proposed Development are likely to be compensated by increased survival or breeding success in the survivors, and therefore there can be no effect on the resident population, or the rate of population increase. Also, given that the collision risk for the Proposed Development itself is thought to be an overestimate and based on the low number of recorded casualties in Ireland and Europe between 2002-2023, it is likely that the cumulative risk is also an overestimate. It is *unlikely* that there will be appreciable increases in the rates of decline and *no significant cumulative effects* on the national scale or county / regional scales are predicted.

MITIGATION MEASURES

5.628 The developer will implement proposed mitigation and compensation during construction and the operator will implement mitigation during operation and decommissioning.

Mitigation Measures During Construction Phase

Designated Nature Conservation Sites, Fisheries and Aquatic Ecology

5.629 Mitigation measures to prevent adverse effects on downstream Natura 2000 sites during construction are provided in full in the NIS shown in **Appendix 15-11** found in Volume III of this EIAR and are the same as those outlined below (also submitted with this Planning Application). These will ensure no deterioration in the quality of water entering the River Boyne and River Blackwater cSAC, the River Boyne and River Blackwater SPA and Royal Canal pNHA and will ensure there will be impacts on any QI habitats and species. The same is true for IEF non-QI aquatic habitats and species.

5.630 Consequently, with respect to all downstream Natura 2000 sites and aquatic ecology receptors, the Proposed Development would not be contrary to Ireland's obligations under the Habitats and Birds Directives, nor WCDP Policy CPO 12.1, 12.4, 12.13, 12.24, 12.48, 12.51, 12.54 and 12.58, and MCDP HER Pol 28, 32, 35 and Obj 35.

5.631 These measures are taken from Chapter 7 and the CEMP (**Appendix 2-2** found in Volume III of this EIAR).

5.632 To mitigate potential impacts during the construction phase, best practice construction methods will be implemented to prevent water (surface water and groundwater) pollution. Examples of these measures are the storage of potentially polluting materials in fully bunded tanks and controlling / reducing runoff from hardstand areas. Good practice measures will be applied in relation to pollution risk, sediment management and management of surface runoff rates and volumes. These measures are expanded upon below.

5.633 A CEMP (**Appendix 2-2** found in Volume III of this EIAR) has been developed for the Proposed Development to ensure adequate protection of the water environment. All personnel working on the Proposed Development will be responsible for the environmental control of their work and will perform their duties in accordance with the requirements and procedures of the CEMP.

5.634 During the construction phase, all works associated with the construction of the Proposed Development will be undertaken in accordance with the guidance contained within CIRIA Document C741 'Environmental Good Practice on Site' (CIRIA, 2015). Any groundwater encountered will be managed and treated in accordance with CIRIA C750, 'Groundwater control: design and practice' (CIRIA, 2016).

Buffer to Watercourses

5.635 A buffer distance of 50 m will be between watercourses, including the gravel ponds, and any proposed construction activities or infrastructure. Where the 50 m buffer cannot be provided at T1, a drainage report has been undertaken and mitigation measures provided for (see **Appendix 7-4** found in Volume III of this EIAR). The mitigation measures include the provision of a silt fence between the turbine T1 construction area and the River Boyne and River Blackwater cSAC boundary.

Groundwater Levels

5.636 Temporary lowering of groundwater levels may be required during the construction of the turbine bases and borrow pits. The impact will be limited by the localised and short-term nature of any dewatering required.

5.637 There could be an indirect impact on GWDTE bog woodland, as the boundary for this habitat type is close to the T1 construction area.

5.638 The T1 construction area is expected to be underlain by low permeability superficial deposits consisting of Fen Peat. Higher permeability sand and gravel eskers are not present in the T1 area. The superficial deposits are expected to be underlain by the Lucan Limestone bedrock aquifer.

5.639 Prior to construction of the turbine base at T1, a groundwater monitoring borehole will be extended to confirm the ground conditions and determine the depth to groundwater. Due to the presence of low permeability superficial deposits at the T1 area, shallow groundwater is not expected to be encountered and it is not expected that there would be any impact on groundwater levels on nearby GWDTEs during construction. However, should significant dewatering be required during the construction of the turbine base at T1, sheet piling will be placed between the construction area and the GWDTEs, so that there would be no change in the groundwater level at the GWDTEs.

Good Practice Measures

5.640 Implementation of good practice measures as a matter of course during the construction of the Proposed Development are not considered to be mitigation measures but form an integral part of the design/construction process. Key good practice measures are stated below, and the assessment incorporates these measures as part of the Proposed Development.

5.641 Measures to prevent the release of any pollution/sediment are as follows:

- prior to construction, section specific drainage plans will be produced. These will take into account any existing local drainage which may not be mapped and incorporate any section specific measures identified during the assessment.
- measures for dealing with pollution/sedimentation/flood risk incidents are included in the CEMP (see Appendix **7-4** found in Volume III of this EIAR) and will be developed prior to construction. This will include incorporating elements of SuDS design into site drainage, and using swales, check dams, silt traps, buffer strips and slope grading where appropriate.
- the CEMP (see Appendix **7-4** found in Volume III of this EIAR) will contain details on the location of spill kits, will identify 'hotspots' where pollution may be more likely to originate from, provide details to construction personnel on how to identify the source of any spill and state procedures to be adopted in the case of a spill event. As identified in the CEMP, a specialist spill response contractor will be identified to deal with any major environment incident.
- a wet weather protocol will be developed. This will detail the procedures to be adopted by all staff during periods of heavy rainfall. Toolbox talks will be given to engineering / construction / supervising personnel. Roles will be assigned, and the inspection and maintenance regimes of sediment and runoff control measures will be adopted during these periods.
- in extreme cases, the above protocol will dictate that work onsite may have to be temporarily suspended until weather/ground conditions allow. An Ecological Clerk of Works (ECoW), would be appointed during the period of construction and post-construction restoration, as approved by Westmeath County Council (WCC), and would

provide environmental advice on matters such as this. Further detail on the powers of the ECoW are outlined in the CEMP (see **Appendix 7-4** found in Volume III of this EIAR).

Site Drainage

5.642 During the construction phase of the Proposed Development, measures will be adopted to prevent silt, chemicals and/or other contaminants from being washed into existing watercourses. Areas exposed due to the removal of vegetation are more susceptible to erosion during heavy rainfall so areas will be reinstated prior to heavy rainfall to minimise this effect.

5.643 This will include specific guidance in relation to drainage (and control of pollution to the water environment) around the following aspects of site infrastructure as outlined in the DoHLGH guidance "The Planning System and Flood Risk Management - Guidelines for Planning Authorities":

- access routes,
- foundations, and
- hardstanding areas and new structures.

5.644 The appropriate methodologies to cover water control and the means of drainage from all hard surfaces and structures within the Proposed Development are described in the following sections.

Management of Sediment and Surface Waters

5.645 Techniques outlined in Section 5 of the CEMP (see **Appendix 7-4** found in Volume III of this EIAR) will be adopted for the management of sediment and surface water run-off generated during the construction phase of the Proposed Development.

5.646 Drainage from the Proposed Development will include elements of SuDS design. SuDS replicate natural drainage patterns and have a number of benefits:

- SuDS will attenuate run-off, thus reducing peak flow and any flooding issues that might arise downstream, and
- SuDS will treat run-off, which can reduce sediment and pollutant volumes in run-off before discharging back into the water environment, and
- SuDS measures, such as lagoons or retention ponds, where appropriate and correctly implemented will produce suitable environments for wildlife.

5.647 In addition, a wet weather protocol (see the CEMP in **Appendix 2.2** found in Volume III of this EIAR) will be implemented to manage activities during periods of heavy and prolonged precipitation to be approved by Westmeath County Council and Meath County Council in consultation with the EPA.

5.648 Heavy or prolonged rainfall during construction and operation may lead to sediment transport or vegetation causing blockage to infrastructure drainage channels or any temporary watercourse crossing structures. Regular monitoring and prompt maintenance of these assets by the ECoW will ensure that the drainage system continues to function as designed.

5.649 Good practice measures for the management of earthworks to reduce erosion and sedimentation are outlined in the CEMP and will be implemented as follows:

- all stockpiled materials will be located at least 50 m from watercourses,
- stockpiled material will either be seeded or appropriately covered,
- water will be prevented as far as possible, from entering excavations such as borrow pits through the use of appropriate cut-off drainage away from these areas,

- in the event that water does enter a borrow pit, it will be pumped to a number of settlement lagoons and silt/sediment traps to remove silt prior to discharge into the surrounding drainage system,
- clean and dirty (silty) water encountered onsite during the construction works will be separated, and dirty water will pass through a number of settlement lagoons and silt/sediment traps to remove silt before re-entering the water environment through percolation to ground or discharge to the surrounding drainage system,
- if soil/subsoil material is stockpiled on a slope, silt fences will be located at the toe of the slope to reduce sediment transport,
- the amount of ground exposed, and time period during which it is exposed, will be kept to a minimum and appropriate drainage will be in place to prevent surface water entering deep excavations, specifically borrow pit excavations,
- drainage systems will be designed to minimise sedimentation into natural watercourses - this will include silt traps, check dams and/ or diffuse drainage,
- silt/sediment traps, single size aggregate, geotextiles or straw bales will be used to filter any coarse material and prevent increased levels of sediment. Further to this, activities involving the movement or use of fine sediment will avoid periods of heavy rainfall, and
- construction personnel and the Principal Contractor will carry out regular visual inspections of watercourses to check for suspended solids in watercourses downstream of work areas, in consultation with an ECoW.

Foul Drainage

5.650 Any waste that is generated during the development's construction phase will be collected, separated and stored in dedicated receptacles at the temporary construction compounds during construction works. A fully authorised waste management contractor will be appointed prior to the commencement of construction works. This contractor will provide the appropriate receptacles for the collection of the various waste streams able ensure regular emptying and/or collection of these receptacles. Appropriate licensed waste facilities in the surrounding area will be used as part of Waste Management arrangements. Effluent and waste from onsite construction will be captured onsite in a foul holding tank and stored for offsite disposal by a licensed contractor.

Pollution Risk

5.651 Good practice measures in relation to pollution prevention will be implemented as follows:

- refuelling will take place at least 50 m from watercourses and where possible it will not occur when there is risk that oil from a spill could directly enter the water environment, for example, periods of heavy rainfall or when standing water is present will be avoided,
- a vehicle management plan and speed limit will be strictly enforced onsite to minimise the potential for accidents to occur,
- drip trays will be placed under all stationary vehicles which could potentially leak fuel/oils,
- areas will be designated for washout of vehicles which are a minimum distance of 50 m from a watercourse,
- water will be prevented as far as possible, from entering excavations such as borrow pits,
- areas of battery storage will be bunded and positively drained so that the quality of runoff can be visually monitored prior to release by tap, and contained if required,
- fuels and other potentially contaminative materials will be stored in 110% bunded storage facilities to minimise the potential for accidental spillage, and
- an appropriately sized spill kit(s) would be provided and maintained onsite, consideration would be given to suitable locations across the active areas of the site and to having vehicles including plant carry a spill kit. This kit would contain materials,

such as absorbent granules and pads, absorbent booms and collection bags. These are designed to halt the spread of spillages and would be deployed, as necessary, should a spillage occur elsewhere within the construction compound.

Fluvial Flood Risk

5.652 It is proposed to adopt SuDS as part of the Proposed Development. SuDS techniques aim to mimic pre-development runoff conditions and balance or throttle flows to the rate of runoff that might have been experienced at Proposed Development prior to development. Good practice in relation to the management of surface water runoff rates and volumes and potential for localised fluvial flood risk will include the following:

- drainage systems are designed to ensure that any sediment, pollutants or foreign materials which may cause blockages are removed before water is discharged into a watercourse,
- onsite drainage will be subject to routine checks by construction personnel and the Principal Contractor, in consultation with the ECoW, to ensure that there is no build-up of sediment or foreign materials which may reduce the efficiency of the original drainage design causing localised flooding.
- appropriate drainage will attenuate runoff rates and reduce runoff volumes to ensure minimal effect upon flood risk,
- in instances where water may accumulate, leading to potential flood risk, check dams will be used within cable trenches in order to prevent trenches developing into preferential flow pathways, and
- as per good practice for pollution and sediment management, prior to construction, section specific drainage plans will be developed and construction personnel made familiar with the implementation of these.

5.653 Drainage design for the Proposed Development is set out in the planning drawings accompanying the EIAR.

Water Quality Monitoring

5.654 Water quality monitoring during the construction phase will be undertaken for the surface water catchments that serve the Proposed Development, to ensure that none of the tributaries of the main channels are carrying pollutants or suspended solids. Monitoring will be carried out at a specified frequency on these catchments.

5.655 With regard to the protection of the water environment the following risks will be addressed:

- siltation of watercourses,
- discolouration of raw water,
- potential pollution from construction traffic due to diesel spillage or similar,
- alteration of raw water quality resulting from imported track construction material,
- excavation and earthworks,
- use of large quantities of concrete,
- site compound and associated drainage/foul drainage and diesel spill issues,
- the Project Supervisor Construction Stage (PSCS) will compile a monitoring and maintenance plan for the drainage system and surface water runs which will as a minimum include:
  - visual monitoring/inspections during site works and water crossing construction works, the relevant drainage/surface water features potentially being impacted by these works will be inspected on a daily basis by the Environmental Clerk of Works (ECoW) while works are ongoing in this area.
- a Water Quality Monitoring Plan (WQMP) will be developed to form part of the Construction Method Statement (CMS), which will be submitted to the appropriate

planning authorities prior to construction and development. The WQMP will be implemented to monitor surface water quality, fish populations and macroinvertebrate community prior to, during and post-construction. A robust baseline of water quality in surface watercourses / drainage channels downstream of construction works will be established prior to construction commencing and used as a benchmark of water quality for the construction phase monitoring.

5.656 The purpose of the WQMP is to:

- ensure that the commitments put forward in the EIAR are fulfilled with regards to identified ground and surface water receptors,
- provide a specification for monitoring prior to, during and after construction,
- provide a record of water quality across the site that can be compared to rainfall and site activities,
- provide reassurance of the effectiveness of pollution prevention measures installed to protect surface watercourses throughout the construction period, and
- provide data to identify any potential pollution incidents, and to inform a structured approach to manage and control such incidences.

5.657 The WQMP will outline details for the monitoring of surface watercourses down gradient of works areas including watercourse crossings, access tracks, turbine foundations and borrow pits and at control sites (up gradient of works areas), and will include:

- planning level monitoring locations,
- frequency of monitoring prior to, during and after construction,
- parameters for field hydrochemistry testing and laboratory analysis including as a minimum pH, electrical conductivity, suspended solids, dissolved metals, nutrients and hydrocarbons,
- sampling and analysis protocols,
- relevant environmental quality standards (EQS),
- responsibilities for monitoring –the ECoW will be responsible for daily monitoring of watercourses particularly around active works areas and watercourse crossings,
- procedures to be followed in the event of an environmental incident, and
- recording and communicating of results.

5.658 Details of the Private Water Supply (PWS) Action Plan are provided in the CEMP. A PWS will be developed and will include details regarding all water monitoring and reporting, pollution incident reporting and emergency mitigation measures to address a temporary or permanent material change in either the quality or quantity of an existing private water supply. The PWS Action plan shall include as a minimum:

- the provision of an emergency hotline telephone number for householders so that they can contact the project with any concern regarding water quality or quantity,
- the contact details of householders downgradient of work areas to alert in the event of a pollution incident,
- the provision of an alternative water supply, if required, during any periods of PWS disruption, and/or
- to supply affected properties with filters for particulate removal.

Emergency Response

5.659 Drainage networks provide a conduit for rapid transport of silty water and potential contamination from surface spills of fuels / oils, concrete or chemicals. A pollution emergency incident will include any discharge to the drainage network that could potentially cause environmental damage. Examples of pollution emergency incidents include:

- fuel drips or spills during refuelling,

- leaking plant or equipment,
- leaks from fuel or chemical containers,
- contaminated water or sediment / silt entering a watercourse or drainage network,
- windblown dust and waste,
- excess silt deposition in drainage ditches, channels, culverts following heavy rainfall events,
- operational failures of pumps and pipelines, and
- failures of treatment or sediment controls.

5.660 The PSCS will be required to prepare an Environmental Incident and Emergency Response Plan (as noted in Section 6.1 of the CEMP which will provide emergency response contacts, reporting procedures, and procedures for dealing with all potential pollution incidents during the construction of the Proposed Development.

5.661 There will also be a method statement in relation to cleaning machinery and the avoidance of importing/spreading non-native plant invasive species. Any plant or equipment that may have worked in environments where invasive species are present (including but not restricted to Japanese knotweed, cherry laurel, snowberry and winter heliotrope), will be suitably cleaned by high pressure hose, disinfected and dried before being used on site to prevent the spread of invasive species.

5.662 A check-clean-dry protocol will be used to help spread crayfish plague.

5.663 A Habitat and Species Management Plan (HASMP) will be used to prevent the spread of invasive and non-native species and is contained in **Appendix 5-10** found in Volume III of this EIAR.

5.664 Temporary fencing (paling with 25 mm mesh) will be erected around the required site works to delineate the works area and to minimise the potential for disturbance impacts outside of the works area. As no otter holts were identified within the Proposed Development area of the Proposed Development, there is no specific mitigation required for the protection of this species in relation to relocation/construction of artificial dwellings.

5.665 Removal of brash and felled trees near to watercourses and drainage ditches will ensure that no significant acidification of downstream watercourses will occur.

Habitats

5.666 The location of the Proposed Development layout does not overlap with high-value terrestrial habitats and is located almost entirely within commercial conifer or broadleaved plantation, and improved grassland. The Cable Corridor is located almost entirely within existing roads and only small lengths will go through improved grassland. Construction for the majority of the proposed access tracks will mainly involve upgrading existing forestry and farm tracks.

5.667 Areas requiring felling to implement bat mitigation buffers has been focused on commercial conifer plantation habitats and small amounts of highly modified/non-native mixed broadleaved woodland. Also, the lengths of tree lines and hedgerows to be removed has been minimised. PAW have been avoided. Consequently, the Proposed Development would not be contrary to WCDP Policy CPO 12.15, 12.24 and 12.37, and MCDP HER Pol 28.

5.668 Any treelines or hedgerows removed will be replaced in-situ elsewhere in the Proposed Development at appropriate locations (i.e. designed to maximise ecological connectivity and outside of bat mitigation buffers). All new treelines or hedgerows will be planted using native species and in a similar composition to treelines or hedgerows lost. Consequently, the

Proposed Development would not be contrary to WCDP Policy CPO 12.24 and 12.40, and MCDP HER Pol 37.

5.669 To avoid widespread disturbance to habitats, access within the Proposed Development will be restricted to the footprint of the proposed works corridor and no access between different parts of the Proposed Development will be permitted, except via the proposed works corridor. An ECoW will be employed throughout the construction phase to ensure that construction activities do not encroach, unnecessarily, into any important habitats.

5.670 To avoid damaging the roots of hedgerows and tree lines, root protection zones will be used. The roost protection zone area will be equivalent to a circle with a radius 12 times the diameter of the tree's trunk at 1.5 m above ground level.

5.671 During dry weather (i.e. no rainfall), dust generated will be managed through the use of dust suppression bowsers. This will avoid damaging tree lines and hedgerows.

Rare Flora

5.672 No rare flora were recorded during surveys and so no mitigation measures are required.

Invasive Plants

5.673 A Habitat and Species Management Plan (HASMP) will be used to prevent the spread of invasive and non-native species and is contained in **Appendix 5-10** found in Volume III of this EIAR. Japanese knotweed, cherry laurel, winter heliotrope and snowberry must not be spread during construction works.

5.674 A pre-construction walkover survey of the works corridor will confirm the presence of any invasive/non-native species that may have escaped into the area since the baseline surveys were conducted.

5.675 Consequently, the Proposed Development would not be contrary to WCDP Policy CPO 12.27 and 12.28, and MCDP HER Pol 43.

Birds

5.676 To avoid widespread disturbance to birds, access will be restricted to the footprint of the proposed works corridor. Measures proposed in paragraph 5.629 onwards will prevent deterioration of water quality and adverse effects on birds relying on downstream habitats, such as kingfisher.

5.677 The following will be implemented to reduce the possibility of damage and destruction (and disturbance to sensitive species) to occupied bird nests:

- clearance of woodlands and uncultivated vegetation i.e. trees and hedgerows (including vegetation removal for creation/maintenance of bat mitigation buffers), will be undertaken outside the main breeding season from March to September inclusive,
- if other site clearance and construction activities are required to take place during the main breeding bird season, pre-commencement survey work will be undertaken to ensure that nest destruction and disturbance is avoided. This will include the implementation of disturbance-free buffers for common snipe (400 m) and Eurasian woodcock (500 m), which have been recorded breeding within the Main Wind Farm Site previously,
- once vegetation has been removed from the works corridor, these areas will be retained in a condition that limits suitability for nesting birds for the remainder of the construction phase e.g. cover for ground nesting species will be made unsuitable by cutting vegetation or tracking over with an excavator, and

- a suitably experienced ECoW will be employed for the duration of the construction period to make contractors aware of the ornithological sensitivities of the Proposed Development and to undertake surveys for nesting birds throughout the construction period, enforcing exclusion areas as required.

5.678 Consequently, with respect to all bird species, the Proposed Development would not be contrary to Ireland's obligations under the Birds Directive, Regional Policy Objective 7.22 (targets for, *inter alia*, protected species), nor WCDP Policy CPO 12.13 (Protect, manage and enhance…biodiversity) and MCDP HER Obj 35 (No significant adverse impact…on bird species protected by law).

Terrestrial Mammals (Excluding Bats)

5.679 Measures proposed in paragraph 5.629 onwards will prevent deterioration of water quality and adverse effects on mammals relying on downstream habitats, such as otter. Habitat features important for mammals will be retained as much as possible (e.g. hedgerows, treelines and scrub). While commercial conifer plantation and non-native mixed broadleaved woodland will be removed, connectivity between woodland linear habitat features has been retained throughout all phases of the Proposed Development.

5.680 A pre-construction walkover survey of the Proposed Development will be undertaken. This will search for mammal resting/breeding places, which could change over time. If any are identified, then appropriate exclusion zone(s) will be implemented and construction activities timed to avoid sensitive periods, such as the breeding season or hibernation, as relevant.

5.681 The following will be implemented to reduce the possibility of direct and indirect effects on mammals:

- limiting constructions works to daylight hours,
- providing exit points for any excavations (e.g. escape planks or spoil runs) so mammals do not become trapped, and
- a suitably qualified ECoW will be employed for the duration of the construction period to make contractors aware of the mammalian sensitivities of the Proposed Development and to undertake surveys for breeding or resting mammals throughout the construction period, enforcing exclusion areas as required. These are 50 m for red squirrel, 100 m for pine marten, 150 m for otter and 50 m for badger. If in the unlikely event that exclusion zones cannot be implemented, advice will be sought from NPWS, and appropriate mitigation and compensation measures will be put in place and an application will be made to NPWS for a derogation licence if required.

5.682 Consequently, with respect to mammal species, the Proposed Development would not be contrary to Ireland's obligations under the Habitats Directive, Regional Policy Objective 7.22 (targets for, *inter alia*, protected species), nor WCDP Policy CPO 12.13 (Protect, manage and enhance…biodiversity) and MCDP HER Obj 35 (No significant adverse impact…on animal species protected by law).

Bats

5.683 All hedgerows and treelines that will be lost due to construction will be replaced within the Proposed Development (see paragraph 5.724 and **Appendix 5-10** found in Volume III of this EIAR). This will ensure that there is no net loss of commuting and foraging routes for bats.

5.684 Along the Cable Corridor, immediately in advance of construction works, an ECoW will undertake a comprehensive survey of bridges / structures / trees with moderate to high bat

roosting potential (see **Appendix 5-3** found in Volume III of this EIAR) and emergence surveys will be carried out to determine if bats are present following Collins (2023) guidelines.

5.685 No destruction or disturbance of active bat roosts is predicted. However, given that a period of time is likely to elapse prior to the commencement of construction, it is acknowledged that roosting bats could move and occupy new PRFs, such as ivy clad trees with occasional holes/fissures. Therefore, pre-construction roost surveys will be undertaken to identify and protect any bats occupying roosts in vegetation earmarked for removal.

5.686 Any trees identified as supporting moderate to high potential roost features within the works corridor will be targeted with further surveys, including emergence/re-entry surveys and/or roost inspections (using endoscopes and thermal imaging cameras). Surveys will determine occupancy, the type of roost (e.g. maternity, hibernation, mating, transitional), species using the roost and the level of occupancy. Surveys will be conducted by appropriately experienced ecologists.

5.687 For any newly occupied roost sites, where vegetation removal is proposed, these surveys will inform a derogation license application process from the NPWS to undertake appropriate mitigation actions, as required, to ensure the conservation of bats. Such actions could include measures to exclude bats from potential roost holes prior to vegetation removal and provision of alternative roost sites.

5.688 Regarding felling of trees with moderate to high potential roost features, if emergence and roost inspection survey fail to detect bats, then 'soft felling' will be implemented (NRA, 2005). This will be carried out in suitable weather conditions and at appropriate times of year (other than winter when they are hibernating). Briefly, this involves the following:

- removal of the tree in sections, starting with the top branches and working down the trunk avoiding cutting through cavities,
- lowering of any sections with potential roost features with care, positioning them on the ground with potential entrances to roosts facing upwards to allow bats to exit the roost, and
- leaving these sections in place for at least 24 hours in suitable weather.

5.689 For occupied roost sites where no vegetation removal is proposed, an exclusion zone will be implemented to avoid disturbance. This exclusion zone will only be implemented according to when and how the roost is used and will be proportional to the disturbance levels from the construction activity. For example, 30 m is an appropriate exclusion zone for piling. The following will be implemented:

- maternity roosts: works will be carried out between 1 October to 1 May inclusive,
- summer roost (not a maternity roost): works will be carried out between 1 September to 1 May inclusive,
- hibernation roost: works will be carried out between 1 May to 1 October inclusive, and
- mating/swarming roost: works will be carried out between 1 November to 1 August inclusive.

5.690 The following will also be implemented to reduce the possibility of direct and indirect effects on bat species: no night-time lighting will be used during construction where possible. If unavoidable (e.g. turbine delivery and setting of concrete for turbine foundations), cowled lighting to prevent light spill will be used.

5.691 Consequently, with respect to bat species, the Proposed Development would not be contrary to Ireland's obligations under the Habitats Directive, Regional Policy Objective 7.22 (targets for, *inter alia*, protected species), nor WCDP Policy CPO 12.13 (Protect, manage

and enhance…biodiversity) and MCDP HER Obj 35 (No significant adverse impact…on animal species protected by law).

Other Protected Fauna

5.692 Pre-construction checks will be undertaken for spawning frogs if construction works are undertaken in February. If present, adults and spawn will be translocated under NPWS licence to suitable alternative locations. Pitfall traps and drift fences will be used to capture adult frogs.

5.693 Amphibian-proof fencing close to any ponds/pools will be used to prevent frogs or smooth newts from accessing any parts of the Proposed Development most hazardous to amphibians during the construction phase.

5.694 Pre-construction checks will be undertaken for breeding marsh fritillary if construction works are to be undertaken in the late summer. If present, larval webs will be translocated under NPWS licence to suitable locations.

5.695 Consequently, with respect to other protected fauna, the Proposed Development would not be contrary to Ireland's obligations under the Habitats Directive, Regional Policy Objective 7.22 (targets for, *inter alia*, protected species), nor WCDP Policy CPO 12.13 (Protect, manage and enhance…biodiversity) and MCDP HER Obj 35 (No significant adverse impact…on animal species protected by law).

Mitigation Measures During Operational Phase

Designated Nature Conservation Sites, Fisheries and Aquatic Ecology

5.696 Mitigation measures to protect water quality are shown in Chapter 7 and in **Appendix 2.2** found in Volume III of this EIAR. Maintenance of the wind farm drainage system will ensure the system is operating effectively and will be undertaken following the CIRIA C697 SuDS and Maintenance Manual. A review of the ecological mitigation measures will be required during the operational phase and Proposed Development specific mitigation will be provided as appropriate where further measures are required to ensure no significant environmental effects on aquatic receptors and designated sites. The following mitigation measures will be implemented:

- site access will be restricted by gates to prevent illegal dumping, use by off road vehicles etc., and
- as during construction, any stockpiled material will be within the proposed site compound or a minimum of 50 m from any surface water drainage.

5.697 This will prevent any negative effects on downstream aquatic receptors and designated sites. Consequently, with respect to all downstream Natura 2000 sites and aquatic ecology receptors, the Proposed Development would not be contrary to Ireland's obligations under the Habitats and Birds Directives, nor WCDP Policy CPO 12.1, 12.4, 12.13, 12.24, 12.48, 12.51, 12.54 and 12.58, and MCDP HER Pol 28, 32, 35 and Obj 35.

Birds

Reduction in habitat suitability

5.698 The species assessed most likely to move into the newly felled bat mitigation buffer areas putting it at risk of collision with operational turbines is common kestrel.

5.699 Mitigation to limit common kestrel foraging activity around turbines will be implemented i.e. this will deter kestrel to ensure no significant effects from collision on this species. This will

include the following measures to reduce prey availability in an area of 104 m to 117 m surrounding each turbine (this range reflects the dimensions of the turbine permutations assessed):

- creation of uniformly short vegetation heights via infrequent mowing or trimming of vegetation,
- removal of timber/brash from felling and chipping of tree stumps to ground level,
- spread and compaction of chipped wood and spoil to create a flat surface to prevent rapid colonisation of new vegetation, and
- piping/filling over of open field/forestry drains.

5.700 Full details are included in **Appendix 5-10** found in Volume III of this EIAR.

Turbine curtailment

5.701 In addition, turbine curtailment for birds will be implemented if the results of the proposed monitoring programme show there is a significant effect on bird populations (see paragraph 5.736).

5.702 Curtailment will be implemented via a system of adaptive management. Thus, if bird carcasses are recorded during post-construction monitoring, curtailment will be implemented where appropriate during 'at-risk' time periods and weather conditions, and as discussed and agreed with NPWS.

5.703 Curtailment for birds is different to curtailment for bats and would involve downtime of the actual turbine. This would only be implemented during the 'at-risk' period and weather conditions when visibility is low e.g. in conditions of fog. This will be achieved by fitting weather detection sensors or cameras to the turbines, which will be linked to turbines via a supervisory control and data acquisition (SCADA) system. Thus, curtailment will only occur in foggy conditions during the 'at-risk' period for the relevant species.

5.704 It is important to reiterate that the implementation of curtailment will only be implemented where the results of post-commissioning monitoring demonstrate a significant, adverse effect on IEF birds. This would be demonstrated via an assessment of recorded mortality in the light of changes in current conservation status at the time of the monitoring survey, indicating that the Proposed Development is contributing to the decline or hindering restoration efforts for the relevant species.

5.705 Consequently, with respect to all bird species, the Proposed Development would not be contrary to Ireland's obligations under the Birds Directive, Regional Policy Objective 7.22 (targets for, *inter alia*, protected species), nor WCDP Policy CPO 12.13 (Protect, manage and enhance…biodiversity) and MCDP HER Obj 35 (No significant adverse impact…on bird species protected by law).

Terrestrial Mammals (Excluding Bats)

5.706 Connectivity between woodland habitats and linear features will be retained. Any treelines and hedgerows due to be lost at the construction phase will be reinstated elsewhere within the Proposed Development using like-for-like planting. This will ensure no net loss of linear habitats.

5.707 Mitigation measures to protect water quality in **Chapter 7** and **Appendix 2-2** found in Volume III of this EIAR will avoid significant downstream effects on otter. These are outlined earlier in the current chapter; see paragraph 5.629 for further details.

Bats

Bat mitigation buffers

5.708 Bat mitigation buffers refers to the felling of vegetation around turbines to make the environment less attractive to bats. This measure will help avoid collision and barotrauma by removing habitat features used by commuting and foraging bats in proximity of turbines. NatureScot (2021) guidelines state that a 50 m distance from the blade tips of the turbine to the nearest habitat feature must be maintained free of trees and shrubs for the duration of wind farm operation. The following formula is used:

$$b = \sqrt{(50 + bl)^2 - (hh - fh)^2}$$

5.709 Where b = buffer radius, bl = blade length, hh = hub height, fh = feature height (all in metres).

5.710 Thus, the buffer radius is given as the horizontal distance from the turbine tower and relates to both the habitat feature height, the turbine hub height and the blade length. Taller habitat features require a larger horizontal buffer radius. Note that feature heights were assumed as the maximum height that could be obtained over the lifespan of the Proposed Development. For conifer and broadleaved plantation habitats and treelines, this height was assumed to be 20 m based on the heights of the conifer plantation being felled during surveys. For non-plantation broadleaved woodland habitats, this height was assumed to be 40 m based on maximum likely tree height. For hedgerows and scrub, this height was 5 m based on the maximum height of hedgerows being maintained by landowners during surveys.

5.711 For the turbine dimensions, a worst-case scenario was adopted with dimensions from the Vestas 162 candidate turbine adopted i.e. a blade length of 81 m and a hub height of 99 m. This corresponds to a broadleaved woodland buffer of 117 m, a conifer/broadleaved plantation and treeline buffer radius of 104 m, and a hedgerow buffer radius of 91 m. This is a worst-case scenario because it assumes the largest bat felling buffer radiuses i.e. all other permutations within the turbine range will require a smaller buffer radius because of their dimensions.

5.712 Details of the buffers required for each turbine are shown below in **Table 5-15** and **Figure 5-9**.

Table 5-15: Details of Bat Mitigation Buffers Required for Each Turbine

Turbine Number	Habitat Feature	Area (ha) or length (m) to be removed
T1	Broadleaved woodland	0.18 ha
	Recolonising cutover bog (areas containing scrub and saplings)	0.10 ha
T2	Hedgerow	148.4 m
T3	Broadleaved woodland	2.48 ha
T4	Broadleaved woodland	2.59ha
	Conifer plantation	0.69 ha

Turbine Number	Habitat Feature	Area (ha) or length (m) to be removed
T5	Broadleaved woodland	1.37 ha
	Conifer plantation	1.39 ha
T6	None nearby	No felling required
T7	Broadleaved plantation	2.56 ha
T8	None nearby – overhang of branches only	No felling required – trimming only

5.713 The area where trees/scrub is cleared to create the bat mitigation buffers will be kept clear over the lifetime of the Proposed Development and will be made as unfavourable to bats as possible. Felled timber and branches will be removed with stumps brashed to ground level. Any excess soil generated by construction will be deposited over stumps to flatten the ground during the first instance of felling. Deposition of excess soil will not be undertaken near watercourses to avoid the risk of sedimentation and runoff. This is appropriate for turbines T1 and T2.

5.714 To avoid root damage to sensitive PAW areas, felling near the PAW 20 m root zone buffer for turbines T4 and T5 will be undertaken by hand. No felling of PAW areas themselves will occur.

5.715 Felling and vegetation removal within the recolonising cutover bog area near T1 will also be undertaken by hand, which will help avoid damage to any areas of sensitive recolonising vegetation.

Turbine curtailment and feathering

5.716 It is predicted that bat mitigation buffers will limit bat activity near turbines, reducing potential collision risk.

5.717 In addition, the following operational mitigation measures for bats will be implemented if the proposed monitoring programme shows there is a significant effect (see paragraph 5.737):

- Feathering of Blades: there is evidence that bat casualties at wind farms are reduced by pitching the blades out of the wind (“feathering”) to reduce rotation speeds below 2 r.p.m. while idling. As such, the feathering of blades to prevent ‘idling’ during low wind speeds is proposed for all turbines based on the results of the post-construction monitoring programme. Feathering will be implemented via a system of adaptive management. Thus, if any significant effects are recorded during post-construction monitoring, feathering will be implemented at the relevant turbines during the bat activity season (April-October) or where temperatures are optimal for bat activity, and
- Curtailment: this involves raising the cut-in speed with associated loss of power generation in combination with reducing the blade rotation below the cut-in speed, as above. This will only occur where feathering below cut-in normal speed (above) will not provide sufficient reduction in risk to bats. The curtailment is achieved by feathering (not the actual braking of the turbine) so that the blades continue to rotate slowly (at ~2 r.p.m. or less). If feathering is not providing sufficient mitigation, curtailment will be implemented via a system of adaptive management. Thus, if any significant effects on bats due to turbine strike are still being recorded during post-construction monitoring following feathering of blades, cut-in speeds will be increased at the relevant turbines

during the bat activity season (April-October) or where temperatures are optimal for bat activity.

5.718 It is important to reiterate that the implementation of the above operational phase measures (feathering of blades or curtailment) will only be implemented where the results of post-commissioning monitoring demonstrate a notable adverse effect on bats. This would be demonstrated via an assessment of recorded mortality in the light of changes in current conservation status at the time of the monitoring survey, indicating that the Proposed Development is contributing to the decline or hindering restoration efforts for the relevant species.

5.719 It is the conclusion of this assessment that, with the removal of vegetation within the above-referenced buffer zones, that the characteristics of the Proposed Development, for bats, will be highly altered and the turbine locations are unlikely to be suitable for bat activity. Consequently, it is assessed that the implementation of the buffer zones will ensure the avoidance of significant effects on bats. In the unlikely event of notable fatalities, a further suite of measures will be implemented as set out above.

5.720 Consequently, with respect to all bat species, the Proposed Development would not be contrary to Ireland's obligations under the Habitats Directive, Regional Policy Objective 7.22 (targets for, *inter alia*, protected species), nor WCDP Policy CPO 12.13 (Protect, manage and enhance…biodiversity) and MCDP HER Obj 35 (No significant adverse impact…on animal species protected by law)

Mitigation Measures During Decommissioning Phase

5.721 Mitigation measures for decommissioning will be similar to those for the construction phase, however the magnitude required will be less, as track and turbine installation will not be required.

COMPENSATION MEASURES

5.722 Full details of compensation measures are included in **Appendix 5-10** found in Volume III of this EIAR.

Replacement Planting

5.723 Following DAFM (2017) guidance, 13.69 ha of replacement woodland will be planted ex situ. This will compensate for the loss of woodland habitats permanently felled to accommodate the Proposed Development. This will be subject to a separate consenting process (see paragraph 5.3).

5.724 To compensate for the loss of linear treeline and hedgerow habitats, 98.9 m of treelines will be replaced, and 548.86 m of hedgerows will be replaced in situ. This is different to the replant lands noted above. There will also be 1,461.14 m additional new hedgerow and 396.11 m additional treeline planted than will be needed to replace any due to be lost, which will result in a net gain of hedgerow and treeline due to the Proposed Development. The placement of these will be designed to ensure connectivity between habitat features at the Proposed Development is maintained and enhanced. The replacement of treelines and hedgerows will also ensure that there is no net loss as a result. The placement of these replacement hedgerows will also be used to help enhance biodiversity (see section below). Full details are shown in **Appendix 5-10** found in Volume III of this EIAR.

5.725 Consequently, with respect to hedgerow and treeline habitats, the Proposed Development would not be contrary to Ireland's obligations under Article 10 of the Habitats Directive, Regional Policy Objective 7.22 (targets for, *inter alia*, protected species), nor WCDP Policy CPO 12.24, 12.39 and 12.40, and MCDP HER Policy 37.

Birds

5.726 One common snipe and two Eurasian woodcock territories could be lost because of the Proposed Development.

5.727 To compensate, there will be the creation of two new wetland areas (wader scrapes) of 20 m^2 in existing fields to encourage and promote breeding common snipe. These are shown in **Appendix 5-10** found in Volume III of this EIAR in biodiversity enhancement zones 'A' and 'B'. For moderate quality wet grasslands derived from improved grassland, approximately two pairs per 1 x km^2 or 100 ha could be expected (Hoodless et al., 2007). Circa 9.284 ha of suitable habitat will be managed for snipe, which includes continued but low intensity grazing by farm animals (or hand mowing if not possible) in the new, fenced-off wetland areas. Thus, this will not fully compensate for the loss of an entire snipe territory, but it is unlikely that an entire territory will be lost.

5.728 To compensate, 0.7 ha of new broadleaved woodland will be planted, with glades created for Eurasian woodcock within an area of 1.3 ha (biodiversity enhancement zone 'C') to be managed for this species. These are shown in **Appendix 5-10** found in Volume III of this EIAR. Daily breeding range sizes are between 0.06 – 1.25 ha (Hoodless and Hirons, 2007). Thus, the area managed for woodcock will likely not fully compensate for the predicted loss of two territories, as the 0.7 ha of new woodland is smaller than 2.50 ha, which could be the maximum size of two woodcock territories.

BIODIVERSITY ENHANCEMENT

5.729 Enhancement measures are included in **Appendix 5-10** found in Volume III of this EIAR. These include:

- Planting of 1,018 m of hedgerow and 142 m of treeline (the remainder of the hedgerow i.e. 992 m and treeline i.e. 353 m will be planted at the Proposed Substation) along the southern side of the SAC watercourses Killacroy Stream and D'arcys Crossroads Stream (mostly at least 10-15 m back from the riverbank) to improve the riparian zone (IFI, 2020) as part of restoration efforts, subject to discussion and agreement with NPWS,
- Enhancement of existing poor-quality hedgerows and treelines within the Main Wind Farm Site,
- Erection of 1,440 m of stock-proof fencing along the southern side of the SAC river (at least 10 m back from the riverbank where possible) to prevent livestock from damaging the riparian zone, which has been shown to contribute towards 'passive restoration' of the zone (Fleming et al, 2021), subject to discussion and agreement with NPWS,
- Erection of stock-proof fencing around the 8.44 ha area to the west of turbine T1 (biodiversity enhancement zone 'B') and maintaining low stocking densities (0.2 – 0.8 cattle / ha) in the driest months of summer, for at least two weeks of the year, which will simultaneously prevent livestock damage to sensitive Annex I transition mire and quaking bog habitats (Šefferová Stanová V. et al., 2008) and marsh fritillary breeding areas (Phelan et al., 2021), while also preventing the encroachment of scrub,

- Creation of eight log pile hibernacula at the Main Wind Farm Site for hedgehogs and/or amphibians or reptiles from hardwood trees and shrubs removed during vegetation clearance,
- Erection of 10 bat boxes near the Proposed Substation to enhance local bat populations while avoiding increasing collision risk for bats at the Main Wind Farm Site,
- Erection of one swift tower near the Proposed Substation to enhance local swift populations while avoiding increasing collision risk for swifts at the Main Wind Farm Site,
- Maintain 5 m rough grassland buffer along internal access tracks at the Main Wind Farm Site where possible,
- Erection of three insect hotels per 35 ha (i.e. four in total spread across the Main Wind Farm Site), and
- Management of new and existing drainage ditches within Proposed Development to benefit amphibians.

5.730 Consequently, the Proposed Development would not be contrary to obligations under WCDP Policy CPO 12.14, 12.24, 12.27 and 12.28, and MCDP HER Policy 27, 28, 43 and Obj 32.

5.731 A summary table of compensation and enhancement measures shown in the HASMP is provided in Table below.

Table 5-16: Summary of Compensation and Enhancement Measures

Ecological Feature	Summary of Measure
Terrestrial habitats	Hedgerow / tree line creation and enhancement: 2,010 m of hedgerows and 495 m of tree line
	Enhancement of existing poor-quality hedgerows / treelines
	Fencing of area and managed, low-density stocking to prevent damage to Annex I mire/bog plus marsh fritillary breeding habitats while also preventing encroachment of scrub
Aquatic habitats / species	Planting of replacement and enhancement hedgerow / tree line along southern side of SAC river at an appropriate distance to avoid damage to the SAC itself to help enhance the riparian zone (subject to discussion and agreement with NPWS)
	Fencing southern side of SAC river as part of 'passive restoration' of riparian zone (subject to discussion and agreement with NPWS)
Birds	Maintenance of low vegetation height around turbines to deter kestrel
	Creation of two wader scrapes for common snipe
	Creation of 0.7 ha of new broadleaved woodland, with glades for Eurasian woodcock in 1.3 ha biodiversity enhancement zone 'C'

Ecological Feature	Summary of Measure
	Erection of swift tower
Bats	Provision of 10 bat boxes
Hedgehogs	Creation of 8 no. log piles
Amphibians / reptiles	Creation of 8 no. log piles (same ones for hedgehogs can also be used here)
	Dredging of new and existing drains (within the Proposed Development where possible i.e. considering landowner constraints) to benefit amphibians
Insects	Fencing of area and managed, low-density stocking to prevent damage to marsh fritillary breeding habitats while also preventing encroachment of scrub
	Maintenance of 5 m rough grassland buffer along the internal access tracks where possible.
	Creation of 4 no. insect hotels
Invasive plants	Prevention, containment, treatment and eradication

MONITORING

General Pre-Construction Confirmation Surveys

5.732 To prevent accidental disturbance to resting places of mammals (badgers, red squirrel, pine marten, otter and hedgehog), an ecological walkover survey will be undertaken prior to any construction activities within the development footprint.

5.733 Similarly, trees and structures within the works corridor will be re-assessed for bat roosting potential, with any inspections or emergence surveys carried out as required under licence.

5.734 Checks for nesting birds will be required for construction undertaken during the bird breeding season. If nests are recorded, ongoing monitoring and appropriate exclusion zones will be implemented to determine when and where works can proceed. If exclusion zones cannot be implemented, NPWS will be contacted and based on their advice, additional mitigation and compensation will be implemented, with relevant licences applied for if required.

Water Quality (During and Post-Construction)

5.735 Water quality monitoring will be undertaken as outlined in **Chapter 7**. This will check the efficacy of mitigation measures.

Birds (Post-Construction)

5.736 Based on current best-practice guidelines (SNH, 2009) and in accordance with EC Recommendation (C/2022/3219), a targeted range of flight activity surveys and collision monitoring (carcass searching) will be undertaken during the breeding and non-breeding seasons in years 1, 2 and 3 post construction, to monitor the rate of avian turbine collisions and identify any significant effects. Six hours of survey per vantage point per month will be carried out for flight activity surveys and one round of carcass searches per turbine per month will be carried out. These surveys should be carried out by qualified ecologists. The results of each year of monitoring will be presented in a report that will be submitted to the competent authority and NPWS. Thereafter, if no significant effects are shown (this would be demonstrated via an assessment of recorded mortality in the light of changes in current conservation status at the time of the monitoring survey, indicating that the Proposed Development is contributing to the decline or hindering restoration efforts for the relevant species), the monitoring should no longer be required, subject to agreement with the competent authority and NPWS. If monitoring indicates potentially significant levels of collision mortality for IEF birds, mitigation measures will be implemented (including turbine curtailment), and further monitoring will also be implemented in all additional years post construction, to ensure there are no significant effects on any IEF birds. Proposed mitigation and monitoring measures will be agreed with the planning authority prior to implementation.

Bats (Post-Construction)

5.737 Post-construction monitoring is required in line with commitments made in respect of the Proposed Development and in accordance with EC Recommendation (C/2022/3219) and should be seen as an opportunity to obtain data on bat/turbine interactions and to allow adaptive management of the proposed mitigation measures.

5.738 To reinforce the baseline results and better inform the precise requirements for post-construction monitoring, a year of confirmatory surveys will be undertaken for bats immediately prior to construction. This will involve three rounds of static detector surveys (spring, summer and autumn) as per the latest NatureScot (2021) guidance. The results of these surveys will be used to provide an updated baseline environment, for bats, and will form the basis of the post-construction monitoring programme. For example, in the event of high levels of activity at certain locations across the Proposed Development, post-construction monitoring will be adapted to pay particular attention to this location.

5.739 Following this additional year of pre-construction monitoring, the results will be used to assess the precise requirements for post-construction monitoring, including methods, timing and duration.

5.740 The post-construction monitoring programme will consist of:

- static detector surveys: these surveys will allow for a valid comparison of bat activity and Proposed Development usage with pre-construction levels. Following NatureScot (2021) guidance, the surveys are to be conducted during years 1, 2 and 3 post construction to allow for annual variation and cumulative effects. Reports will be submitted to the competent authority and NPWS following each year of surveys. Surveys will follow baseline survey methods, as outlined in NatureScot (2021) guidance. After three years of post-construction surveys, the monitoring programme may be extended or halted based on the results and following agreement with the competent authority and NPWS.
- fatality monitoring: if this is determined to be required following the additional year of pre-construction monitoring (i.e. due to high levels of bat activity), this will initially be conducted during years 1, 2 and 3 post construction to allow for annual variation and

cumulative effects. The comprehensive fatality monitoring programme for birds as described above will be extended and duplicated to bats for the first three years per the post-construction monitoring requirements recommended by NatureScot (2021). After three years of post-construction surveys, the monitoring programme may be extended or halted following agreement with the competent authority and NPWS.

5.741 The results of the post-construction monitoring surveys will be used to determine whether further mitigation measures, such as turbine curtailment, are required.

5.742 Bat mitigation buffers will be monitored in years 1, 2 and 3 following construction to ensure vegetation clearance and management measures have resulted in the desired habitat conditions. Once these conditions have been achieved, habitats will be maintained in this manner for the duration of the operational phase. The monitoring programme will help ensure there are no significant adverse effects on bats.

RESIDUAL EFFECTS

5.743 A summary of the effects, mitigation and residual effects, considering cumulative effects, is set out in **Table 5-18**.

5.744 Note that a 'balance-sheet' of habitat losses and gains is also presented in **Table 5-17**, which illustrates the residual direct effects of habitat loss.

Table 5-17: Residual Effects on Habitats

Fossitt Code	Fossitt Name	EU Annex I or PAW Affiliation?	Area (ha) / Length (m)[15]					Where and How Compensation / Enhancement Will Occur
			Total (baseline)	Permanent Loss	Temporary Loss	Compensation / Enhancement Gain	Net Change	
BC4	Flower beds and borders	No	0.03 ha	-	-	-	0 ha	Not required
BL1	Stone walls and other stoneworks	No	0.04 ha / 507.89 m	-	-	-	-0 m	Not required
BL3	Buildings and other artificial surfaces	No	13.11 ha / 83.35 m	-0.5 ha	-2.64 ha	-	-2.69 ha	None – artificial habitat
ED2	Bare ground	No	0.24 ha	-0.01 ha	-0.02 ha	-	-0.01 ha	None – highly modified habitat
ED3	Recolonising bare ground	No	336.96 m	-	-	-	-126.71 m	Not required
ED3 x WS1 x WS3	Recolonising bare ground x scrub x ornamental / non-native shrub mosaic	No	0.87 ha	-	-0.06 ha	-	-0.06 ha	None – highly modified habitat
FL5	Eutrophic lake	No	0.11 ha	-	-	-	0 ha	Not required

[15] Values with a minus sign represent a loss and values with a plus sign represent a gain

Fossitt Code	Fossitt Name	EU Annex I or PAW Affiliation?	Area (ha) / Length (m)[15]					Where and How Compensation / Enhancement Will Occur
			Total (baseline)	Permanent Loss	Temporary Loss	Compensation / Enhancement Gain	Net Change	
FL8	Other artificial lakes and ponds	No	0.04 ha	-	-	-	0 ha	Not required
FW1	Upland / eroding river	No	116.00 m	-	-	-	0 m	Not required
FW2	Lowland / depositing river	No	2,462.91 m	-	-	-	0 m	Not required
FW4	Drainage ditches	No	381.55 m	-	-	-	0 m	Not required
GA1	Improved agricultural grassland	No	175.52 ha	-5.31 ha	-10.06 ha	+10.06 ha	-5.31 ha	Temporary loss will be reverted after construction via natural recolonisation – no compensation of permanent loss required as highly modified habitat
GA1 x ED2	Improved agricultural grassland x bare ground mosaic	No	0.13 ha	-	-0.05 ha	+0.05 ha	0 ha	Temporary loss will be reverted after construction via natural recolonisation
GA2	Amenity grassland	No	3.67 ha	-	-0.15 ha	+0.15 ha	0 ha	Temporary loss will be reverted after construction via natural recolonisation

Fossitt Code	Fossitt Name	EU Annex I or PAW Affiliation?	Area (ha) / Length (m)[15]					Where and How Compensation / Enhancement Will Occur
			Total (baseline)	Permanent Loss	Temporary Loss	Compensation / Enhancement Gain	Net Change	
GS1	Dry and calcareous grassland	No	1.48 ha	-	-0.21 ha	+0.21 ha	0 ha	Temporary loss will be reverted after construction via natural recolonization (adjacent to existing habitat area and already highly modified)
GS2	Dry meadows and grassy verges	No	0.24 ha	-	-0.09 ha	+0.09 ha	0 ha	Temporary loss will be reverted after construction via natural recolonisation
GS4	Wet grassland	No	2.19 ha	-	-0.15 ha	+0.15 ha	0 ha	Temporary loss will be reverted after construction via natural recolonisation
PB4	Cutover bog (recolonizing)	No	1.31 ha	-0.12 ha	-0.07 ha	+7.26 ha	+7.26 ha	Temporary loss will be reverted after construction; permanent loss will compensated for, as enhancement of Area B will increase condition of recolonizing habitat types
PF3	Transition mire and quaking bog	**Yes – H7140**	2.11 ha	-	-	+7.07	+7.07 ha	Enhancement of Area B will increase condition (and likely the area of the existing habitat type)

Fossitt Code	Fossitt Name	EU Annex I or PAW Affiliation?	Area (ha) / Length (m)[15]					Where and How Compensation / Enhancement Will Occur
			Total (baseline)	Permanent Loss	Temporary Loss	Compensation / Enhancement Gain	Net Change	
WD1	(Mixed) broadleaved woodland	**Yes - PAW**	52.46 ha	-11.36 ha	-3.12 ha	+0.7 ha (in-situ) and 14.48 ha (ex-situ replacement planting)	+0.7 ha ha	Ex-situ replacement planting will be used to compensate for permanent and temporary loss (none of PAW type will be lost); compensatory planting in Area C for woodcock.
WD4	Conifer plantation	No	26.58 ha	-2.30 ha	-0.30 ha	+2.59 7 ha	0 ha	Ex-situ replanting
WD5	Scattered trees and parklands	No	12.84 ha	-	-	-	0 ha	Not required
WL1	Hedgerows	No	10,734.11 m	-402.62 m	-53.60	+1,917.36 m	+1,461.14 m	In-situ replanting, plus enhancement
WL1 x FW4	Hedgerow x drainage ditch mosaic	No	182.89	-6.43 m	-	+6.43 m	0 m	In-situ replanting
WL1 x WL2	Hedgerow x tree line mosaic	No	1,059.39 m	-20.74 m	-65.47 m	+86.21 m	0 m	In-situ replanting
WL2	Tree lines	No	6,861.52 m	-61.66 m	-37.23 m	+495.00 m	+396.11 m	In-situ replanting, plus enhancement
WN2	Oak-ash-hazel woodland	**Yes – PAW**	7.32 ha	-0.02 ha	-0.04	+0.06 ha	0 ha	Ex situ replanting (none of PAW type will be lost)

Fossitt Code	Fossitt Name	EU Annex I or PAW Affiliation?	Area (ha) / Length (m)[15]					Where and How Compensation / Enhancement Will Occur
			Total (baseline)	Permanent Loss	Temporary Loss	Compensation / Enhancement Gain	Net Change	
WN6	Wet willow-alder-ash woodland	No	0.22 ha	-	-	-	0 ha	Not required
WN7	Bog woodland	No	2.30 ha	-0.02 ha	-	+0.02 ha	0 ha	Very small area will be lost; enhancement of Area B and C will offset loss, as recolonizing cutover bog contains bog woodland species.
WS1	Scrub	No	3.57 ha	-0.01 ha	-0.18 ha	+0.19 ha	-0.19 ha	Area B will be fenced off and managed, with small areas of scrub left to recolonise and compensate for loss

Table 5-18: Summary of Effects

Ecological Feature	Phase	Potential Effect	Potential Cumulative Effect	Significance Pre-Mitigation	Proposed Mitigation / Compensation / Enhancement	Significance of Residual Effect
Riparian Designated Sites and Aquatic Ecology						
River Boyne and River Blackwater cSAC, River Boyne and River Blackwater SPA	Construction	Direct: none Indirect: short-term deterioration in water quality due to pollution or suspended solids	Risk slightly increased due to other projects and plans	Significant at the international scale for cSAC and SPA, national scale for pNHA and county/regional scale for Atlantic salmon,	See paragraph 5.629 onwards based on **Chapter 7** and CEMP in **Appendix 2-2** found in Volume III of this EIAR	Not significant

Ecological Feature	Phase	Potential Effect	Potential Cumulative Effect	Significance Pre-Mitigation	Proposed Mitigation / Compensation / Enhancement	Significance of Residual Effect
and Royal Canal pNHA Atlantic salmon, brook lamprey, European eel, white-clawed crayfish and otter				brook lamprey, European eel, white-clawed crayfish and otter		
	Operation	Direct: none Indirect: short-term deterioration in water quality due to lag in re-vegetation of bat mitigation buffers / poorly designed engineered, and constructed wind farm, leading to increased run-off, sedimentation, cement, concrete and hydrocarbons.	Risk slightly increased due to other projects and plans	Significant at the international scale for cSAC and SPA, national scale for pNHA and county/regional scale for Atlantic salmon, brook lamprey, European eel, white-clawed crayfish and otter	See paragraph 5.629 onwards based on **Chapter 7** and CEMP in **Appendix 2-2** found in Volume III of this EIAR. Enhancement measures to protect the riparian zone in the Northern Cluster (see **Appendix 5-10** found in Volume III of this EIAR) should help reduce the risk of any negative effects further.	Not significant
	Decommissioning	Direct and indirect: as for construction phase but no excavation needed, so potential effects are reduced in magnitude	Risk slightly increased due to other projects and plans	Significant at the international scale for cSAC and SPA, national scale for pNHA and county/regional scale for Atlantic salmon, brook lamprey, European eel, white-	See paragraph 5.629 onwards based on **Chapter 7** and CEMP in **Appendix 2-2** found in Volume III of this EIAR. Enhancement measures to protect the riparian zone in the Northern Cluster (see **Appendix 5-10**	Not significant

Ecological Feature	Phase	Potential Effect	Potential Cumulative Effect	Significance Pre-Mitigation	Proposed Mitigation / Compensation / Enhancement	Significance of Residual Effect
				clawed crayfish and otter	found in Volume III of this EIAR) should help reduce the risk of any negative effects further.	
Non-Riparian Designated Sites						
Lough Derravaragh SPA, Lough Glore pNHA and Lough Ramor pNHA	Construction / decommissioning	No direct or indirect effects are possible, as the only source-receptor pathway to the pNHAs are ecological	No elevated risk	Not significant	None	Not significant
	Operation	Direct mortality due to collision for pNHA bird species (whooper swan, coot, tufted duck and pochard for Lough Derravaragh SPA; coot, common snipe, northern lapwing, Eurasian curlew, Eurasian teal, pochard, tufted duck and common kestrel for Lough Glore pNHA; and great cormorant for Lough Ramor pNHA)	Additional mortality could occur to populations due to other wind farms in area	Not significant for whooper swan, coot, pochard and tufted duck for Lough Derravaragh SPA. Not significant for coot, northern lapwing, Eurasian curlew, Eurasian teal, pochard, tufted duck and common kestrel for Lough Glore pNHA. Not significant for great cormorant for Lough Ramor pNHA.	None	Not significant
	Decommissioning	No direct or indirect effects are possible, as the only	No elevated risk	Not significant	None	Not significant

Ecological Feature	Phase	Potential Effect	Potential Cumulative Effect	Significance Pre-Mitigation	Proposed Mitigation / Compensation / Enhancement	Significance of Residual Effect
		source-receptor pathway to the pNHAs are ecological				
Habitats						
For details on habitats see Table 5-17	Construction and Decommissioning	Direct effects: habitat loss	Risk unchanged by other wind farms, projects and plans in the area	Significant negative effect at local scale for mixed broadleaved woodland, oak-ash-hazel woodland, bog woodland, eutrophic pond, cutover bog, hedgerows, treelines (and mosaics), grassy verges, wet grassland, calcareous grassland, and scrub.	Enhancement will occur for transition mire and quaking bog and cutover bog, hedgerows. Compensation will occur for cutover bog, mixed broadleaved woodland, conifer plantation, hedgerows, treelines, oak-ash-hazel woodland, bog woodland and scrub. Temporary loss will be reverted after construction for improved agricultural grassland (including mosaics), amenity grassland, dry and calcareous grassland, dry meadows and grassy	Not significant

Ecological Feature	Phase	Potential Effect	Potential Cumulative Effect	Significance Pre-Mitigation	Proposed Mitigation / Compensation / Enhancement	Significance of Residual Effect
					verges, wet grassland, No compensation is proposed for loss of low-value, highly modified or artificial habitats (see Table 5-17 for details).	
		Indirect effects: smothering due to sediment washout, compaction, and excavation of soil adjacent to hedgerows and tree lines, smothering by dust on hedgerows and tree lines, and spread of non-native Japanese knotweed, cherry laurel, winter heliotrope and snowberry.	Risk unchanged by other wind farms, projects and plans in the area	Significant effects of smothering to Annex I transition mire and fen habitat at the county / regional scale. Significant effects of soil compaction / excavation, and dust smothering on hedgerows or tree lines at county / regional scale. Significant effects of spreading invasive and non-native species on hedgerows, amenity grassland, tree lines and conifer plantation habitats at the local scale.	As detailed in paragraph 5.629 onwards, a series of mitigation measures will be used to prevent sediment washout to Annex I transition mire and quaking bog habitats. As detailed in paragraph 5.670, root protection areas (circles around trees with radiuses defined as 12 x the diameter of the tree 1.5 m above ground) and dust suppression bowsers will be used to avoid damaging hedgerows and tree lines.	Not significant

Ecological Feature	Phase	Potential Effect	Potential Cumulative Effect	Significance Pre-Mitigation	Proposed Mitigation / Compensation / Enhancement	Significance of Residual Effect
					An Invasive Species Management Plan will be used to contain and eradicate Japanese knotweed, cherry laurel, winter heliotrope and snowberry detailed in paragraph 5.673 and the HSMP (shown in **Appendix 10-10** found in Volume III of the EIAR).	
	Operation	Direct: loss of habitat due to maintenance of bat mitigation buffers (detailed above in construction phase). Indirect: inappropriate drainage could affect hydrological levels of GWDTEs Annex I transition mire and quaking bog and bog woodland.	Risk unchanged by other wind farms, projects and plans in the area	Significant at the county / regional scale.	See paragraph 5.629 onwards based on **Chapter 7** and CEMP in **Appendix 2-2** found in Volume III of this EIAR. Enhancement measures to protect the riparian zone in the Northern Cluster (see **Appendix 5-10** found in Volume III of this EIAR) should help reduce the risk of any negative effects further.	Not significant
IEF Birds Primary Target Species						

Ecological Feature	Phase	Potential Effect	Potential Cumulative Effect	Significance Pre-Mitigation	Proposed Mitigation / Compensation / Enhancement	Significance of Residual Effect
Avian assemblage (primary target species as a collective)	Construction and Decommissioning	Direct nest damage or destruction	Risk unchanged by other wind farms, projects and plans in area	Not significant due to embedded mitigation	As detailed in paragraph 5.674 onwards, a series of embedded mitigation measures are included to avoid destruction of active nests.	Not significant
		Habitat loss leading to indirect disturbance / displacement. Especially breeding snipe and Eurasian woodcock. Also, for yellowhammer, skylark and meadow pipit.	Risk unchanged other wind farms, projects and plans in area.	Significant at county / regional scale for common snipe and Eurasian woodcock, and at local scale for yellowhammer, skylark and meadow pipit.	As detailed in HASMP (**Appendix 5-10** found in Volume III of this EIAR), measures are proposed to compensate for loss of hedgerows, tree lines, snipe territories and woodcock territories in situ. Loss of plantation habitats will also create open compensatory open habitats for skylark. Also, other habitats will be managed for biodiversity. Good practice measures will avoid disturbing species in breeding season	Not significant for common snipe, yellowhammer, skylark and meadow pipit. Partial compensation of loss of Eurasian woodcock territories means that some significant displacement effects are still likely but at the *local scale only*.

Ecological Feature	Phase	Potential Effect	Potential Cumulative Effect	Significance Pre-Mitigation	Proposed Mitigation / Compensation / Enhancement	Significance of Residual Effect
					including use of appropriate buffers if nests are discovered.	
	Operation	Barrier effect	No elevated risk due to presence of other projects or plans	Not significant	None	Not significant
European golden plover	Operation	Direct mortality due to collision	Additional mortality could occur to populations due to other wind farms in area	Not significant at national or county / regional scale for wintering population.	Post-construction monitoring is proposed (see paragraph 5.736). If monitoring shows potentially significant levels of collisions with turbines, mitigation measures will be implemented in conjunction with the Planning Authority and NPWS, which will include curtailment.	Not significant
Eurasian curlew	Operation	Direct mortality due to collision	Additional mortality could occur to populations due to other	Not significant at county / regional scale for wintering population only.	Post-construction monitoring is proposed (see paragraph 5.736). If monitoring shows potentially significant	Not significant

Ecological Feature	Phase	Potential Effect	Potential Cumulative Effect	Significance Pre-Mitigation	Proposed Mitigation / Compensation / Enhancement	Significance of Residual Effect
			wind farms in area		levels of collisions with turbines, mitigation measures will be implemented in conjunction with the Planning Authority and NPWS, which will include curtailment.	
Common kestrel	Operation	Direct mortality due to collision	Additional mortality could occur to populations due to other wind farms in area	Not significant at national or county / regional scale for resident population.	Reduction in suitability of habitats in bat mitigation buffers (see paragraph 5.698) to bring collision risk down further. Post-construction monitoring is proposed (see paragraph 5.736). If monitoring shows potentially significant levels of collisions with turbines, mitigation measures will be implemented in conjunction with the Planning Authority and NPWS, which will include turbine curtailment.	Not significant

Ecological Feature	Phase	Potential Effect	Potential Cumulative Effect	Significance Pre-Mitigation	Proposed Mitigation / Compensation / Enhancement	Significance of Residual Effect
Northern lapwing	Operation	Direct mortality due to collision	Additional mortality could occur to populations due to other wind farms in area	Not significant at national and county / regional scale for breeding or wintering population only.	Post-construction monitoring is proposed (see paragraph 5.736). If monitoring shows potentially significant levels of collisions with turbines, mitigation measures will be implemented in conjunction with the Planning Authority and NPWS, which will include turbine curtailment.	Not significant
Mallard	Operation	Direct mortality due to collision	Additional mortality could occur to populations due to other wind farms in area	Not significant at the national or county / regional scale	Post-construction monitoring is proposed (paragraph 5.736). If monitoring shows potentially significant levels of collisions with turbines, mitigation measures will be developed in conjunction with the Planning Authority and NPWS, which could include turbine curtailment.	Not significant

Ecological Feature	Phase	Potential Effect	Potential Cumulative Effect	Significance Pre-Mitigation	Proposed Mitigation / Compensation / Enhancement	Significance of Residual Effect
Peregrine falcon	Operation	Direct mortality due to collision	Additional mortality could occur to populations due to other wind farms in area	Not significant at national or county / regional scale for resident population.	Post-construction monitoring is proposed (paragraph 5.736). If monitoring shows potentially significant levels of collisions with turbines, mitigation measures will be implemented in conjunction with the Planning Authority and NPWS, which will include turbine curtailment.	Not significant
Whooper swan	Operation	Direct mortality due to collision	Additional mortality could occur to populations due to other wind farms in area	Not significant at national or county / regional scale for resident population.	Post-construction monitoring is proposed (paragraph 5.736). If monitoring shows potentially significant levels of collisions with turbines, mitigation measures will be implemented in conjunction with the Planning Authority and NPWS, which will include turbine curtailment.	Not significant

Ecological Feature	Phase	Potential Effect	Potential Cumulative Effect	Significance Pre-Mitigation	Proposed Mitigation / Compensation / Enhancement	Significance of Residual Effect
Common snipe	Operation	Disturbance/displacement and barrier effects	Risk increased slightly due to proximity of other wind farms, projects and plans in area.	Significant disturbance / displacement effects at county / regional scale due to loss of one breeding territory. Not significant barrier effects.	Compensation of lost breeding area via creation of wader 'scrapes'. Also, measures to enhance habitat quality of Annex I habitat / marsh fritillary breeding area will also help increase suitability for snipe via reduction of scrub. See paragraph 5.727 and **Appendix 5-10** shown in Volume III of the EIAR.	Not significant
		Direct mortality due to collision	Additional mortality could occur to populations due to other wind farms in area	Not significant (insufficient flight lines for modelling, so collision risk is by definition, extremely low)	Post-construction monitoring is proposed (paragraph 5.736). If monitoring shows potentially significant levels of collisions with turbines, mitigation measures will be implemented in conjunction with the Planning Authority and NPWS, which	Not significant

Ecological Feature	Phase	Potential Effect	Potential Cumulative Effect	Significance Pre-Mitigation	Proposed Mitigation / Compensation / Enhancement	Significance of Residual Effect
					will include turbine curtailment.	
Eurasian woodcock	Operation	Disturbance / displacement and barrier effects	Risk increased slightly due to proximity of other wind farms, projects and plans in area.	Significant disturbance / displacement effects at county / regional scale due to loss of two breeding territories. No significant barrier effects.	Compensation of one lost breeding territory via creation of new broadleaved woodland area with glades managed for Eurasian woodcock (see paragraph 5.728).	Partial compensation of loss of Eurasian woodcock territories means that some significant displacement effects are still likely but at the *local scale only*.
		Direct mortality due to collision	Additional mortality could occur to populations due to other wind farms in area	Not significant (insufficient flight lines for modelling, so collision risk is by definition, extremely low)	Post-construction monitoring is proposed (paragraph 5.736). If monitoring shows potentially significant levels of collisions with turbines, mitigation measures will be implemented in conjunction with the Planning Authority and NPWS, which will include turbine curtailment.	Not significant

Ecological Feature	Phase	Potential Effect	Potential Cumulative Effect	Significance Pre-Mitigation	Proposed Mitigation / Compensation / Enhancement	Significance of Residual Effect
Black-headed gull	Operation	Direct mortality due to collision	Additional mortality could occur to populations due to other wind farms in area	Not significant (insufficient flight lines for modelling, so collision risk is by definition, extremely low)	Post-construction monitoring is proposed (paragraph 5.736). If monitoring shows potentially significant levels of collisions with turbines, mitigation measures will be implemented in conjunction with the Planning Authority and NPWS, which will include turbine curtailment.	Not significant
Great cormorant	Operation	Direct mortality due to collision	Additional mortality could occur to populations due to other wind farms in area	Not significant (insufficient flight lines for modelling, so collision risk is by definition, extremely low)	Post-construction monitoring is proposed (paragraph 5.736). If monitoring shows potentially significant levels of collisions with turbines, mitigation measures will be implemented in conjunction with the Planning Authority and NPWS, which will include turbine curtailment.	Not significant

Ecological Feature	Phase	Potential Effect	Potential Cumulative Effect	Significance Pre-Mitigation	Proposed Mitigation / Compensation / Enhancement	Significance of Residual Effect
Hen harrier	Operation	Direct mortality due to collision	Additional mortality could occur to populations due to other wind farms in area	Not significant (insufficient flight lines for modelling, so collision risk is by definition, extremely low)	Post-construction monitoring is proposed (paragraph 5.736). If monitoring shows potentially significant levels of collisions with turbines, mitigation measures will be implemented in conjunction with the Planning Authority and NPWS, which will include turbine curtailment.	Not significant
Merlin	Operation	Direct mortality due to collision	Additional mortality could occur to populations due to other wind farms in area	Not significant (insufficient flight lines for modelling, so collision risk is by definition, extremely low)	Post-construction monitoring is proposed (paragraph 5.736). If monitoring shows potentially significant levels of collisions with turbines, mitigation measures will be implemented in conjunction with the Planning Authority and NPWS, which will include turbine curtailment.	Not significant

Ecological Feature	Phase	Potential Effect	Potential Cumulative Effect	Significance Pre-Mitigation	Proposed Mitigation / Compensation / Enhancement	Significance of Residual Effect
Mute swan	Operation	Direct mortality due to collision	Additional mortality could occur to populations due to other wind farms in area	Not significant (insufficient flight lines for modelling, so collision risk is by definition, extremely low)	Post-construction monitoring is proposed (paragraph 5.736). If monitoring shows potentially significant levels of collisions with turbines, mitigation measures will be implemented in conjunction with the Planning Authority and NPWS, which will include turbine curtailment.	Not significant
IEF Birds Secondary Target Species						
Eurasian teal, Eurasian coot, shelduck, Eurasian wigeon, lesser black-backed gull, common gull and barn owl	Construction / decommissioning	Disturbance / displacement due to habitat loss	Risk slightly increased due to proximity of other wind farms, projects and plans in the area	Not significant, as surveys suggest habitats outside the Proposed Development are more important for foraging, and a lack of breeding or sensitive roosts sites nearby	None	Not significant
	Operation	Disturbance / displacement and barrier effects	Risk slightly increased due to proximity of	Not significant, as surveys suggest habitats outside the Proposed	None	Not significant

Ecological Feature	Phase	Potential Effect	Potential Cumulative Effect	Significance Pre-Mitigation	Proposed Mitigation / Compensation / Enhancement	Significance of Residual Effect
			other wind farms, projects and plans in the area	Development are more important for foraging, and a lack of breeding or sensitive roosts sites nearby		
		Direct mortality due to collision	Additional mortality could occur to populations due to other wind farms in area	Not significant	Post-construction monitoring is proposed (paragraph 5.736). If monitoring shows potentially significant levels of collisions with turbines, mitigation measures will be implemented in conjunction with the Planning Authority and NPWS, which will include turbine curtailment.	Not significant
IEF Birds Red Listed Passerines						
Goldcrest, greenfinch, grey wagtail, house martin, house sparrow, linnet, meadow pipit, sand martin, redwing, skylark,	Construction / decommissioning	Disturbance / displacement due to habitat loss	Risk slightly increased due to proximity of other wind farms, projects and	Not significant	None. New broadleaved woodland will help create foraging and breeding habitats for woodland passerines (see paragraph 5.729).	Not significant

Ecological Feature	Phase	Potential Effect	Potential Cumulative Effect	Significance Pre-Mitigation	Proposed Mitigation / Compensation / Enhancement	Significance of Residual Effect
swallow, swift, willow warbler and yellowhammer			plans in the area		A new swift tower is part of enhancement measures (see paragraph 5.729), which will help boost the population of this species.	
	Operation	Disturbance / displacement and barrier effects	Risk slightly increased due to proximity of other wind farms, projects and plans in the area	Not significant	None	Not significant
IEF Mammals (Non-Bat)						
Badger	Construction / decommissioning	Direct destruction of setts / mortality	No risk	Not significant as no setts located within 50 m of proposed infrastructure and habitat enhancement will also help provide compensatory foraging and sheltering habitat.	See paragraph 5.680. Pre-construction walkover surveys will be undertaken and if breeding/resting places are discovered, exclusion zones will be implemented. Construction will also	Not significant

Ecological Feature	Phase	Potential Effect	Potential Cumulative Effect	Significance Pre-Mitigation	Proposed Mitigation / Compensation / Enhancement	Significance of Residual Effect
					be timed to avoid sensitive periods.	
		Indirect loss of foraging, commuting and sheltering habitat	No risk	Not significant	Compensatory broadleaved woodland for woodcock will also provide compensatory foraging and sheltering habitat (see paragraph 5.729).	Not significant
	Operation	Direct loss breeding / resting sites during vegetation clearance to maintain bat mitigation buffers	No risk	Not significant as no setts within 50 m of felling buffers.	See paragraph 5.680. Pre-construction walkover surveys will be undertaken and if breeding/resting places are discovered, exclusion zones will be implemented. Construction will also be timed to avoid sensitive periods.	Not significant
		Indirect disturbance/displacement	No risk	Not significant	None	Not significant

Ecological Feature	Phase	Potential Effect	Potential Cumulative Effect	Significance Pre-Mitigation	Proposed Mitigation / Compensation / Enhancement	Significance of Residual Effect
Pine marten	Construction / decommissioning	Direct destruction of dens / mortality	No risk	Not significant as no dens located within 100 m of proposed infrastructure and habitat enhancement will also help provide compensatory foraging and sheltering habitat.	See paragraph 5.680. Pre-construction walkover surveys will be undertaken and if breeding/resting places are discovered, exclusion zones will be implemented. Construction will also be timed to avoid sensitive periods.	Not significant
		Indirect loss of foraging, commuting and sheltering habitat	No risk	Not significant	Compensatory broadleaved woodland for woodcock will also provide compensatory foraging and sheltering habitat (see paragraph 5.729).	Not significant
	Operation	Direct loss of breeding/resting sites during vegetation clearance to maintain bat mitigation buffers	No risk	Not significant as no dens within 100 m of felling buffers.	See paragraph 5.680. Pre-construction walkover surveys will be undertaken and if breeding/resting places are	Not significant

Ecological Feature	Phase	Potential Effect	Potential Cumulative Effect	Significance Pre-Mitigation	Proposed Mitigation / Compensation / Enhancement	Significance of Residual Effect
					discovered, exclusion zones will be implemented. Construction will also be timed to avoid sensitive periods.	
		Indirect disturbance/displacement	No risk	Not significant	None	Not significant
Red squirrel	Construction / decommissioning	Direct destruction of dreys / mortality	No risk	Not significant as no dreys located within 50 m of proposed infrastructure and habitat enhancement will also help provide compensatory foraging and sheltering habitat.	See paragraph 5.680. Pre-construction walkover surveys will be undertaken and if breeding/resting places are discovered, exclusion zones will be implemented. Construction will also be timed to avoid sensitive periods.	Not significant
		Indirect loss of foraging, commuting and sheltering habitat	No risk	Not significant	Compensatory broadleaved woodland for woodcock will also provide compensatory foraging and sheltering habitat	Not significant

Ecological Feature	Phase	Potential Effect	Potential Cumulative Effect	Significance Pre-Mitigation	Proposed Mitigation / Compensation / Enhancement	Significance of Residual Effect
					(see paragraph 5.729).	
	Operation	Direct loss of breeding/resting sites during vegetation clearance to maintain bat mitigation buffers	No risk	Not significant as no dreys within 50 m of felling buffers.	See paragraph 5.680. Pre-construction walkover surveys will be undertaken and if breeding/resting places are discovered, exclusion zones will be implemented. Construction will also be timed to avoid sensitive periods.	Not significant
		Indirect disturbance/displacement	No risk	Not significant	None	Not significant
Irish hare	Construction / decommissioning	Direct destruction of forms / mortality	No risk	Not significant as construction will be undertaken in daylight hours	See paragraph 5.680. Pre-construction walkover surveys will be undertaken and if breeding/resting places are discovered, exclusion zones will be implemented. Construction will also	Not significant

Ecological Feature	Phase	Potential Effect	Potential Cumulative Effect	Significance Pre-Mitigation	Proposed Mitigation / Compensation / Enhancement	Significance of Residual Effect
					be timed to avoid sensitive periods.	
	Operation	Direct loss of breeding/resting sites during vegetation clearance to maintain bat mitigation buffers	No risk	Not significant as vegetation clearance will be undertaken in daylight hours	See paragraph 5.680. Pre-construction walkover surveys will be undertaken and if breeding/resting places are discovered, exclusion zones will be implemented. Construction will also be timed to avoid sensitive periods.	Not significant
		Indirect disturbance/displacement	No risk	Not significant	None	Not significant
Hedgehog	Construction / decommissioning	Direct destruction of hibernacula / mortality if construction takes place in winter months	No risk	Significant at local scale	See paragraph 5.680. Pre-construction walkover surveys will be undertaken and if breeding/resting places are discovered, exclusion zones will be implemented. Construction will also	Not significant

Ecological Feature	Phase	Potential Effect	Potential Cumulative Effect	Significance Pre-Mitigation	Proposed Mitigation / Compensation / Enhancement	Significance of Residual Effect
					be timed to avoid sensitive periods. Hibernacula enhancement (see paragraph 5.729) will help increase the local population.	
		Indirect disturbance could cause premature emergence from hibernation and starvation	No risk	Significant at local scale	Embedded mitigation and good practice will avoid impacts on hedgehogs (paragraph 5.680)	Not significant
	Operation	Direct loss of breeding/resting sites during vegetation clearance to maintain bat mitigation buffers	No risk	Significant at local scale	See paragraph 5.680. Pre-construction walkover surveys will be undertaken and if breeding/resting places are discovered, exclusion zones will be implemented. Construction will also be timed to avoid sensitive periods.	Not significant
		Indirect disturbance/displacement could cause premature	No risk	Significant at local scale	Embedded mitigation and good practice will avoid impacts on	Not significant

Ecological Feature	Phase	Potential Effect	Potential Cumulative Effect	Significance Pre-Mitigation	Proposed Mitigation / Compensation / Enhancement	Significance of Residual Effect
		emergence from hibernation and starvation			hedgehogs (paragraph 5.680)	
IEF Bats						
Bat assemblage	Construction / decommissioning	Direct destruction / disturbance of roost sites	No risk	Not significant at no roosts were recorded in works footprint of Proposed Development	See paragraph 5.685. Replacement of lost hedgerows/tree lines with like-for-like species. Inspection of trees/structures in works footprint at Proposed Development and along cable route will be undertaken in advance of construction. Emergence surveys and exclusion (under derogation licence) will be undertaken if destruction of roost is required. Exclusion zones and the timing of work will also be used to avoid impacts on bat roosts. Provision of bat boxes as part of	Not significant

Ecological Feature	Phase	Potential Effect	Potential Cumulative Effect	Significance Pre-Mitigation	Proposed Mitigation / Compensation / Enhancement	Significance of Residual Effect
					enhancement measures (see paragraph 5.729) will help increase the local population of bat species.	
	Operation	Indirect disturbance / displacement due to lighting	No risk	Not significant as most recorded bat species (common and soprano pipistrelle and Leisler's bat) are less sensitive to light disturbance; other species only recorded very infrequently	Embedded mitigation and good practice will avoid impacts on bats; cowled lighting will also be used as a precaution (see paragraph 5.685)	Not significant
		Indirect loss of foraging / commuting features and disturbance by night-time working	No risk	Significant at local scale for species recorded using foraging/commuting features (common and soprano pipistrelle, and Leisler's bat)	No night working is proposed as part of embedded mitigation (see paragraph 5.685) but if necessary, cowled lighting will be used to minimize any disturbance effects. Design of Proposed Development designed to avoid disrupting connectivity to landscape. Compensatory	Not significant

Ecological Feature	Phase	Potential Effect	Potential Cumulative Effect	Significance Pre-Mitigation	Proposed Mitigation / Compensation / Enhancement	Significance of Residual Effect
					measures (see paragraph 5.724) to offset loss of hedgerows and treelines will ensure like-for-like replanting of linear feature lost.	
Common, Nathusius' and soprano pipistrelle, and Leisler's bat	Operation	Direct collision with turbines or barotrauma	Additional mortality could occur to populations due to other wind farms in area	Significant at local scale for all but Nathusius' pipistrelle, which is not significant	Bat buffers will be implemented to reduce collision risk. Post-construction monitoring is proposed (paragraph 5.740). If monitoring shows potentially significant levels of collisions with turbines, mitigation measures will be implemented in conjunction with the Planning Authority and NPWS, which will include turbine feathering and / or curtailment.	Not significant
Myotis species and brown long-eared bat	Operation	Direct collision with turbines or barotrauma	Additional mortality could occur to	Not significant due to low activity and collision risk	Bat buffers will be implemented to reduce collision risk.	Not significant

Ecological Feature	Phase	Potential Effect	Potential Cumulative Effect	Significance Pre-Mitigation	Proposed Mitigation / Compensation / Enhancement	Significance of Residual Effect
			populations due to other wind farms in area			
IEF Other Fauna						
Amphibians (common frog and smooth newt)	Construction / decommissioning	Direct effects via accidental destruction of spawn.	No risk	Significant at local scale	See paragraph 5.692. Pre-construction checks and translocation of spawn/mating frogs will be undertaken under NPWS licence if present in Proposed Development footprint. Amphibian-proof fencing will be used to prevent amphibians from accessing any hazardous parts of the Proposed Development.	Not significant
		Indirect loss of foraging habitats	No risk	Not significant as enhancement of mire and cutover bog habitats compensatory foraging, commuting and sheltering habitat	None required. Hibernacula enhancement (see paragraph 5.729) will help increase local population.	Not significant

Ecological Feature	Phase	Potential Effect	Potential Cumulative Effect	Significance Pre-Mitigation	Proposed Mitigation / Compensation / Enhancement	Significance of Residual Effect
Marsh fritillary butterfly	Construction / decommissioning	Direct mortality / loss of habitat	No risk	Not significant as key breeding habitats will not be affected, with extensive buffers implemented to avoid damage to the area.	None required, although pre-construction checks will be employed in case marsh fritillary start to breed nearer to the development footprint. If that is the case, translocation under NPWS licence will be carried out. See paragraph 5.694 for details. Enhancement of key breeding habitats and surrounding mire and cutover bog areas will increase suitability of wider area for breeding marsh fritillary. See **Appendix 5-10** in Volume III of this EIAR.	Not significant
		Indirect loss of foraging habitats	No risk	Not significant as foraging habitats will be largely untouched (majority of habitat loss will be of low-value agricultural grassland and commercial conifer	None required. Enhancement of key breeding habitats and surrounding mire and cutover bog areas will increase	Not significant

Ecological Feature	Phase	Potential Effect	Potential Cumulative Effect	Significance Pre-Mitigation	Proposed Mitigation / Compensation / Enhancement	Significance of Residual Effect
				plantations, which do not offer important foraging opportunities to adult butterflies)	suitability of wider area for foraging marsh fritillary. See **Appendix 5-10** in Volume III of this EIAR. Enhancement of rough grassland around access roads (see paragraph 5.729) will help increase the provision of pollinating plants.	

CONCLUSION

5.745 This chapter comprehensively assesses all scenarios within the Turbine Range which is described throughout. The potential significant effects that could arise from the Proposed Development during the construction, operational and decommissioning phases are set out in this conclusion.

5.746 There are slight changes to the operational effects on IEF habitats, birds and bats associated between hub height 97.5 m and rotor diameter 155 m compared to hub height 99 m and rotor diameter 162 m but they will be no worse than the described effects. This is because a worst-case scenario has been assumed whereby the greatest potential effects have been identified depending on all permutations within the turbine range.

5.747 A proposed mitigation scheme for the construction, operational and decommissioning phases is described in this chapter and these mitigation measures will be implemented in full for the turbine selected within the Turbine Range.

5.748 Assuming that the mitigation measures in this Chapter are adopted in full, there are not likely to be any significant residual effects on important ecological features, apart from significant effects on Eurasian woodcock at the local scale due to partial loss of one breeding territory.

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FIGURES

660000 662000 664000 666000

768000

766000

T1 T2 T3 T4 T5 T6 T7 T8

Milestone Cross Roads

Lough Sheik Cross Roads

Killua Castle Deer Park

N

0 0.5 1

Kilometres

LEGEND

- Proposed Development Site Boundary
- Proposed Turbine Location
- Proposed Internal Cable Route
- Proposed Cable Route
- Proposed Substation Location
- Existing High Voltage Transmission Line
- Survey Area (Optioned Land and Proposed Cable Route 100 m Buffer)

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BIODIVERSITY

TERRESTRIAL ECOLOGY SURVEY AREA

FIGURE 5-1

Scale 1:20,000 @ A3

Date NOVEMBER 2023

02036.00812.0070.0 Terrestrial Ecology Survey Area

656000 660000 664000 668000

772000 768000 764000

02036.00812.0088.0 Aquatic Ecology Survey Area

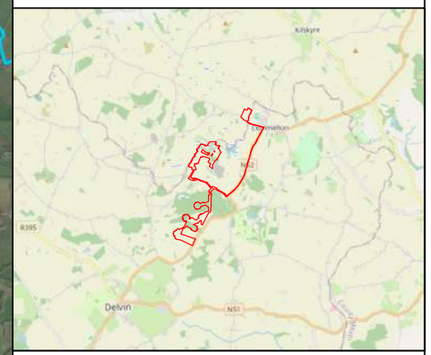
N

LEGEND

- Proposed Development Site Boundary
- Proposed Turbine Location
- Proposed Internal Cable Route
- Proposed Cable Route
- Proposed Substation Location
- Proposed Borrow Pit Search
- Existing High Voltage Transmission
- Watercourse
- Waterbody

Aquatic Survey Site

- Pond
- Riverine/Lake
- eDNA Sample Taken



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KNOCKANARRAGH WIND FARM ENVIRONMENTAL IMPACT ASSESSMENT REPORT

BIODIVERSITY

AQUATIC ECOLOGY SURVEY AREA

FIGURE 5-2-a

Scale 1:50,000 @ A3

Date MARCH 2024

0 2 4 Kilometres

662000 663000 664000 665000

769000

768000

02036.00812.0088.0 Aquatic Ecology Survey Area

B1 B2 B3 B4 B5* T1 T2 T3 P1 P2 P3 P4 P5 P6 P7 P8 P9 L1* Newtown Lough A1 A2 A3

KILLACROY KILSKEER Clonmellon KILSKEER KILRUSH LOWER SRANABOLL CARNYBROGAN Dicey's Crossroads Stream

N

0 200 400 Meters

LEGEND

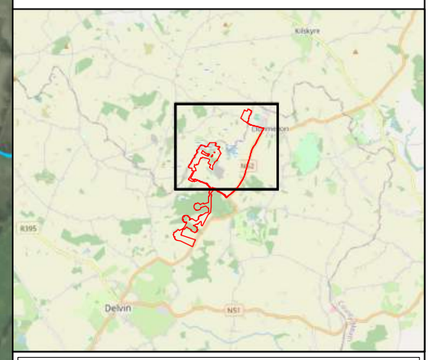
- Proposed Development Site Boundary
- Proposed Turbine Location
- Proposed Access Point
- Proposed Cable Route
- Proposed Access Track
- Proposed Construction Compound
- Proposed Substation Location
- Proposed Borrow Pit Search Area

Proposed Crane Hardstanding

- Permanent Hardstanding
- Temporary Hardstanding
- Level and Clearance Area
- Existing High Voltage Transmission Line
- Watercourse
- Waterbody

Aquatic Survey Site

- Pond
- Riverine/Lake
- eDNA Sample Taken



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KNOCKANARRAGH WIND FARM ENVIRONMENTAL IMPACT ASSESSMENT REPORT

BIODIVERSITY

AQUATIC ECOLOGY SURVEY AREA

FIGURE 5-2-b

Scale 1:10,000 @ A3

Date MARCH 2024

662000 663000 664000

767000 766000 765000

02036.00812.0088.0 Aquatic Ecology Survey Area

B5* B6 SHEEPSTOWN 07

Cross Keys Stream

D'arcys Crossroads Stream

Stonyford 07

P2 P3 P4 P5 P6 P7 P8 P9 P10 P11 P12

T4 T5 T6 T7 T8

N

0 200 400

Meters

LEGEND

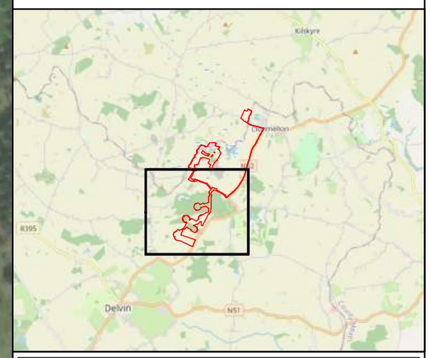
- Proposed Development Site Boundary
- Proposed Turbine Location
- Proposed Access Point
- Proposed Main Ring Unit
- Proposed Internal Cable Route
- Proposed Cable Route
- Proposed Access
- Proposed Operational Compound
- Proposed Borrow Pit Search Area

Proposed Crane Hardstanding

- Permanent Hardstanding
- Temporary Hardstanding
- Level and Clearance Area
- Watercourse
- Waterbody

Aquatic Survey Site

- Pond
- Riverine/Lake
- eDNA Sample Taken



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ASSESSMENT REPORT

BIODIVERSITY

AQUATIC ECOLOGY SURVEY AREA

FIGURE 5-2-c

Scale 1:10,000 @ A3

Date MARCH 2024

645000 660000 675000 690000

780000

765000

02036.00812.0072.0 SACs and SPAs within 20 km of the Proposed Development

Erne_SC_010
Erne_SC_020
Mountnugent_SC_010
Blackwater[Kells]_SC_010
Blackwater[Kells]_SC_020
Killyconny Bog (Cloghbally) SAC
Moynalty_SC_010
Dee_SC_020
Dee_SC_010
Dee_SC_030
Inny[Shannon]_SC_010
Inny[Shannon]_SC_020
Inny[Shannon]_SC_030
Inny[Shannon]_SC_040
White Lough, Ben Loughs And Lough Doo SAC
Lough Bane And Lough Glass SAC
Lough Lene SAC
Lough Derravaragh SPA
Girley (Drewstown) Bog SAC
Blackwater[Kells]_SC_030
Boyne_SC_100
Boyne_SC_120
Boyne_SC_110
Boyne_SC_070
River Boyne And River Blackwater SAC
River Boyne and River Blackwater SPA
Boyne_SC_080
Boyne_SC_050
Deel[Raharney]_SC_010
Boyne_SC_090
Wooddown Bog SAC
Boyne_SC_040
BROSNA_SC_010
Boyne_SC_060
Mount Hevey Bog SAC
Boyne_SC_030
Boyne_SC_020
Yellow[Castlejordan]_SC_010
Boyne_SC_010
RyeWater_SC_010
Liffey_SC_080

N

0 5 10
Kilometres

LEGEND

- Proposed Development Site Boundary
- Proposed Turbine Layout
- Proposed Development Site Boundary 20 km Buffer
- Watercourse
- Special Area of Conservation (SAC)
- Special Protection Area (SPA)
- Catchment Boundary

Catchment

- Boyne
- Erne
- Liffey and Dublin Bay
- Lower Shannon
- Nanny-Delvin
- Newry, Fane, Glyde and Dee
- Upper Shannon
- Sub-Catchment Boundary (Labelled with Sub-Catchment Name)

Ireland
Dublin

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ASSESSMENT REPORT

BIODIVERSTIY

CATCHMENTS AND NATURA 2000 SITES WITHIN 20 KM OF THE PROPOSED DEVELOPMENT STUDY AREA SURFACE WATER CATCHMENT

FIGURE 5-3-a

Scale 1:180,000 @ A3

Date OCTOBER 2023

645000 660000 675000 690000

780000

765000

02036.00812.0072.0 SACs and SPAs within 20 km of the Proposed Development

N

Killyconny Bog (Cloghbally) SAC

White Lough, Ben Loughs And Lough Doo SAC

Lough Bane And Lough Glass SAC

Girley (Drewstown) Bog SAC

River Boyne and River Blackwater SPA

Lough Derravaragh SPA

Lough Lene SAC

River Boyne And River Blackwater SAC

Wooddown Bog SAC

Mount Hevey Bog SAC

0 5 10

Kilometres

LEGEND

- Proposed Development Site Boundary
- Proposed Turbine Layout
- Proposed Development Site Boundary 20 km Buffer
- Watercourse
- Special Area of Conservation (SAC)
- Special Protection Area (SPA)

Ireland

Dublin

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KNOCKANARRAGH WIND FARM ENVIRONMENTAL IMPACT ASSESSMENT REPORT

BIODIVERSTIY

CATCHMENTS AND NATURA 2000 SITES WITHIN 20 KM OF THE PROPOSED DEVELOPMENT STUDY AREA GROUNDWATER BODIES

FIGURE 5-3-b

Scale 1:180,000 @ A3

Date OCTOBER 2023

645000 660000 675000 690000

780000

765000

02036.00812.0074.0 NHAs and pNHAs within 20 km of the Proposed Development

Erne_SC_010
Erne_SC_020
Mountnugent_SC_010
Blackwater[Kells]_SC_010
Lough Ramor pNHA
Blackwater[Kells]_SC_020
Dee_SC_020
Dee_SC_010
Dee_SC_030
Moynalty_SC_010
Killyconny Bog (Cloghbally) pNHA
Inny[Shannon]_SC_010
Hill Of Mael And The Rock Of Curry pNHA
Inny[Shannon]_SC_020
Lough Naneagh pNHA
Lough Glore pNHA
White Lough, Ben Loughs And Lough Doo pNHA
Blackwater[Kells]_SC_030
Girley Bog NHA
Boyne_SC_120
Boyne_SC_100
Boyne_SC_110
Lough Shesk pNHA
Jamestown Bog NHA
Lough Derravaragh NHA
Inny[Shannon]_SC_030
Lough Derravaragh NHA
Lough Derravaragh NHA
Boyne_SC_070
Boyne_SC_080
Boyne_SC_050
Deel[Raharney]_SC_010
Boyne_SC_090
Inny[Shannon]_SC_040
Royal Canal pNHA
Wooddown Bog NHA
Boyne_SC_040
Boyne_SC_060
BROSNA_SC_010
Molerick Bog NHA
Mount Hevey Bog pNHA
Ballynabarny Fen pNHA
Boyne_SC_030
Boyne_SC_020
Yellow[Castlejordan]_SC_010
Boyne_SC_010
RyeWater_SC_010
Liffey_SC_080

N

0 5 10
Kilometres

LEGEND

- Proposed Development Site Boundary
- Proposed Turbine Location
- Proposed Development Site Boundary 20 km Buffer
- Watercourse
- Natural Heritage Area (NHA)
- Proposed Natural Heritage Area (pNHA)
- Catchment Boundary

Catchment

- Boyne
- Erne
- Liffey and Dublin Bay
- Lower Shannon
- Nanny-Delvin
- Newry, Fane, Glyde and Dee
- Upper Shannon
- Sub-Catchment Boundary (Labelled with Sub-Catchment Name)

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BIODIVERSTIY

CATCHMENTS, NHAS AND PNHAS WITHIN 20 KM OF THE PROPOSED DEVELOPMENT STUDY AREA SURFACE WATER CATCHMENT

FIGURE 5-4-a

Scale 1:180,000 @ A3

Date DECEMBER 2023

645000
660000
675000
690000
780000
765000

02036.00812.0074.0 NHAs and pNHAs within 20 km of the Proposed Development

Lough Ramor pNHA
Killyconny Bog (Cloghbally) pNHA
Hill Of Mael And The Rock Of Curry pNHA
Lough Naneagh pNHA
Lough Glore pNHA
White Lough, Ben Loughs And Lough Doo pNHA
Aghalasty Fen pNHA
Lough Derravaragh NHA
Lough Shesk pNHA
Girley Bog NHA
Jamestown Bog NHA
Lough Sheever Fen/Slevin's Lough Complex pNHA
Wooddown Bog NHA
Royal Canal pNHA
Mount Hevey Bog pNHA
Molerick Bog NHA
Ballynabarny Fen pNHA

N

0 5 10
Kilometres

LEGEND

- Proposed Development Site Boundary
- Proposed Turbine Location
- Proposed Development Site Boundary 20 km Buffer
- Watercourse
- Natural Heritage Area (NHA)
- Proposed Natural Heritage Area (pNHA)

Groundwater Body

- Gravel
- Karstic
- Poorly Productive Bedrock
- Productive Fissured Bedrock

Newry
Éire / Ireland
Dublin
Galway

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BIODIVERSTIY

CATCHMENTS, NHAS AND PNHAS WITHIN 20 KM OF THE PROPOSED DEVELOPMENT STUDY AREA GROUNDWATER BODIES

FIGURE 5-4-b

Scale 1:180,000 @ A3
Date DECEMBER 2023

660000 662000 664000 666000

770000

768000

N

T1 T2 T3 T4 T5 T6 T7 T8

Fossit Code

- BL1 - Stone Walls and Other Stonework
- BL3 - Buildings and Artifical Surfaces
- ED3 - Recolonising Bare Ground
- FW1 - Eroding/Upland River
- FW2 - Depositing/Lowland River
- FW4 - Drainage Ditch
- WL1 - Hedgerow
- WL1 x FW4 - Hedgerow and Drainage Ditch
- WL1 x WL2 - Hedgerow and Treeline
- WL2 - Treeline

Habitat (Fossitt Code)

- PB4
- Annex 1 PF3 – Transition Mire and Quaking Bog
- BC4 - Flower Beds and Borders
- BL1 - Stone Walls and Other Stonework
- BL3 - Buildings and Artifical Surfaces
- ED2 - Spoil and Bare Ground
- ED3 x WS1 X WS3
- FL5 - Eutrophic Lake
- FL8 - Other Artifical Lakes and Ponds
- GA1 - Improved Agricultural Grassland
- GA1 x ED2 - Improved Agricultural Grassland and Spoil & Bare Ground Mosaic
- GA2 - Amenity Grassland (Improved)
- GS1 - Dry and Calcareous Neutral Grassland
- GS2 - Dry Meadows & Grassy Verges
- GS4 - Wet Grassland
- WD1 - Mixed Broadleaved Woodland
- WD4 - Conifer Plantation
- WD5 - Scattered Trees and Parkland
- WN2 - Oak-Ash-Hazel Woodland
- WN6 - Wet Willow-Alder-Ash Woodland
- WN7 - Bog Woodland
- WS1 - Scrub
- No Anticipated Impact

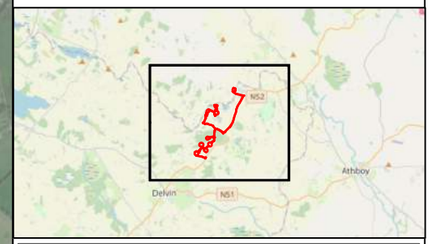
LEGEND

- Proposed Development Site Boundary
- Proposed Turbine Location
- Proposed Access Point
- Proposed Internal Cable Route
- Proposed Cable Route
- Proposed Substation Location
- Proposed Borrow Pit
- Existing High Voltage Transmission Line
- Survey Area (Optioned Land and Proposed Cable Route 100 m Buffer)

Invasive/Non-Native Species

- Cherry Laurel
- Japanese Knotweed
- Snowberry
- Japanese Knotweed

0 1 2 Kilometres



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KNOCKANARRAGH WIND FARM ENVIRONMENTAL IMPACT ASSESSMENT REPORT

BIODIVERSITY

HABITATS OF THE PROPOSED DEVELOPMENT AND CABLE ROUTE

FIGURE 5-5-a

Scale 1:25,000 @ A3

Date DECEMBER 2023

02036.00812.0075.0 Habitats of the Proposed Development and Cable Route

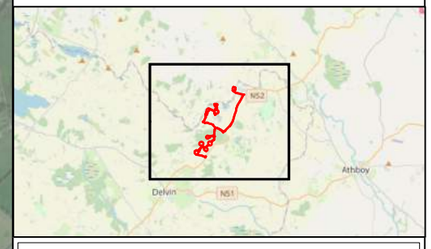
660000
662000
664000
666000
770000
768000

T1
T2
T3
T4
T5
T6
T7
T8

N

LEGEND

- Proposed Development Site Boundary
- Proposed Turbine Location
- Proposed Access Point
- Proposed Internal Cable Route
- Proposed Cable Route
- Proposed Substation Location
- Proposed Borrow Pit
- Existing High Voltage Transmission Line
- Survey Area (Optioned Land and Proposed Cable Route 100 m Buffer)
- Possible Ancient Woodland (PAW)



0
1
2
Kilometres

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BIODIVERSITY

HABITATS OF THE PROPOSED DEVELOPMENT AND CABLE ROUTE

FIGURE 5-5-b

Scale 1:25,000 @ A3

Date DECEMBER 2023

02036.00812.0075.0 Habitats of the Proposed Development and Cable Route

662000

WD4 WD4 WD4 WS1 WS1 WN6 WL1 GA1 WD1 WD1 WL1 WL1 WN6 T7 GS1 GA1 T8 GS1 WL2 GA1 WL2 FW4 WD1 BL1 ED2 BL1 GA1 WL2 WL2 GA1 BL3 BL3 BL3 GA1 BL1 BL3 WD5 ED2 GA1 WL1 GA1 ED3 WL1 WL2 WD5 GA1 WL2 WL2 WD1 WL1 GA1 FW2 WL1 WL1 GA1 WL2 WL1

0 0.2 0.4 Kilometres

N

LEGEND

- Proposed Development Site Boundary
- Proposed Turbine Location
- Proposed Access Point
- Proposed Internal Cable Route
- Proposed Borrow Pit
- Survey Area (Optioned Land and Proposed Cable Route 100 m Buffer)

Linear Habitat (Fossit Code)

- BL1 - Stone Walls and Other Stonework
- ED3 - Recolonising Bare Ground
- FW2 - Depositing/Lowland River
- FW4 - Drainage Ditch
- WL1 - Hedgerow
- WL2 - Treeline

Habitat (Fossitt Code)

- BL1 - Stone Walls and Other Stonework
- BL3 - Buildings and Artifical Surfaces
- ED2 - Spoil and Bare Ground
- GA1 - Improved Agricultural Grassland
- GS1 - Dry and Calcareous Neutral Grassland
- WD1 - Mixed Broadleaved Woodland
- WD4 - Conifer Plantation
- WD5 - Scattered Trees and Parkland
- WN2 - Oak-Ash-Hazel Woodland
- WN6 - Wet Willow-Alder-Ash Woodland
- WS1 - Scrub

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KNOCKANARRAGH WIND FARM ENVIRONMENTAL IMPACT ASSESSMENT REPORT

BIODIVERSITY

HABITATS OF THE PROPOSED DEVELOPMENT AND CABLE ROUTE

FIGURE 5-5-c

Scale 1:5,000 @ A3

Date DECEMBER 2023

02036.00812.0075.0 Habitats of the Proposed Development and Cable Route

662000

766000

02036.00812.0075.0 Habitats of the Proposed Development and Cable Route

N

LEGEND

- Proposed Development Site Boundary
- Proposed Turbine Location
- Proposed Access Point
- Proposed Internal Cable Route
- Proposed Cable Route
- Proposed Borrow Pit
- Survey Area (Optioned Land and Proposed Cable Route 100 m Buffer)

Invasive/Non-Native Species

- Japanese Knotweed
- Snowberry
- Japanese Knotweed

Linear Habitat (Fossit Code)

- FW2 - Depositing/Lowland River
- WL1 - Hedgerow
- WL1 x WL2 - Hedgerow and Treeline
- WL2 - Treeline

Habitat (Fossitt Code)

- BL3 - Buildings and Artifical Surfaces
- ED2 - Spoil and Bare Ground
- ED3 x WS1 X WS3
- FL5 - Eutrophic Lake
- FL8 - Other Artifical Lakes and Ponds
- GA1 - Improved Agricultural Grassland
- GS4 - Wet Grassland
- WD1 - Mixed Broadleaved Woodland
- WD4 - Conifer Plantation
- WN2 - Oak-Ash-Hazel Woodland
- WN6 - Wet Willow-Alder-Ash Woodland
- WN7 - Bog Woodland
- WS1 - Scrub

0 0.2 0.4

Kilometres

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KNOCKANARRAGH WIND FARM ENVIRONMENTAL IMPACT ASSESSMENT REPORT

BIODIVERSITY

HABITATS OF THE PROPOSED DEVELOPMENT AND CABLE ROUTE

FIGURE 5-5-d

Scale 1:5,000 @ A3

Date DECEMBER 2023

768000

N

GS4
T1
GA1
WD1
FW2
Annex 1 PF3 – Transition Mire and Quaking Bog
PB4
WN7
WL1 x FW4
T2
WL1
T3
WL1 x WL2
WL2
BL3
ED2

0 0.2 0.4
Kilometres

LEGEND

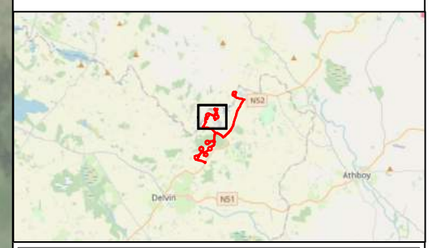
- Proposed Development Site Boundary
- Proposed Turbine Location
- Proposed Access Point
- Proposed Cable Route
- Proposed Borrow Pit
- Survey Area (Optioned Land and Proposed Cable Route 100 m Buffer)

Linear Habitat (Fossit Code)

- FW2 - Depositing/Lowland River
- WL1 - Hedgerow
- WL1 x FW4 - Hedgerow and Drainage Ditch
- WL1 x WL2 - Hedgerow and Treeline
- WL2 - Treeline

Habitat (Fossitt Code)

- PB4
- Annex 1 PF3 – Transition Mire and Quaking Bog
- BL3 - Buildings and Artifical Surfaces
- ED2 - Spoil and Bare Ground
- GA1 - Improved Agricultural Grassland
- GA1 x ED2 - Improved Agricultural Grassland and Spoil & Bare Ground Mosaic
- GS4 - Wet Grassland
- WD1 - Mixed Broadleaved Woodland
- WN7 - Bog Woodland



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HABITATS OF THE PROPOSED DEVELOPMENT AND CABLE ROUTE

FIGURE 5-5-e

Scale 1:5,000 @ A3

Date DECEMBER 2023

02036.00812.0075.0 Habitats of the Proposed Development and Cable Route

664000

N

LEGEND

- Proposed Development Site Boundary
- Proposed Turbine Location
- Proposed Access Point
- Proposed Cable Route
- Proposed Borrow Pit
- Survey Area (Optioned Land and Proposed Cable Route 100 m Buffer)

Invasive/Non-Native Species

- Japanese Knotweed
- Japanese Knotweed

Linear Habitat (Fossit Code)

- BL1 - Stone Walls and Other Stonework
- ED3 - Recolonising Bare Ground
- WL1 - Hedgerow
- WL1 x WL2 - Hedgerow and Treeline
- WL2 - Treeline

Habitat (Fossitt Code)

- BL3 - Buildings and Artifical Surfaces
- ED2 - Spoil and Bare Ground
- ED3 x WS1 X WS3
- FL5 - Eutrophic Lake
- FL8 - Other Artifical Lakes and Ponds
- GA1 - Improved Agricultural Grassland
- GA1 x ED2 - Improved Agricultural Grassland and Spoil & Bare Ground Mosaic
- GA2 - Amenity Grassland (Improved)
- GS2 - Dry Meadows & Grassy Verges
- GS4 - Wet Grassland
- WD1 - Mixed Broadleaved Woodland
- WD4 - Conifer Plantation
- WS1 - Scrub
- No Anticipated Impact

0 0.2 0.4

Kilometres

02036.00812.0075.0 Habitats of the Proposed Development and Cable Route

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HABITATS OF THE PROPOSED DEVELOPMENT AND CABLE ROUTE

FIGURE 5-5-f

Scale 1:5,000 @ A3

Date DECEMBER 2023

664000

768000

02036.00812.0075.0 Habitats of the Proposed Development and Cable Route

LEGEND

- Proposed Development Site Boundary
- Proposed Cable Route
- Survey Area (Optioned Land and Proposed Cable Route 100 m Buffer)

Linear Habitat (Fossit Code)

- BL1 - Stone Walls and Other Stonework
- ED3 - Recolonising Bare Ground
- FW2 - Depositing/Lowland River
- WL1 - Hedgerow
- WL2 - Treeline

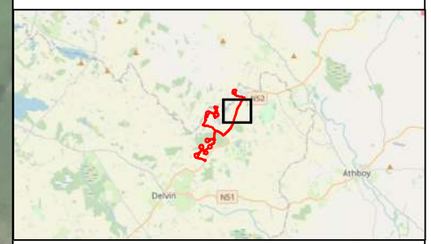
Habitat (Fossitt Code)

- BC4 - Flower Beds and Borders
- BL3 - Buildings and Artifical Surfaces
- ED2 - Spoil and Bare Ground
- GA1 - Improved Agricultural
- GA2 - Amenity Grassland
- GS4 - Wet Grassland
- WD1 - Mixed Broadleaved Woodland
- WS1 - Scrub
- No Anticipated

N

0 0.2 0.4

Kilometres



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HABITATS OF THE PROPOSED DEVELOPMENT AND CABLE ROUTE

FIGURE 5-5-g

Scale 1:5,000 @ A3

Date DECEMBER 2023

664000

N

LEGEND

- Proposed Development Site Boundary
- Proposed Access Point
- Proposed Cable Route
- Proposed Substation Location
- Existing High Voltage Transmission Line
- Survey Area (Optioned Land and Proposed Cable Route 100 m Buffer)

Invasive/Non-Native Species

- Cherry Laurel

Linear Habitat (Fossit Code)

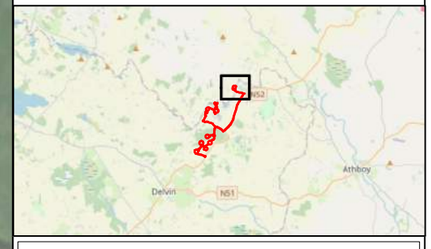
- BL1 - Stone Walls and Other Stonework
- BL3 - Buildings and Artifical Surfaces
- FW1 - Eroding/Upland River
- FW2 - Depositing/Lowland River
- WL1 - Hedgerow
- WL2 - Treeline

Habitat (Fossitt Code)

- BC4 - Flower Beds and Borders
- BL3 - Buildings and Artifical Surfaces
- GA1 - Improved Agricultural Grassland
- GA2 - Amenity Grassland (Improved)
- WS1 - Scrub
- No Anticipated Impact

0 0.2 0.4

Kilometres



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HABITATS OF THE PROPOSED DEVELOPMENT AND CABLE ROUTE

FIGURE 5-5-h

Scale 1:5,000 @ A3

Date DECEMBER 2023

02036.00812.0075.0 Habitats of the Proposed Development and Cable Route

660000 675000 690000 705000

780000

765000

Lough Shesk pNHA

River Boyne And River Blackwater SAC

River Boyne and River Blackwater SPA

Trim pNHA

Boyne Woods pNHA

Slane Riverbank pNHA

Crewbane Marsh pNHA

Dowth Wetland pNHA

Boyne River Islands pNHA

King William's Glen pNHA

Boyne Coast and Estuary SAC

Boyne Coast And Estuary pNHA

Boyne Estuary SPA

North-West Irish Sea SPA

N

0 5 10

Kilometres

LEGEND

- Proposed Development Site Boundary
- Potential Hydrological Connection
- Special Area of Conservation (SAC)
- Special Protection Area (SPA)
- Proposed Natural Heritage Area (pNHA)

Éire / Ireland

Dublin

Newry

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HYDROLOGICAL CONNECTIONS TO DESIGNATED NATURE CONSERVATION SITES

FIGURE 5-6

Scale 1:180,000 @ A3

Date DECEMBER 2023

02036.00812.0129.0 SAC and SPA Hydrological Connection

662000
663000
664000
665000
769000
768000

02036.00812.0076.0 Mammals Recorded at the Proposed Development

N

T1
T2
T3
T4
T5
T6
T7
T8

1
2
3
4
5
6
7
8
9
10
11
12

0
0.5
1
Kilometres

LEGEND

- Proposed Development Site Boundary
- Proposed Turbine Location
- Proposed Internal Cable Route
- Proposed Cable Route
- Proposed Access Track
- Proposed Construction Compound
- Proposed Operational Compound
- Proposed Substation Location
- Proposed Borrow Pit Search Area
- Proposed Crane Hardstanding
- Existing High Voltage Transmission Line
- Trail Camera Location

Mammal Sign

- Badger Latrine
- Active Badger Sett
- Non-Active Badger Sett
- Badger Snuffle Pit
- Fox Scat
- Fox Sighting
- Red Squirrel Nuts

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MAMMALS RECORDED AT THE PROPOSED DEVELOPMENT

FIGURE 5-7-a

Scale: 1:20,000 @ A3

Date: MARCH 2024

656000
660000
664000
668000
772000
768000

T1
T2
T3

N

LEGEND

- Proposed Development Site Boundary
- Proposed Turbine Location
- Proposed Access Point
- Proposed Cable Route
- Proposed Access Track
- Proposed Construction Compound
- Proposed Substation Location
- Proposed Borrow Pit Search Area

Proposed Crane Hardstanding

- Permanent Hardstanding
- Temporary Hardstanding
- Level and Clearance Area
- Existing High Voltage Transmission Line
- Trail Camera Location

0 250 500
Metres

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MAMMALS RECORDED AT THE PROPOSED DEVELOPMENT

FIGURE 5-7-b

Scale	Date
1:10,000 @ A3	MARCH 2024

02036.00812.0076.0 Mammals Recorded at the Proposed Development

662000
663000
664000
767000
766000

T4
T5
T6
T7
T8
1
2
3
4
5
6
7
8

N

0
250
500
Metres

LEGEND

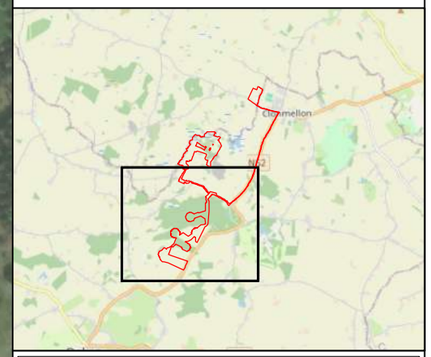
- Proposed Development Site Boundary
- Proposed Turbine Location
- Proposed Access Point
- Proposed Internal Cable Route
- Proposed Cable Route
- Proposed Access Track
- Proposed Operational Compound
- Proposed Borrow Pit Search Area

Proposed Crane Hardstanding

- Permanent Hardstanding
- Temporary Hardstanding
- Level and Clearance Area
- Trail Camera Location

Mammal Sign

- Badger Latrine
- Active Badger Sett
- Non-Active Badger Sett
- Badger Snuffle Pit
- Fox Scat
- Fox Sighting
- Red Squirrel Nuts



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MAMMALS RECORDED AT THE PROPOSED DEVELOPMENT

FIGURE 5-7-c

Scale 1:10,000 @ A3

Date MARCH 2024

02036.00812.0076.0 Mammals Recorded at the Proposed Development

662500
663000
663500
768500
768000

N

T1
T2
T3

0 100 200
Metres

LEGEND

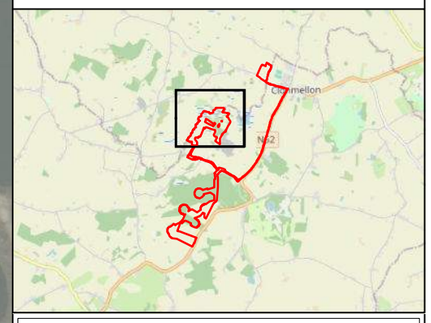
- Proposed Development Site Boundary
- Proposed Turbine Location
- Proposed Access Track
- Proposed Construction Compound
- Proposed Borrow Pit Search Area

Proposed Crane Hardstanding

- Permanent Hardstanding
- Temporary Hardstanding
- Level and Clearance Area

Survey Results

- Area Where Marsh Fritillary Larvel Webs Recorded



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MARSH FRITILLARY RECORDED AT THE PROPOSED DEVELOPMENT

FIGURE 5-8

Scale 1:5,000 @ A3

Date MARCH 2024

02036.00812.0077.0 Marsh Fritillary Recorded at the Proposed Development

656000
660000
664000
668000
772000
768000
764000
02036.00812.0078.0 Bat Felling Buffers

N

T1
T2
T3
T4
T5
T6
T7
T8

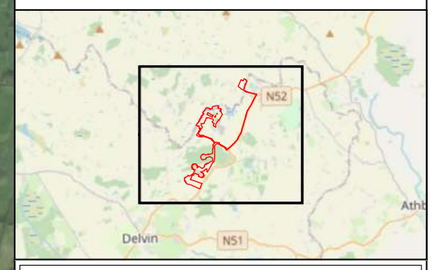
0
0.5
1
Kilometres

LEGEND

- Proposed Development Site Boundary
- Proposed Turbine Location
- Proposed Access Point
- Proposed Internal Cable Route
- Proposed Cable Route
- Proposed Access Track
- Proposed Construction Compound
- Proposed Operational Compound
- Proposed Substation Location
- Proposed Borrow Pit Search Area
- Proposed Crane Hardstanding
- Existing High Voltage Transmission Line

Bat Felling Buffer

- Broadleaved Plantation Buffer (105 m)
- Broadleaved Woodland & Treeline Buffer (117 m)
- Conifer Plantation Buffer (104 m)
- Other Woodland Buffer (104 m)
- Hedgerow Buffer (91 m)



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BAT FELLING BUFFERS

FIGURE 5-9-a

Scale 1:20,000 @ A3

Date MARCH 2024

662000 663000 664000 665000

769000

768000

T1 T2 T3

N

0 200 400

Meters

LEGEND

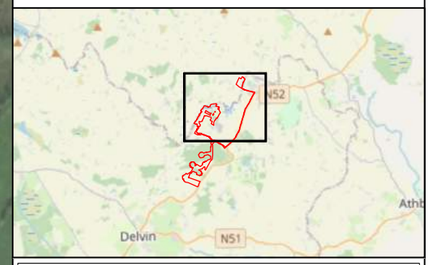
- Proposed Development Site Boundary
- Proposed Turbine Location
- Proposed Access
- Proposed Cable Route
- Proposed Access Track
- Proposed Construction Compound
- Proposed Substation Location
- Proposed Borrow Pit Search

Proposed Crane Hardstanding

- Permanent Hardstanding
- Temporary Hardstanding
- Level and Clearance
- Existing High Voltage Transmission Line

Bat Felling Buffer

- Broadleaved Woodland & Treeline Buffer (117 m)
- Other Woodland Buffer (104 m)
- Hedgerow Buffer (91 m)



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BAT FELLING BUFFERS

FIGURE 5-9-b

Scale 1:10,000 @ A3

Date MARCH 2024

02036.00812.0078.0 Bat Felling Buffers

662000
663000
664000
767000
766000
765000

T4
T5
T6
T7
T8

N

0
200
400
Meters

LEGEND

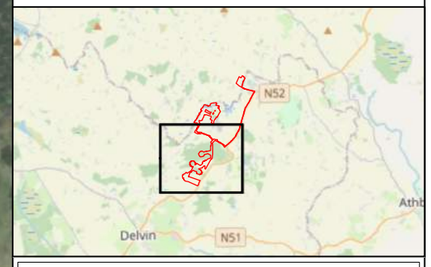
- Proposed Development Site Boundary
- Proposed Turbine Location
- Proposed Access Point
- Proposed Internal Cable Route
- Proposed Cable Route
- Proposed Access Track
- Proposed Operational Compound
- Proposed Borrow Pit Search Area

Proposed Crane Hardstanding

- Permanent Hardstanding
- Temporary Hardstanding
- Level and Clearance Area

Bat Felling Buffer

- Broadleaved Plantation Buffer (105 m)
- Broadleaved Woodland & Treeline Buffer (117 m)
- Conifer Plantation Buffer (104 m)
- Hedgerow Buffer (91 m)



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BAT FELLING BUFFERS

FIGURE 5-9-c

Scale 1:10,000 @ A3

Date MARCH 2024

02036.00812.0078.0 Bat Felling Buffers

APPENDICES

Appendix 5-1: County Development Plans

Appendix 5-2: Baseline Bird Reports

Appendix 5-3: Baseline Bat Reports

Appendix 5-4: Aquatic Ecology Reports

Appendix 5-5: Terms for Impact Assessment

Appendix 5-6: Designated Nature Conservation Site Synopses

Appendix 5-7: Desktop Data

Appendix 5-8: Collision Risk Model Report

Appendix 5-9: Habitat Survey Results

Appendix 5-10: Habitat and Species Management Plan

Appendix 5-11: NIS

(Refer to Volume III for Appendices)