Chapter 15: Biodiversity

Coolglass Wind Farm EIAR Vol 2

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0.5 (Final)				

Table of Contents

Tables in Text

Figures in Text

Photos in Text

Appendices

Acronyms and Abbreviations

SLR	SLR Consulting Limited
EIAR	Environmental Impact Assessment Report
EIA	Environmental Impact Assessment
DAFM	Department of Agriculture, Food and the Marine
CIEEM	Chartered Institute of Ecology and Environmental Management
CIRIA	Construction Industry Research and Information Association
AOD	Above Ordnance Datum
UN	United Nations
EU	European Union
NIS	Natura Impact Statement
SAC	Special Area of Conservation
SCI	Special Conservation Interests
SPA	Special Protection Area
GB	Great Britain
CEMP	Construction and Environmental Plan
SWMP	Surface Water Monitoring Plan
SuDS	Sustainable Drainage System
EMP	Ecological Monitoring Plan

QI	Qualifying Interest
ECoW	Ecological Clerk of Works
EM	Environmental Manager
AA	Appropriate Assessment
DOEHLG	Department of Environment, Housing and Local Government
CJEU	Court of Justice European Union
EPA	Environmental Protection Agency
NBDC	National Biodiversity Data Centre
NPWS	National Parks and Wildlife Services
BCI	Bat Conservation Ireland
FT	Fehily Timoney and Company
BoCCI	Birds of Conservation Concern
I-WeBS	Irish Wetland Bird Survey
TDR	Turbine Delivery Route
VP	Vantage Point
BoCCI	Birds of Conservation Concern Ireland
NS	NatureScot
GPS	Global Positioning System
DECC	Department of Environment, Climate and Communications
eDNA	Environmental DNA
IEFs	Important Ecological Features
ZOI	Zone of Influence
NHA	Natural Heritage Area
pNHA	Proposed Natural Heritage Area
ROI	Republic of Ireland
EPA	Environmental Protection Agency
CRM	Collision Risk Model
CRZ	Collision Risk Zone
IBAs	Important Bird Areas
WP	Wind Farm Polygon
PCH	Potential Collision Height
AGL	Above Ground Level
BTO	British Trust for Ornithology
CSZ	Core Sustenance Zones
FPM	Freshwater Pearl Mussel
SEDIMATS	Disturbed Sediment Entrainment Mats
HASMP	Habitat and Species Management Plan
SNH	Scottish Natural Heritage

15.0 Biodiversity

15.1 Introduction

15.1.1 Overview of the Proposed Development

All elements of the Project are described in Section 3.5 of this EIAR and the description of the Proposed Development is found in section 3.8.1 of this EIAR.

This chapter assesses the Proposed Development in accordance with section 3.1 and 3.1.1 of chapter 3 in this EIAR. Minimum and maximum hub height and rotor diameter parameters being proposed and all design permutations within that range as set out in Table 3.1 of Chapter 3 in this EIAR are being applied for.

Two cable connection route options (Options 1 and 2) which are part of the "Project" but not part of the Proposed Development that are being applied for are also assessed as part of this EIAR.

The Proposed Development is located entirely within the administrative area of Co. Laois.

Any forestry permanently lost due to the Proposed Development will be replanted elsewhere as per DAFM (2017) guidelines. These replant lands are not located within the same hydro- or hydrogeological sub-catchment and have no connectivity to the Proposed Development. The replant lands will be further assessed separately as part of a separate planning application and licensing process by the DAFM, when the exact location needs to be identified. This rationale is outlined further in Methodology Section 15.2.3.

15.1.2 Overview of Biodiversity in the Local Environment

The Site is dominated by conifer plantations and agriculture, like much of the wider landscape. The Northern Cluster is in an upland area at elevations between 285 – 325 m AOD. The Southern Cluster is in a flatter and lower area, with elevations between 196 - 300 m AOD. There are several minor watercourses within and near the Site: the Northern Cluster area drains to the Honey stream, Fossy Lower stream, Fallowbeg Upper stream and Owveg [Nore] river. The Southern Cluster area drains to the Clogh 15 and Brennanshill streams. There are also multiple drainage ditches along forestry tracks and field boundaries.

For the majority of both Cable Route Options, the cable will be embedded within existing roads or under botanically species-poor roadside verges. Only small sections of the routes, near the two substation options, will require excavation works, which are both confined to areas of agricultural land. There are roadside drainage ditches which flow parallel to the road. Both Cable Route Options cross the Scotland 15 stream. Option 1 Cable Route crosses the Owveg [Nore] River three times, the Cleanagh stream, the Garrintaggart stream and the Graiguenahown stream. Option 2 Cable Route crosses the Aghoney stream, the Fossy_Lower stream, The Stradbally [Laois] River and the Cremorgan stream.

15.1.3 Statement of Authority

Richard Arnold

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

This Chapter has been written by Jonathon Dunn MA (Cantab.) MSc PhD MCIEEM. Jonathon also undertook habitat surveys, mammal surveys, bat surveys and co-ordinate the bird 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 managing bird surveys. Jonathon has worked on a wide variety of projects with a focus on wind farms.

Sinéad Clifford

Habitat surveys, mammal surveys and the bat surveys (including call analysis) were undertaken by Sinéad Clifford BSc (Hons). 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

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 a number of 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

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.

15.1.4 Certainty and Sufficiency of Information Provided

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 Section 15.2.6.

15.2 Methodology and Guidance

15.2.1 Turbine Range

As stated in Chapter 3, a range of turbine permutations between a minimum hub height of 99 m and maximum hub height of 102.5 m and a minimum rotor diameter of 155 m and maximum of 162 m has been assessed in this EIAR. The approach in the current 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 where relevant to illustrate the effects of the other permutation. Any marked deviations in effects on biological receptors is discussed in the 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.

15.3.1 Legislation, Policy and Guidance

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

International legislation and policy

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

European legislation and policy

- EU Habitats Directive on the conservation of natural habitats and of wild fauna and flora (92/43/EEC) (as amended) (the Habitats Directive);
- EU Birds Directive on the conservation of wild birds (2009/147/EC) (as amended);
- The Berne Convention on the Conservation of European Wildlife and Natural Habitats;
- The Bonn Convention on the Conservation of Migratory Species of Wild Animals;
- EU Water Framework Directive establishing a framework for Community action in the field of water policy (2000/60/EC) (as amended);
- EU Environmental Liability Directive (2004/35/EC);
- EU EIA Directive on the assessment of the effects of certain public and private projects on the environment (2011/92/EU) (as amended) ;
- European Communities (Planning and Development) (Environmental Impact Assessment) Regulations 2018, as amended;

- European Communities (Water policy) Regulations, 2003, as amended ;
- European Communities Environmental Objectives (Surface Waters) Regulations 2009;
- EU Biodiversity Strategy 2020; 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 - Regulation 49 and 50 of European Communities (Birds and Natural Habitats) Regulations;
- S.I. No. 272/2009 – European Communities Environmental Objectives (Surface Waters) Regulations, as amended;
- S.I. No. 293/1988 - European Communities (Quality of Salmonid Waters) Regulations;
- European Union Environmental Objectives (Freshwater Pearl Mussel) (Amendment) Regulations 2009 to 2018;
- The Flora (Protection) Order 2022;
- The Heritage Act, 2018 (as amended);
- Planning and Development Act, 2000 (as amended);
- Project Ireland 2040;
- National Planning Framework;
- National Development Plan 2021-2030;
- National Heritage Plan 2030; and
- National Biodiversity Action Plan 2017-2021.

Local policy

The relevant component of chapters from Laois and Kilkenny County Development Plans have also been considered and are shown in Technical Appendix 15.1 found in Volume III of this EIAR:

- Laois County Draft Development Plan 2021-2027, Chapter 11 (Biodiversity and Natural Heritage);
- Kilkenny City and County Development Plan 2021-2027, Chapter 9 (Heritage, Culture and the Arts);
- Eastern & Midlands Regional Assembly; and
- Southern Regional Assembly

Guidance

Similarly, the following guidance has been applied during the preparation of the Chapter and appendices:

- Appropriate Assessment of Plans and Projects in Ireland – Guidance for Local Authorities (2010);
- OPR Practice Note PN01: Appropriate Assessment Screening for Development Management (2021);
- European Commission Guidance - Managing Natura 2000 sites: The provisions of Article 6 of the 'Habitats' Directive 92/43/EEC (2018);
- European Commission Guidance - Guidance document on wind energy development and EU nature legislation (2020);
- European Commission Guidance - Assessment of plans and projects in relation to Natura 2000 sites – methodology guidance on Article 6(3) and (4) of the Habitats Directive 92/43/EEC;
- BS43030: 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);
- EPA Guidelines on the information to be contained in Environmental Impact Assessment Reports (EIAR) 2022;
- All Ireland Pollinator Plan 2021-2025;
- Bat Conservation Ireland (2012);
- NatureScot guidance for birds e.g. (NatureScot, 2018), (NatureScot, 2017) ; and
- NatureScot guidance for bats e.g. (NatureScot, 2021).

15.2.2 Scoping

A request for observations on the preparation of the EIAR for the Proposed Development was sent to various consultees on 6 July 2022 (see Chapter 2). A summary of key points relating specifically to biodiversity taken from the responses is provided in **Table 15-1.** The responses are included in Technical Appendix 1.3 found in Volume III of this EIAR.

Table 15-1 Summary of Consultation Responses

Consultee	Date of first consultation	Consultee's Comments	Response
An Tasice	06/7/2022	No response	None required
BirdWatch Ireland	06/7/2022	No response	None required
Department of Agriculture, Food and the Marine	06/7/2022	No response	None required
Department of Arts, Heritage, Regional and Rural and Gaeltacht Affairs – Development Applications Unit	06/7/2022	No response	None required; sent follow-up email on 17/06/2022 but no response provided.

Consultee	Date of first consultation	Consultee's Comments	Response
(Nature Conservation)			
EPA	06/7/2022	No response	None required
Inland Fisheries Ireland	06/7/2022	Required the following of surveys: • Must demonstrate how Proposed Development will cause no deterioration to named waterbodies; and • Baseline ecological assessments of watercourses potentially affected by Proposed Development including physico-chemical surveys. Required the following reporting: • Must demonstrate how Proposed Development will cause no deterioration to named waterbodies; • Map of all aquatic habitats potentially affected by project; • Assessment of all potential adverse effects on all relevant aquatic receptors including River Barrow and River Nore SAC; and • Impact assessment should also include all other existing/approved Projects cumulatively. Required the following mitigation/monitoring: • Field testing and laboratory analysis of parameters to be undertake at agreed sites according to specific criteria during construction; • Records of monitoring before, during and after works; • Adherence to 'Guidelines on Protection of Fisheries during Construction Works in an advance to Waters 2016'; • Restrictions on timing of instream works and no interference with watercourses without IFI agreement and method statement; • Minimisation of new water crossings. Alteration of existing crossings should	Chapter 9 'Water' demonstrates that the Proposed Development will cause no deterioration to named waterbodies. Undertook baseline ecological and hydrological surveys following IFI guidance for wind farm developments including physico-chemical surveys. All aquatic habitats potentially affected by the Proposed Development are mapped in the current Chapter, which is accompanied by a detailed aquatic ecology and fisheries report (Technical Appendix 15.4 found in Volume III of this EIAR) that shows the locations of Annex 1 freshwater habitat. An assessment of all potential adverse effects on relevant aquatic receptors is included in the current chapter, which is accompanied by an NIS (Technical Appendix 15.10 found in Volume III of this EIAR) which includes an assessment of all potential effects on relevant aquatic receptors for Natura 2000 sites (including the River Barrow and River Nore SAC). Both this chapter and the NIS consider cumulative effects from other existing/approved projects. The mitigation/monitoring regime for the Proposed Development as pertains to aquatic ecology is described in the current chapter in sections 15.6 and 15.9. The Construction and Environmental Plan (CEMP), Surface Water Monitoring Plan (SWMP, which includes SuDS principles) and Ecological Monitoring Plan (EMP) are shown in Technical Appendix 3.2 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
		improve habitats and biodiversity net gain with IFI consultation; • Inclusion of CEMP, SWMP, EMP for EIAR and NIS, including EM and ECoW for works; and • SuDS principles for SWMP and installation of drainage in dry conditions.	
Irish Peatland Conservation Council	06/7/2022	No response	None required
Irish Raptor Group	06/7/2022	No response	None required
Irish Red Grouse Association	06/7/2022	No response	None required
Irish Wildlife Trust	06/7/2022	No response	None required
Kilkenny County Council	06/7/2022	The River Barrow and River Nore SAC, which is designated Natura 2000 site, is located close to the proposed wind farm and the associated NIS should ensure that there shall be no significant impact on the conservation objectives of the Natura 2000 site [sic]. The EIAR shall also address potential impacts pertaining to County Kilkenny in addition to County Laois.	Impacts on the River Barrow and Rive Nore SAC were assessed in the NIS. This concluded that with mitigation the conservation objectives of this Natura 2000 site would not be undermined and there were no likely significant effects on this Natura 2000 site from the Proposed Development, alone or in combination with any other plan or project. The current chapter examines potential impacts on County Kilkenny as well as County Laois.
Laois County Council	06/7/2022	With respect to AA, refer to DOEHLG AA of Plans and Projects in Ireland Guidance for Planning Authorities (2009) and Court Ruling (case C-323/17 People Over Wind and Peter Sweetman v Coillte) whereby CJEU ruled that mitigation measures could not be taken into account at screening stage of an AA	Mitigation measures were not included in the AA screening stage.
South Eastern River Basin Distriction	06/7/2022	No response	None required
Waterways Ireland	06/7/2022	No response	None required

15.2.3 Replant Lands

Replant lands equivalent in area size to the permanently clear-felled lands will be required (see Section 15.4.2 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 closer to the time of commencement of development works to identify the replant lands.

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.

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 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, delaying the identification of replant lands until such time as they are required enables identification of optimum lands available from an environmental perspective.

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.

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 (2016) Environmental Requirements for Afforestation and (2015) 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.

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

15.2.4 Desktop Assessment

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

The following resources were used for the desktop assessment:

- Satellite imagery[1];
- Environmental Protection Agency (EPA) maps[2];

[1] www.google.ie/maps Last accessed 20/06/2023

[2] https://gis.epa.ie/ Last accessed 20/06/2023

- National Biodiversity Data Centre (NBDC) database[3];
- Environmental Sensitivity Mapper[4];
- National Parks and Wildlife Services (NPWS)[5];
- NPWS data request. Request received on 16/03/2022;
- Bat Conservation Ireland (BCI) data request. Request received on 28/06/2022;
- Previous survey data from Fehily Timoney and Company (FT);
- A review of Greenland White-fronted Geese *Anser albifrons flavostris* 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).

These data and sources were used to help shape the scope of field surveys but were not used for impact assessment, except for the winter 2017/18 bird survey data that was collected by FT, which was site-specific and appropriate to use for assessment. All other desktop data were either collected at too coarse a spatial scale or were not specifically collected for the purposes of wind farm impact assessment.

Some of the organisations listed above collate their data at various spatial scales. A 10 km grid square S58 was used to collate spatial data for the 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 Route Options, which consist of a much smaller development footprint. Cable route options 1 and 2 are primarily confined to existing surfaced roads. As such, 2 km grid squares were only examined for the parts of the Cable Route Options that were off-road. This consisted of square S58B for Option 1 Cable Route 1 (c. 1.5 km along a forestry track and improved agricultural grassland) and square S59G for Option 2 Cable Route (c. 0.5 km through improved agricultural grassland).

As the accommodation works proposed along the Turbine Delivery Route (TDR) is minor and consists of trimming vegetation and temporary removal of signage/street furniture (see Technical Appendix 12.1 found in Volume III of this EIAR), desktop searches were not undertaken.

Designated Sites

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

[3] https://maps.biodiversityireland.ie/ Last accessed 20/06/2023

[4] https://airomaps.geohive.ie/ESM/ Last accessed 20/06/2023

[5] www.npws.ie/ Last accessed 20/06/2023

[6] www.birdwatchireland.ie/our-work/surveys-research/research-surveys/irish-wetland-bird-survey/ Last accessed 25/11/2022. 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 20/06/2023.

- NPWS; and
- NBDC.

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 Section 15.2.4.

15.2.5 Field Assessment

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 15-2** below.

Table 15-2 Summary of Ecological Surveys

Survey	Description	Timing	Guidance Applied
Habitats and flora	Walkover survey at Project.	July 2022	(Fossitt, 2000) (Smith, O'Donoghue, O'Hora, & Delaney, 2011)
Birds Full details are contained within Technical Appendix 15.2 found in Volume III of this EIAR.	Vantage point (VP) surveys covering each turbine location plus a 500 m radius around the same. Seven VPs x 36 hours/VP/season over 1.5 years[8] Five VPs x 36/hours/VP/season over 0.5 years[9] (Site reduced in size)	Non-breeding season 2017/18: 7 September 2017 to 29 March 2018	(NatureScot, 2017)
		Breeding season 2021: 27 April to 20 September 2021	
		Non-breeding season 2021/22: 12 October 2021 to 2 April 2022	
		Breeding season 2022: 13 May to 30 August 2022	
	Breeding raptor surveys within the Site plus a 2 km buffer zone	Breeding season 2021: 19 May to 31 July 2021	
		Breeding season 2022: 6 May to 25 July 2022	

[8] Except for winter 2017/19 where VP1 had 51 hours/season, VP2 had 43.5 hours/season, VP3 had 40 hours/season, VP4 had 32.5 hours/season and VP5 had 30 hours/season. Years referred to include the winter of 2017/18, summer of 2021 and winter of 2021/22.

[9] Years referred to include the summer of 2022

Survey	Description	Timing	Guidance Applied
	Breeding wader surveys (lowland) within the Site	Breeding season 2022: 6 May to 23 June 2022	
	Feeding distribution surveys within the Site plus a 500 m buffer zone	Non-breeding season 2021/22: 22 October 2021 to 15 March 2022	
	Winter transect surveys within the Site	Non-breeding season 2017/18: 20 November 2017 to 27 March 2018	(Marchant, 1983)
Terrestrial mammals (excluding bats)	Searches within 150 m of Site infrastructure	Winter 2021: 7 to 10 February 2022 and summer 2022: 4 to 6 July 2022	(Cresswell, et al., 2012)
	Trail cameras within the Site	Summer 2022: 7 to 20 July 2022	
Bats Full details are contained in Technical Appendix 15.3 found in Volume III of this EIAR.	Preliminary ecological appraisal and winter roost assessment: within Site	Winter 2021: 7 to 10 February 2022	(Collins, 2016) (NatureScot, 2021)
	Summer roost assessment: within Site	Summer 2021: 4 to 6 July 2022	
	Ground-level static detectors: at 16 turbines for summer and autumn 2021 rounds and 11 turbines for spring 2022 round (five less detectors were deployed in spring 2022 due to a reduction in the proposed number of turbines)	Summer: 12 July to 4 August 2021 Autumn: 7 September to 23 September 2021 Spring: 26 May to 7 June 2022	(NatureScot, 2021)
	Transects: two locations (one in Northern Cluster and one in Southern Cluster)	Spring: 26 May 2022 Summer: 16 August 2022 Autumn: 28 September 2022	(Collins, 2016) (NatureScot, 2021)
	Emergence survey: derelict building near quarry	15 August 2022	(Collins, 2016)
	Survey of trees/structures along cable routes and TDR	13 - 14 August, and 20 – 21 August 2022	(Collins, 2016)
Other protected fauna	Invertebrates, amphibians and reptiles within Site	4 to 6 July 2022	N/A
Fisheries and aquatic ecology Full details are contained in	Undertaken on a catchment-wide scale, the baseline surveys focused on aquatic habitats in relation	31 August to 3 September 2022	(Environment Agency, 2003)

Survey	Description	Timing	Guidance Applied
Confidential Technical Appendix 15.4 found in Volume III of this EIAR.	to fisheries potential (including both salmonid and lamprey habitat), white-clawed crayfish *Austropotamobious pallipes*, freshwater/Nore pearl mussel *Margaritifera margaritifera* and *Magaritifera durrovensis* (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 the Project is located.		

Study Areas

See Figure 15-1, Figure 15-2 and below for further details on taxon-specific surveys areas.

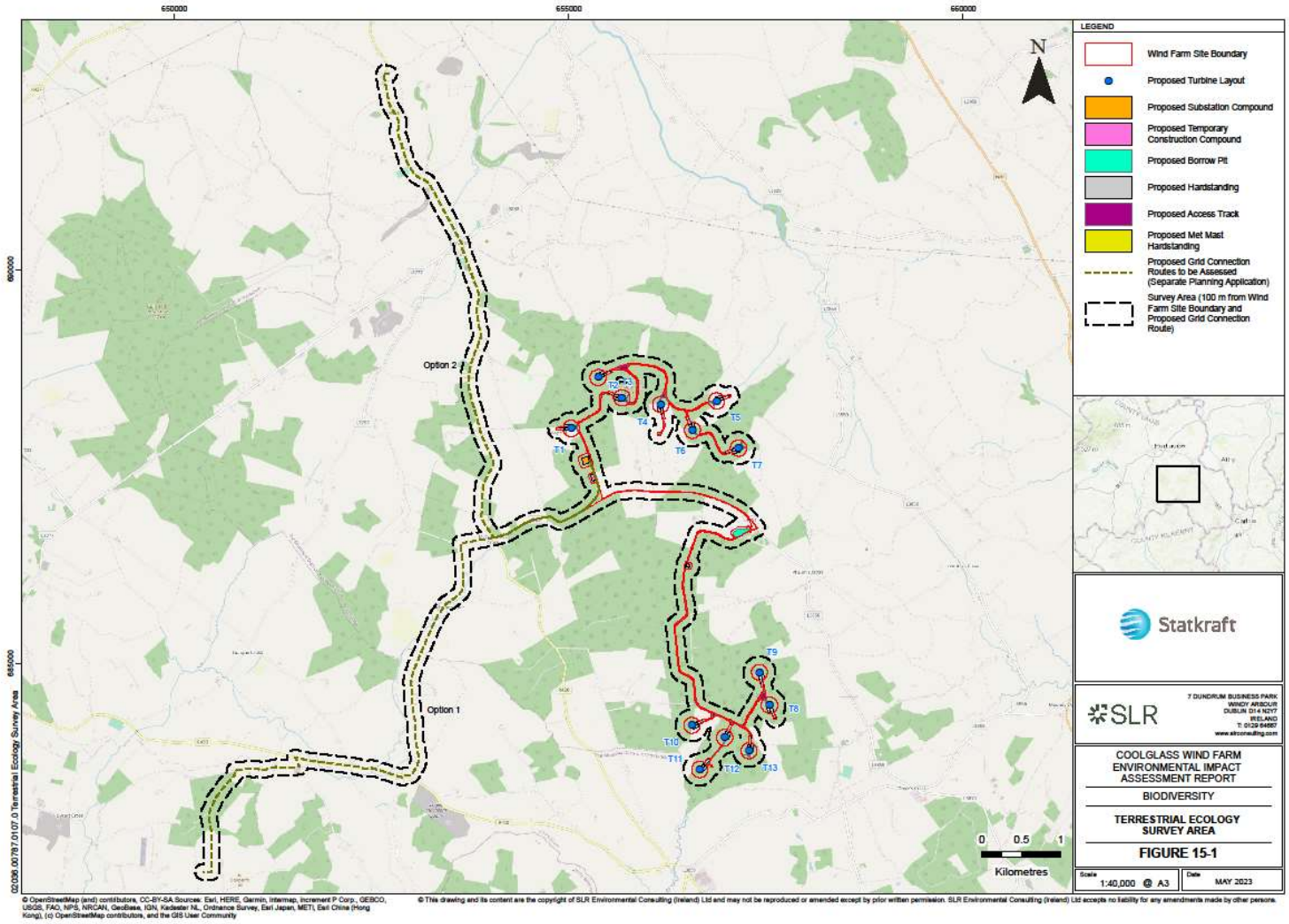


Figure 15-1: Terrestrial Ecology Survey Area

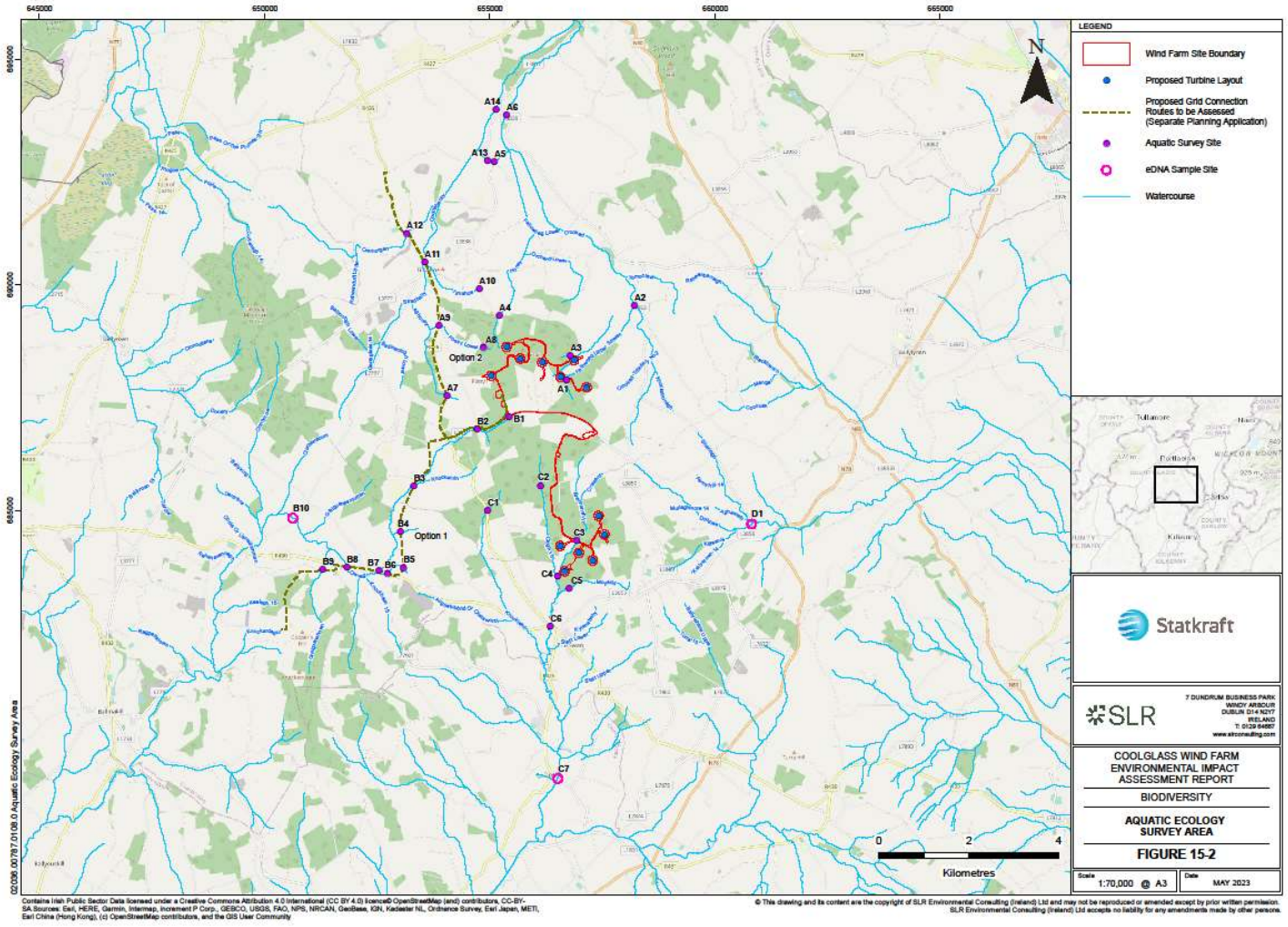


Figure 15-2: Aquatic Ecology Survey Area

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

The survey area included the Site, plus adjacent lands to the Cable Route Options and TDR. All areas within 50 m of any proposed infrastructure of the Project were surveyed for signs of mammals. Areas within the Site were assessed for habitat suitability for amphibians and reptiles.

Birds

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 Survey Methodology' Section below and are described in more detail within the baseline survey reports (Technical Appendix 15.2 found in Volume III of this EIAR).

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

The survey areas used for bat impact assessment were as recommended by relevant good practice survey guidance (NatureScot, 2021). These are summarised in the 'Field Survey Methodology' Section below and are described in more detail within the baseline survey reports (Technical Appendix 15.3 found in Volume III of this EIAR).

Fisheries and Aquatic Ecology

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 Project were considered with a total of 33 riverine sites targeted for detailed aquatic assessment. These sites were both within the Site and along the two Cable Route Options. None of the proposed turbine delivery route accommodation works were located near any watercourses. The surveys are summarised in the 'Field Survey Methodology' Section below and are described in more detail within the baseline survey report (Technical Appendix 15.4 found in Volume III of this EIAR).

Habitats and Flora

Terrestrial habitats were mapped according to Fossitt (2000) and the good-practice measures outlined in Heritage Council guidance (Smith, O'Donoghue, O'Hora, & Delaney, 2011). The locations of any rare or invasive plant species were recorded using a hand-held GPS. No potential Annex 1 habitats were detected at the Proposed Development Site or the Cable Route Options during the initial surveys and so no further detailed botanical surveys were required. All habitat surveys were conducted during optimal times of year.

Birds

Baseline ornithology surveys were conducted during the period October 2017 to March 2018 and May 2021 to September 2022. Full data are presented in Technical Appendix 15.2 found in Volume III of this EIAR.

Target Species

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.

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, Canavero, Ardenghi, & Zambon, 2015; Beston, Diffendorfer, Loss, & Johnson, 2016; Stewart, Pullins, & Coles, 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 Site.

Primary Target Species

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."

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 1 of the Birds Directive. In addition, some species red-listed under the Birds of Conservation Concern in Ireland (BoCCI) scheme (Colhoun & Cummins, 2013; Gilbert, Stanbury, & Lewis, 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.

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

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

- Common kestrel *Falco tinnunculus*;
- Common snipe *Gallinago gallinago*;
- Eurasian woodcock *Scolopax rusticola*;
- Northern lapwing *Vanellus vanellus*; and
- Peregrine falcon *Falco peregrinus*.

Common kestrel, common snipe and Eurasian woodcock are not listed under Annex 1 of the Birds Directive but they are currently red-listed under the latest BoCCI 4: 2020-2026 scheme (Gilbert, Stanbury, & Lewis, 2021).

Non-Breeding Season

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

- Common kestrel;
- Common snipe;
- Eurasian woodcock;
- European golden plover *Pluvialis apricaria*;
- Hen harrier *Circus cyaneus*;
- Merlin *Falco columbarius*;
- Northern lapwing; and
- Peregrine falcon.

Secondary Target Species

Secondary target species were limited to species that may be affected by wind farms but either lack a higher level of legislative protection (not listed on Annex 1 of the Birds Directive or listed as SCIs) and/or are not red-listed under the latest BoCCI4 scheme.

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*;
- Northern raven *Corvus corax*;
- Grey heron *Ardea cinerea*;
- Great cormorant *Phalacrocorax carbo*; and
- Gulls *Larus* spp. (where not recorded as primary target species).

Baseline Survey Methodologies

Surveys were carried out following the relevant NatureScot (NS) Guidance (NatureScot, 2017). Further details are provided in Technical Appendix 15.2 found in Volume III of this EIAR with a summary provided below.

Flight Activity Surveys

Surveys first commenced in September 2017 and ended in March 2018. They were then re-started in May 2021 and continued until August 2022. As per current guidance, a minimum of thirty-six hours of flight activity surveys were conducted from each of two VP locations during each non-breeding and breeding season.

The number of hours completed at each VP, in each season, is summarised in **Table 15-3** and **Table 15-4**.

Table 15-3 VP Survey Hours (Hrs:Mins), Sept 2017 – Mar 2018

VP	2017-18 (Oct-Mar)
1	51:00
2	43:34
3	40:00
4	32:30

5	30:00
6	36:00
7	36:00

Table 15-4 VP Survey Hours (Hrs:Mins), May 2021 – August 2022

VP	2021 (Apr-Sep)	2021-22 (Oct-Mar)	2022 (Apr-Aug)
1	36:00	36:00	36:00
2	36:00	36:00	36:00
3	36:00	36:00	36:00
4	36:00	36:00	36:00
5	36:00	36:00	-
6	36:00	36:00	-
7	36:00	36:00	36:00

Breeding Wader Surveys

Surveys were undertaken in 2022 within the Site plus a 500 m buffer zone beyond as recommended by NatureScot (2017) guidance, using the methodology described in O'Brien and Smith (1992) which is suitable for lowland grassland sites. Three survey visits were undertaken in each year between the middle of April to June inclusive, at least one week apart. No surveys were undertaken in 2021. However, surveys were undertaken in 2022.

Full details are provided in Technical Appendix 15.2 found in Volume III of this EIAR.

Breeding Raptor Surveys

The survey methodology for breeding raptors in 2021 and 2022 used a driven transect with regular stops, to carry out watches of potentially suitable habitat from appropriate viewpoints to identify potential nesting territories.

Survey timings followed those in Hardey *et al.* (2013), as per current NatureScot (2017) guidelines. Surveys were repeated along the same route monthly from April to July inclusive. A driven survey was used due to limitations to access to third party land within the 2 km buffer zone and the availability of a good road network in the vicinity of the Site. Suitable breeding habitat for Annex 1 raptors within the Site and 2 km buffer was very limited and visibility from the survey route was sufficient to cover the vast majority of potentially suitable breeding habitat within the survey area i.e. the efficacy of the assessment was not affected.

While they were not the focus of the surveys, the regular stops were also used to record other, non-Annex 1, raptor species such as common kestrel and common buzzard. While it is possible that nest locations for the more common raptor species within the 2 km buffer zone were not identified (as they were not specifically searched for), the surveys were sufficient for determining probable breeding territory occupancy as evinced by displaying, courtship and territorial behaviour in suitable breeding habitat. Any such behaviour close to the sites themselves would also have been recorded during VP watches if present.

Full details are provided in Technical Appendix 15.2 found in Volume III of this EIAR.

Swan and Goose Feeding Distribution Surveys

Whooper swan *Cygnus cygnus* and Greenland white–fronted goose are not features of interest of any SPAs within 20 km of the Site (see **Table 15-5**). According to NatureScot (2017) guidance, feeding distribution surveys are not required. However, feeding distribution surveys for these, other wildfowl species, and waders were carried out as a precaution.

Feeding distribution surveys were carried out on every fortnight between October to March inclusive each winter to surveys for swans and geese using fields within 500 m of the Site boundary. These surveys were undertaken by driven transect, stopping on a regular basis to check all fields for swan and goose feeding activity.

Full details are provided in Technical Appendix 15.2 found in Volume III of this EIAR.

Winter Walkover Surveys

While not required by NatureScot (2017) guidance, a winter walkover survey was conducted in the winter of 2017/18. This survey was used to obtain a fuller picture of red- or amber-listed passerines species that might be present. This consisted of walking four transects four times. Two transects were in the Northern Cluster and two were in an area that has since been dropped from the Site. The methodology broadly followed that given by the Bird Survey & Assessment Steering Group (2022) and Marchant (1983).

Full details are provided in Technical Appendix 15.2 found in Volume III of this EIAR.

Fisheries and Aquatic Surveys

Signs of kingfisher nesting/foraging were searched for during aquatic surveys (see below).

Terrestrial Mammals (Excluding Bats)

Dedicated mammal surveys were carried out in the winter of 2021/22 and 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/sighting 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 Cresswell *et al.* (2012), with a particular focus on badger *Meles meles*, pine marten *Martes martes* and red squirrel *Sciurus vulgaris*.

Trail cameras were also deployed at suitable locations in both turbine clusters near tracks adjacent to forestry under licence from NPWS (license no. 195/2021).

Otters *Lutra lutra* were searched for during the aquatic surveys (see below).

Bats

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

Surveys were carried out following the relevant NatureScot Guidance (NatureScot, 2021). Further details are provided in Technical Appendix 15.3 found in Volume III of this EIAR with a summary provided below.

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

A dusk study was used to compile information on potential roosts and foraging habitats within the Site and along the Cable Route Options plus along the turbine delivery route where any works will take place. The survey area was walked during winter 2021/22 and

summer 2022 to search for potential winter and summer roosts, plus to undertake an initial site risk assessment for bats.

Emergence Survey

Following roost searches, a dusk emergence survey was carried out in August 2022 at a derelict farm building in the Southern Cluster. Two surveyors were stationed either side of the structure, each with a Bat Logger-M detector to record calls. Target notes were made on bats exiting the structure and use of the surrounding area.

Activity Survey – Transect Survey

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 detectors to record calls, following methodology from Collins (2016).

Activity Survey – Static Bat Detector Survey

Full spectrum bat detectors (Anabat Swift, Titley Scientific) were deployed at 16 turbine locations for the summer and autumn 2021 seasons, and 11 turbine locations for the spring 2022 season, following methodology from NatureScot (2021).

Other Protected Fauna

No specific surveys for amphibians, reptiles or invertebrates were conducted. Any additional protected fauna were recorded on an *ad hoc* basis during other surveys. In the case of amphibians, this was because they would be detected during eDNA aquatic ecology surveys or during terrestrial habitat surveys. There were no desktop records of protected reptiles and so dedicated surveys were scoped out. Protected invertebrates were judged to be detected via other survey types if present.

Fisheries and Aquatic Ecology

Baseline surveys were carried out in August and September 2022. Full data are presented in Confidential Technical Appendix 15.4 found in Volume III of this EIAR with a summary provided below.

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 Technical Appendix 15.4 found in Volume III of this EIAR.

Physical surveys

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

Fish stock assessment

Electro-fishing was carried out under DECC licence at all riverine survey sites that were not dry at the time of the survey (25 out of 33 sample sites; see **Table 15-2** 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

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 (including eDNA)

There are no known pearl mussel records in the Nore_SC_060, Dinin[North]_SC_10, Barrow_SC_050 and Barrow_SC_070 river catchments. However, historical NPWS records are known for the downstream-connecting River Nore and in the vicinity of Ballyragget. As a precaution, eDNA samples were collected from the Stradbally River, Owveg River, Clogh River and Douglas River to confirm pearl mussel absence. In addition, a stage 1 and 2 pearl mussel survey was undertaken on a 3.9 km stretch of the River Nore in the vicinity of the Owveg River confluence.

eDNA analysis

eDNA samples were undertaken from the Stradbally river, Owveg River, Clogh River and Douglas River and analysed for pearl mussels, white-clawed crayfish and crayfish plague. This was to validate physical site surveys and to search for populations of cryptic aquatic receptors.

Otter survey

Searches were made for otter signs and sightings within 150 m of each aquatic survey site (see **Figure 15-2**) and mapped using a hand-held GPS. Notes were made on the quantity and visible constituents of spraint.

Kingfisher survey

Any evidence of kingfisher breeding or feeding within 150 m of each aquatic survey site (see **Figure 15-2**) was recorded at the same time as the otter survey.

Biological water quality (Q-sampling)

Biological water quality was assessed via Q-sampling at all riverine survey sites that were not dry at the time of the survey (25 out of 33 sample sites). Methodology followed Feeley *et al.* (2020) and samples were converted into Q-ratings per Toner *et al*. (2005). Any rare invertebrate species identified.

Macrophytes and aquatic bryophytes

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 1 habitat types.

15.2.6 Constraints and Limitations

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 site. 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.

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

The validity of ornithological survey data requires that they were obtained using accepted methodologies and that surveys were carried out in suitable conditions. The field survey methodologies outlined above and described in greater detail in Technical Appendix 15.2 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.

Two full years of surveys have been completed, which is recommended by current NatureScot (2017) guidance. The first winter was in the 2017/18, so this winter season's data was collected just outside most recent 5-year period as recommended by NatureScot (2017). However, this is unlikely to represent a key constraint, as the land-use has not changed in the intervening period and so the data are representative of the baseline conditions. An additional winter season of surveys has recently been completed.

Regarding survey effort, VPs 4 and 5 in winter 2017/18 had 32.5 and 30 hours of surveys, respectively. This falls short of the 36 hours per VP per season survey effort required by NatureScot (2017) guidance. However, it is unlikely to represent a significant constraint to the assessment because the viewsheds from VPs 1, 2, 3 and 7 adequately covered the overall survey area and all had survey effort in exceedance of the 36 hours per VP per season.

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.

Regarding VP survey coverage, there are differences in the coverage provided by the two sets of VPs (see figures showing the VP viewsheds within Technical Appendix 15.2 found in Volume III of this EIAR). Those used for the 2017/18 non-breeding season surveys by FT provided imperfect coverage in the north-eastern section of the Northern Cluster (specifically around T4, T5, T6 and T7, although areas of the 500 m buffer around these turbines were visible), whereas coverage at the Southern Cluster was greater. Those used for the 2021 breeding, 2021/22 non-breeding and 2022 breeding season provided greater coverage in the northern cluster and good coverage in the southern cluster. However, the gaps in coverage are not thought to represent a significant limitation as all key habitats were surveyed and visibility on the ground was better than suggested by the viewshed analysis. It is considered that the VP data are representative of the Site as a whole and sufficient to inform a robust impact assessment of the Site.

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 (none were recorded). Similarly, while no dedicated kingfisher *Alcedo atthis* survey was undertaken, kingfishers and their nests were searched for during the aquatic ecology surveys (none were recorded). No dedicated hen harrier winter roost survey was undertaken because the habitats surrounding the Site do not provide roosting habitat (O'Donoghue, 2019) and there was no evidence of hen harriers using the Site and surrounds for anything other than occasional commuting.

Only one year of breeding wader surveys was undertaken in 2022. This was because the habitats at the Site were judged to be of limited suitability for breeding waders (largely conifer plantation); however, a few grassland areas were searched in 2022 as a precaution.

No nocturnal surveys were undertaken, as nocturnal migrants have been shown to have a lower risk of collision with wind energy facilities than diurnally active species (Welcker, Liesenjohann, Blew, Nehls, & Gruenkorn, 2016).

Bats

The layout for the Site changed between autumn 2021 and spring 2022 static detector surveys. Consequently, some static detectors were deployed in areas where there are no longer turbines proposed. However, the habitats that the detectors were deployed are still representative of the turbine locations and the Site as a whole.

Static detector surveys were split over 2021 and 2022 as surveys were not commissioned until the spring 2021 period had elapsed. This is permitted according to NatureScot (2021) guidance.

There were a few occupied houses where it was not possible to gain access for roost surveys both within the Site and adjacent to the Cable Route Options. However, they were all outside of the development footprint.

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.

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

During surveys eight out of 33 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

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.

15.2.7 Evaluation Criteria for Ecological Assessment

Assessing Impact Significance

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.

Determining the Zone of Influence

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.

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 Section 15.3.

For all receptors that are not designated nature conservation sites, the 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 Site and up to a 5 m buffer along the Cable Route Options; and
- Indirect effects: dependent on the type of works and the published sensitivities of the ecological receptor.

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.

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. This initial search area was then reappraised during impact assessment.

Determining Importance

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 this Project the following geographic frame of reference is used:

- International (i.e. Europe);
- national (i.e. Ireland);
- regional/county (i.e. Co. Laois);
- local (i.e. the townlands containing the Project); and
- site (i.e. the Project).

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

Important habitats are listed on Annex 1 of the Habitats Directive, the Irish National Biodiversity Action Plan 2017-2021, under the Wildlife Acts and in Laois County Draft Development Plan 2021-2027, Chapter 11 (Biodiversity and Natural Heritage) and Kilkenny City and County Development Plan 2021-2027, Chapter 9. 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.

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 and criteria where available. Examples of relevant lists and criteria include:

- species of European conservation importance (as listed on Annex 1 of the Birds Directive or Annex 2 or IV of the Habitats Directive); and
- species red-listed in Ireland under the relevant lists e.g. Birds of Conservation Concern (BoCCI) (Gilbert, Stanbury, & Lewis, 2021).

Where appropriate, the value of resident or regularly occurring species populations has been determined using the standard '1% criterion' method (Percival, Birds and wind farms in Ireland: a review of potential issues and impact assessment, 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 etc. In absence of detailed regional or county-level species population data, we have estimated county-level populations for Laois County Council by multiplying the ROI population totals by 0.02. This 0.02 figure is the land area taken up by the County of Laois 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.

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

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

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.

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.

A full definition of all the terms used are described in Technical Appendix 15.5 found in Volume III of this EIAR.

Significant Effects

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.

Determining Significant Effects

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

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.

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.

The following have been considered:

Designated sites and ecosystems

- Whether the Project 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; and
- Whether the Project is likely to result in a change in ecosystem structure and function.

Habitats and species

- Whether the Project will influence the extent, structure and function as well as its distribution and its composition of a habitat; and
- Whether the Project will affect the abundance and distribution of a species.

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

Birds

NatureScot (2018) provides guidance for assessing the significance 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. Consequently, we have not used Percival (2003), which is sometimes used in Ireland.

Disturbance impacts have been assessed with reference to the relevant literature for each avian taxonomic group (Goodship & Furness, 2022; Drewitt & Langston, 2006; Hötker, Thomsen, & Jeromin, 2006; Pearce-Higgins, Stephen, Langston, Bainbridge, & Bullman, The Distribution of Breeding Birds Around Upland Wind Farms, 2009), 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.

The standard Band Collision Risk Model (CRM) (Band, Madders, & Whitfield, 2007) was used to estimate collision risk based on recorded target species activity levels and flight behaviour, proposed turbine numbers and specifications, and the relevant species biometrics and flight characteristics. Modelling collision risk under the Band CRM is a two-stage process. Stage 1 estimates the number of birds that fly through the rotor swept disc. Stage 2 predicts the proportion of these birds that have the potential to be hit by a rotor blade. Combining both stages produces an estimate of collision mortality in the absence of any avoidance action/behaviour by birds. Avoidance rates are then applied to generate predicted rates of collision mortality. Further details of the CRM methodology are provided in Technical Appendix 15.8 found in Volume III of this EIAR.

Bats

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 Site in terms of the 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.

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 Site 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.

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.

See Technical Appendix 15.3 found in Volume III of this EIAR for further details of bat survey results.

Cumulative Impacts and Effects

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.

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

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.

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.

15.3 Description of Existing Environment

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 Section 15.2.4 and Technical Appendix 15.7. Full details of the field surveys (including when the surveys were made) are shown in Section 15.2.5.

15.3.1 Designated Nature Conservation Sites

Site synopses for all designated sites is shown in Technical Appendix 15.6 found in Volume III of this EIAR

International Sites

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.

The Proposed Development and Cable Route Options do not lie within any SAC or SPA. Neither the Site or Option 2 Cable Route are adjacent (i.e. is within 100 m) to any SAC or SPA; however, Option 1 Cable Route runs adjacent (i.e. is within 100 m) to the River Barrow and River Nore cSAC near Chapel Cross Roads along the R430 road.

There are six SACs within 20 km of the Proposed Development and Cable Route Options (see **Figure 15-3**). Of these, the River Barrow and River Nore cSAC is the only one with any connection to the Proposed Development or Cable Route Options, with downstream hydrological connections between riparian habitats and species to both Northern and Southern Clusters, and both Cable Route Options. In addition, there are also potential ecological connections to the same.

There are two SPAs within 20 km of the Proposed Development and Cable Route Options. There is a downstream hydrological connection to the River Nore SPA. For the Slieve Bloom Mountains SPA, there is a potential but weak ecological connection as the special conservation interest, hen harrier, of this SPA was recorded passing over or near (within 500 m) the Site on three occasions during the winter.

The only Ramsar site within 20 km is the Slieve Bloom Mountains (site no. 335). This site is also an SAC, SPA and Nature Reserve. There are no Important Bird Areas (IBAs) within 20 km.

There is no connectivity between the Proposed Development and Cable Route Options, and any international site at a distance greater than 20 km.

Table 15-5 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 Proposed Development and Cable Route Options which require further consideration are highlighted in bold.

Table 15-5 International Sites within 20 km of Proposed Development and Cable Route Options[10]

Site Name	Code	Qualifying Interests	Value	Distance & direction from Site	Distance & direction from Option 1 Cable Route	Distance & direction from Option 2 Cable Route	Connectivity
SACs and cSACs							
River Barrow and River Nore cSAC	002162	Estuaries [1130] Mudflats and sandflats not covered by seawater at low tide [1140] Reefs [1170] *Salicornia* and other annuals colonising mud and sand [1310] Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) [1330] Mediterranean salt meadows (*Juncetalia maritimi*) [1410] **Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation [3260]** European dry heaths [4030]	International	3.2 km W	2.4 m N	3.3 km NE	Downstream hydrological connectivity to riparian QI habitat types (3260 and 6430) and potentially breeding/foraging sites for aquatic QI species (freshwater and Nore pearl mussel, white-clawed crayfish, lamprey spp, twaite shad, salmon and otter). There is also potential connectivity via emissions to the air for Option 1 Cable Route (e.g. dust) where in proximity to the SAC. There is also ecological connectivity with mobile QI species, which could move outside of cSAC along streams with hydrological connections, and for low mobility aquatic species freshwater and Nore pearl mussel, which are dependent on mobile salmonids as hosts for part of their lifecycle. Another connection is via light/noise from the construction of the Cable Route Options, especially when in proximity to the cSAC or mobile QI when outside the cSAC.

[10] Avian qualifying interest species are designated for either their permanent (p), reproducing (r), or wintering (w) populations

Site Name	Code	Qualifying Interests	Value	Distance & direction from Site	Distance & direction from Option 1 Cable Route	Distance & direction from Option 2 Cable Route	Connectivity
		Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels [6430] Petrifying springs with tufa formation (Cratoneurion) [7220] Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles [91A0] Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*) [91E0] *Vertigo moulinsiana* (Desmoulin's whorl snail) [1016] ***Margaritifera margaritifera* (Freshwater pearl mussel) [1029]** ***Austropotamobius pallipes* (White-clawed crayfish) [1092]** ***Petromyzon marinus* (Sea lamprey) [1095]** ***Lampetra planeri* (Brook lamprey) [1096]** ***Lampetra fluviatilis* (River lamprey) [1099]** ***Alosa fallax fallax* (Twaite shad) [1103]** ***Salmo salar* (Atlantic salmon) [1106]** ***Lutra lutra* (Otter) [1355]**					

Site Name	Code	Qualifying Interests	Value	Distance & direction from Site	Distance & direction from Option 1 Cable Route	Distance & direction from Option 2 Cable Route	Connectivity
		Trichomanes speciosum (Killarney fern) [1421] ***Margaritifera durrovensis* (Nore pearl mussel) [1990]**					
Lisbigney Bog SAC	000869	Calcareous fens with *Cladium mariscus* and species of the *Caricion davallianae* [7210] *Vertigo moulinsiana* (Desmoulin's whorl snail) [1016]	International	12.2 km SW	6.1 km SW	11.5 km SW	There is no hydrological, hydrogeological or ecological connectivity.
Ballyprior Grassland SAC	002256	Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*) (* important orchid sites) [6210]	International	4.1 km NE	5.9 km NE	3.8 km E	There is no hydrological, hydrogeological or ecological connectivity.
Slieve Bloom Mountains SAC	000412	Northern Atlantic wet heaths with *Erica tetralix* [4010] Blanket bogs (* if active bog) [7130] Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*) [91E0]	International	22.1 km NW	21.9 km NW	17.9 km NW	There is no hydrological, hydrogeological or ecological connectivity.
Mountmellick SAC	002141	*Vertigo moulinsiana* (Desmoulin's whorl snail) [1016]	International	20.7 km NW	22.3 km NW	16.2 km NW	There is no hydrological, hydrogeological or ecological connectivity.
Cullahill Mountain SAC	000831	Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*) (* important orchid sites) [6210]	International	25.0 km SW	19.1 km SW	24.6 km SW	There is no hydrological, hydrogeological or ecological connectivity

Site Name	Code	Qualifying Interests	Value	Distance & direction from Site	Distance & direction from Option 1 Cable Route	Distance & direction from Option 2 Cable Route	Connectivity
SPAs and proposed SPAs							
River Nore SPA	004233	**Kingfisher *Alcedo atthis* [A229] (r)**	International	11.8 km W	5.9 km SW	11.5 km W	Downstream hydrological connectivity to kingfisher foraging habitats, as Southern Cluster 27.2 km upstream of SPA via Brennanshill stream. Option 1 Cable Route also 11.2 km upstream of SPA via Graiguenahown stream, so hydrological connectivity to SPA present. Kingfishers are mobile and could travel along watercourses (especially non-breeding birds, which are less restricted to territories). However, no evidence of kingfishers was recorded during any bird or aquatic surveys, and the habitat is not appropriate for this species, so there is no ecological connectivity.
Slieve Bloom Mountains SPA	004160	Hen harrier *Circus cyaneus* [A082] (p)	International	20.2 km NW	20.3 km NW	16.0 km NW	No downstream hydrological or hydrogeological connectivity. Hen harrier has been recorded on three occasions during bird surveys at or near (within 500 m) the Site. Hen harrier is mobile and move to lowlands in winter, when it roosts at specific locations. The majority of foraging from winter roosts is thought to be within a c. 10 km radius (Pendlebury, et al., 2011). However, we know of no such roosts within this distance from the Site and there is no clear connectivity to the observations at the Site and the SPA population.

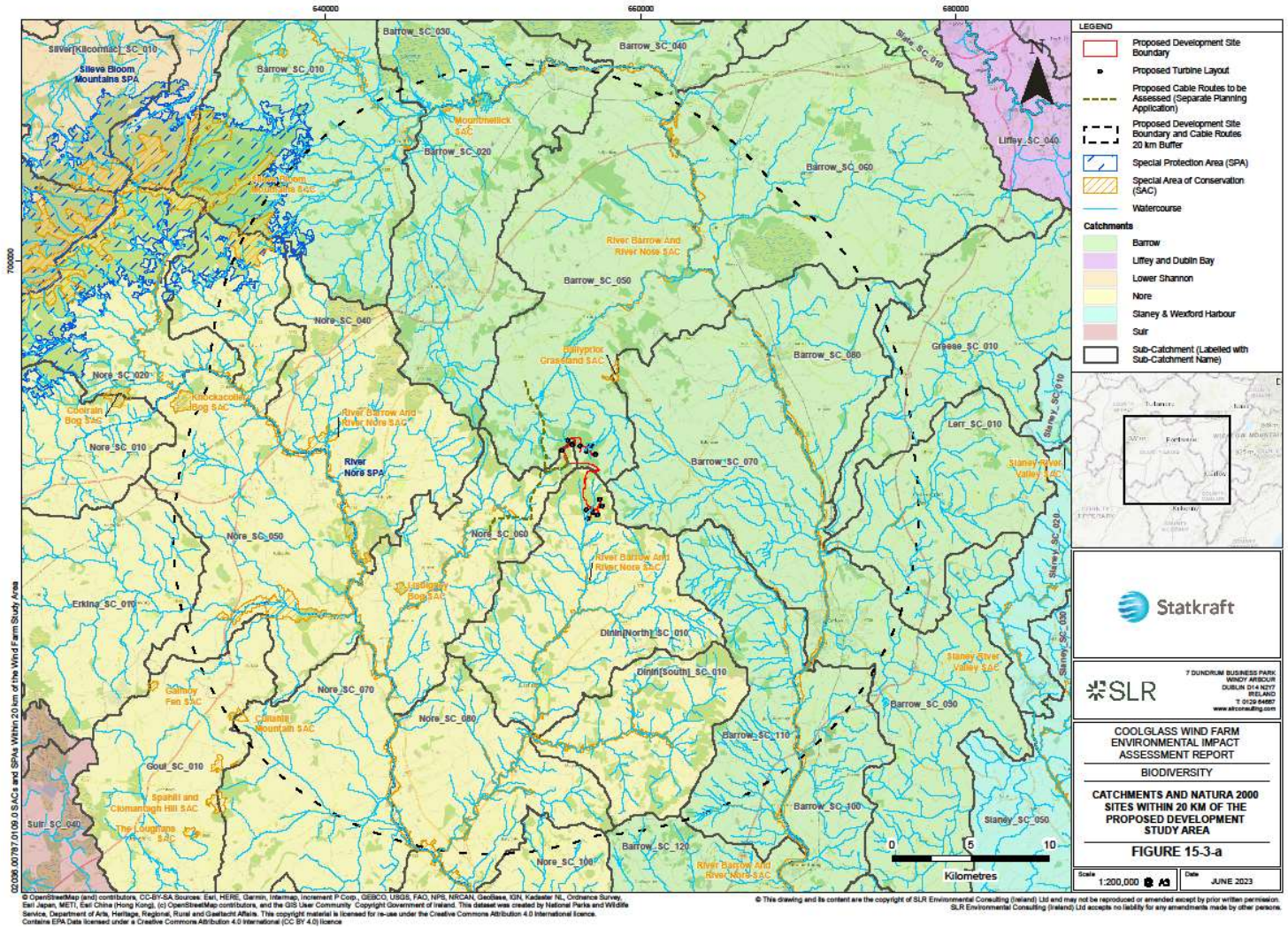
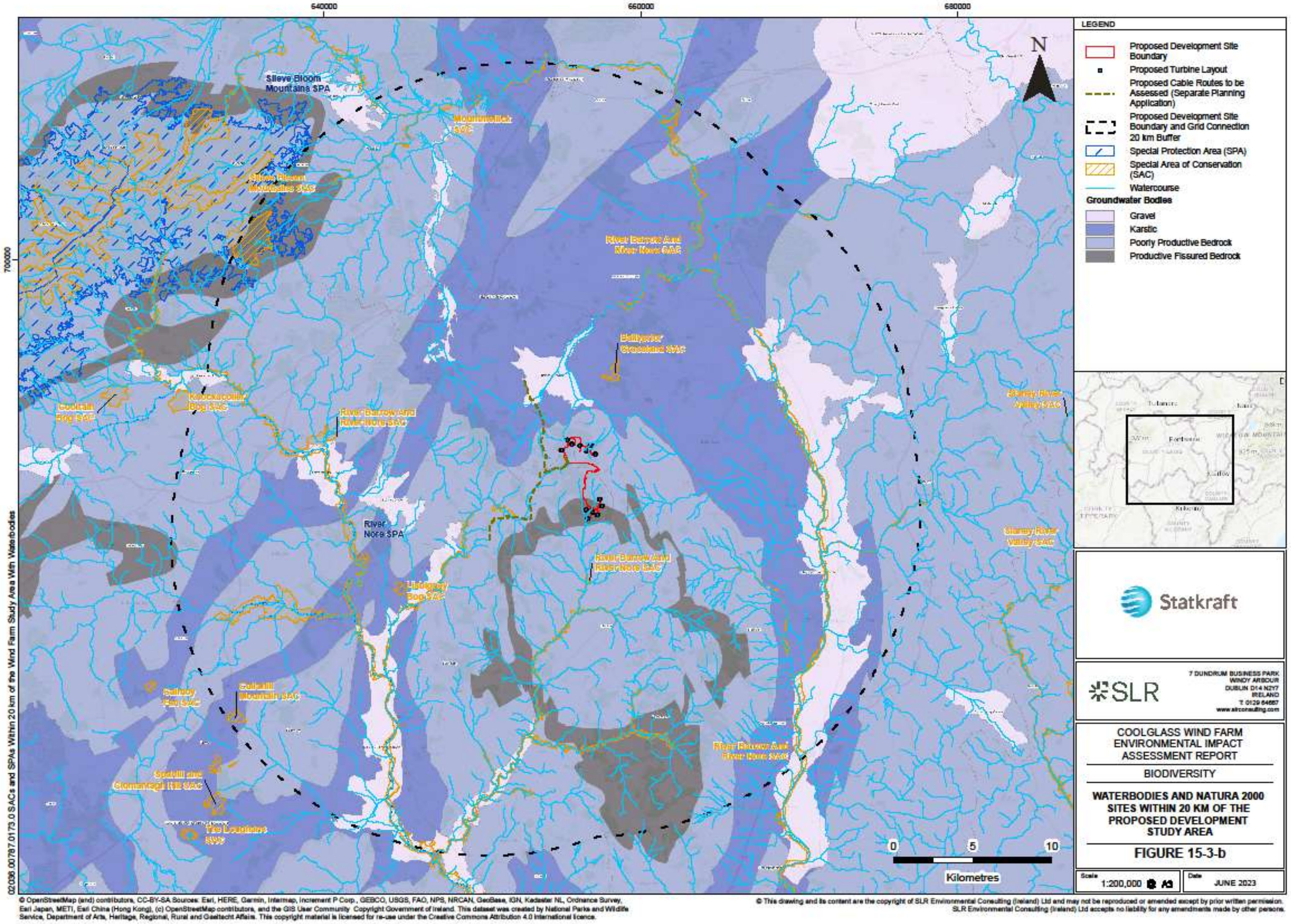


Figure 15-3: SACs and SPAs within 20 km of the Proposed Development Site and Cable Route Options


640000
660000
680000
700000
Slieve Bloom Mountains SPA
Slieve Bloom Mountains SAC
Mountmellick SAC
River Barrow And River Nore SAC
Ballyprior Grassland SAC
Coolrain Bog SAC
Knockacoller Bog SAC
River Nore SPA
Lisbigney Bog SAC
Galmoy Fen SAC
Cullahill Mountain SAC
Spahill and Clomantagh Hill SAC
The Loughans SPA
Slaney River Valley SAC
N
0 5 10
Kilometres
LEGEND
Proposed Development Site Boundary
Proposed Turbine Layout
Proposed Cable Routes to be Assessed (Separate Planning Application)
Proposed Development Site Boundary and Grid Connection 20 km Buffer
Special Protection Area (SPA)
Special Area of Conservation (SAC)
Watercourse
Groundwater Bodies
Gravel
Karstic
Poorly Productive Bedrock
Productive Fissured Bedrock
Statkraft
SLR
7 DUNDRUM BUSINESS PARK
WINDY ARBOUR
DUBLIN D14 N2Y7
IRELAND
T 0129 64667
www.slrconsulting.com
COOLGLASS WIND FARM
ENVIRONMENTAL IMPACT
ASSESSMENT REPORT
BIODIVERSITY
WATERBODIES AND NATURA 2000 SITES WITHIN 20 KM OF THE PROPOSED DEVELOPMENT STUDY AREA
FIGURE 15-3-b
Scale 1:200,000 @ A3
Date JUNE 2023
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National Sites

The rationale for identifying ecological connectivity to SACs and SPAs has also been extended to NHAs and pNHAs. Sites beyond 20 km were also considered if there was hydrological or ecological connectivity, however no such sites were identified.

There are two NHAs and 31 pNHAs within 20 km of the Proposed Development and Cable Route Options (see **Figure 15-4**). Nether of the two NHAs have any source-receptor link. Of these 31 pNHAs, only Timahoe Esker pNHA, Clopook Wood pNHA and Grand Canal pNHA have source-receptor links.

Timahoe Esker pNHA has a potential downstream hydrological link, but the habitats within the pNHA are not aquatic or dependent on surface or groundwater. Clopook Wood pNHA has a potential ecological link, with badgers from the pNHA potentially using the habitats within the Site for foraging. Grand Canal pNHA has a potential downstream hydrological link to riparian tall herb, reed fringe and open water habitats. The same is true for opposite-leaved pondweed *Groenlandia densa* (Flora Protection Order), otter and smooth newt. There is also a potential ecological connection for otter, a highly mobile species along watercourses.

Only national sites with sensitive habitats in proximity to the Proposed Development or Cable Route Options are likely to have connections via emissions to the air (e.g. dust). These are likely to be Timahoe Esker pNHA and Clopook Wood pNHA.

There are no national sites sufficiently close to the Proposed Development or Cable Route Options where light or noise emissions could disturb sensitive species while within the (p)NHA.

There are some pNHAs within 20 km of the Proposed Development or Cable Route Options 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 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 or Cable Route Options. pNHAs overlapping with Natura sites include:

- River Barrow and River Nore cSAC overlaps with Barrow Valley at Tankardstown Bridge, pNHA, River Nore/Abbeyleix Woods Complex pNHA, Shanhoe Marsh pNHA, Cloghristick Wood pNHA, Forest Wood House pNHA, The Curragh and Goul River Marsh pNHA, Ardaloo Fen pNHA and Inchbeg pNHA;
- Lisbigney Bog SAC overlaps with Lisbigney Bog pNHA; and
- Cullahill Mountain SAC overlaps with Cullahill Mountain pNHA.

Timahoe Esker, Slieve Bloom Mountains and Grantstown Wood and Lough pNHAs are also nature reserves.

Table 15-6 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 or Cable Route Options are highlighted in bold.

Table 15-6 National Sites within 20 km of Proposed Development and Cable Route Options

Site Name	Code	Qualifying Interests	Value	Distance and direction from Site	Distance and direction from Option 1 Cable Route	Distance and direction from Option 2 Cable Route	Connectivity
NHAs							
Coan Bogs NHA	002382	Peatlands [4]	National	10.7 km S	11.5 km SE	11.8 km SE	No downstream hydrological, hydrogeological or ecological connectivity.
Clonreher Bog NHA	002357	Peatlands [4]	National	16.4 km NW	17.2 km NW	14.1 km NW	No downstream hydrological, hydrogeological or ecological connectivity.
pNHAs							
Timahoe Esker pNHA	000421	**Eskers** and broadleaved woodland	National	2.7 km NW	4.0 km NW	83 m SW	Downstream hydrological connectivity of Northern Cluster 9.3 km downstream of pNHA via Fallowbeg Upper stream. Also, hydrogeological connectivity as pNHA in same Barrow_SC_050 sub-catchment as Northern Cluster and Option 2 Cable Route. However, esker and broadleaved woodland habitats are not water dependent, so there is no source-pathway-receptor link. There is potential connectivity via emissions to the air for Option 2 Cable Route (e.g. dust) where in proximity to the pNHA.
Clopook Wood pNHA	000860	Ash and hazel *Corylus avellana* woodland, **calcicole flora, rich lichen and bryophyte communities**, and **badger** setts.	National	2.6 km NE	4.6 km NE	4.5 km E	No hydrological or hydrogeological connectivity (habitats not groundwater-dependent). Potential (remote) ecological connectivity, as mobile QI badger could potentially use habitats at Northern Cluster, although they would have to cross the Crooked River and badgers generally avoid swimming where possible.

Site Name	Code	Qualifying Interests	Value	Distance and direction from Site	Distance and direction from Option 1 Cable Route	Distance and direction from Option 2 Cable Route	Connectivity
							There is potential connectivity via emissions to the air (e.g. dust) where in proximity to the pNHA.
Stradbally Hill pNHA	001800	Mature oak *Quercus spp* and hazel woodland.	National	6.1 km NE	7.9 km NE	5.3 km NE	No hydrological, ecological or hydrogeological connectivity (habitats not groundwater-dependent).
Ridge of Portlaoise pNHA	000876	Eskers, woodlands, nettle-leaved bellflower *Campanula trachelium* (Flora Protection Order) and blue fleabane *Erigeron acer* (red-list)[11]	National	9.8 km NW	10.6 km NW	5.3 km NW	No downstream hydrological, hydrogeological or ecological connectivity.
Dunamase Woods pNHA	001494	Oak and beech woodlands.	National	9.6 km NW	11.2 km NW	5.2 km NW	No downstream hydrological, hydrogeological or ecological connectivity.
Rock of Dunamase pNHA	000878	Meadow grassland, shallow limestone soil, pasture and hazel scrub.	National	9.6 km NW	11.2 km NW	5.2 km N	No hydrological, ecological or hydrogeological connectivity (habitats not groundwater-dependent).
Kilteale Hill pNHA	000867	Hazel woodland.	National	9.5 km NW	11.2 km N	5.3 km N	No hydrological, ecological or hydrogeological connectivity (habitats not groundwater-dependent).
Ballylynan pNHA	000857	Meadows.	National	9.3 km E	11.2 km E	11.1 km E	No downstream hydrological, hydrogeological or ecological connectivity.
Grand Canal pNHA	002104	Diversity of habitats (hedgerow, **tall herbs**, calcareous grassland**, reed fringe, open water**, scrub and woodland), **otter**, smooth newt *Lissotriton vulgaris*, **opposite-leaved pondweed.**	National	10.6 km NE	12.6 km NE	9.5 km NE	Downstream hydrological connectivity: Northern cCluster is 14.9 km upstream of pNHA via Fallowbeg Upper stream. Also, Option 2 Cable Route 12.7 km upstream of pNHA via Cremorgan stream. Also, ecological connectivity present for mobile aquatic QIs otter, which could travel via hydrological connections. Very unlikely smooth newt able to

[11] Note that nettle-leaved bellflower is not currently listed under the Flora Protection Order and blue fleabane is not currently red-listed in Ireland (the site synopsis for this pNHA is outdated).

Site Name	Code	Qualifying Interests	Value	Distance and direction from Site	Distance and direction from Option 1 Cable Route	Distance and direction from Option 2 Cable Route	Connectivity
							travel for significant distances upstream, so no ecological connection for this species.
The Great Heath of Portlaoise pNHA	000881	Lowland acidic grassland, few-flowered spike rush *Eleocharis quinquerflora* and fen bedstraw *Galium ulginosum*.	National	12.6 km NW	14.2 km NW	8.1 km N	No hydrological, ecological or hydrogeological connectivity (habitats not groundwater-dependent).
Lisbigney Bog pNHA	000869	Overlaps with SAC of same name; no site synopsis available (main habitat includes raised bog).	National	12.2 km SW	6.1 km SW	11.5 km SW	Considered under NIS.
Barrow Valley at Tankardstown Bridge pNHA	000858	Overlaps with River Barrow and River Nore cSAC; no site synopsis available (main habitats or species include river, canal, grassland and marsh).	National	12.5 km E	14.4 km E	14.4 km E	Considered under NIS.
River Nore/Abbeyleix Woods Complex pNHA	002076	Overlaps with River Barrow and River Nore cSAC and part of the River Nore SPA; no site synopsis available (main habitats or species include river, freshwater pearl mussel, Twaite shad, wet grassland, mixed deciduous woodland of great antiquity and species diversity, with specimen oak).	National	13.6 km W	10.0 km W	12.4 km SW	Considered under NIS.
Shanahoe Marsh pNHA	001923	Overlaps with River Barrow and River Nore cSAC and part of the River Nore SPA; no site synopsis available.	National	14.1 km W	11.1 km NW	12.3 km W	Considered under NIS.
Derries Wood pNHA	000416	Diversity of habitats (mature beech, lake, fens, gravel pits and bogs), sika deer *Cervus nippon*, pine marten, mute swan *Cygnus olor* and duck species.	National	15.0 km NE	16.7 km NE	11.7 km NE	No downstream hydrological or hydrogeological connectivity (habitats not groundwater-dependent). Unlikely there is any ecological connectivity either.

Site Name	Code	Qualifying Interests	Value	Distance and direction from Site	Distance and direction from Option 1 Cable Route	Distance and direction from Option 2 Cable Route	Connectivity
							The distance between the pNHA and the Proposed Development Site and Cable Route Options is larger than the maximum pine marten home range size in Ireland, which is 4.353 km^2 (O'Mahony, O'Reilly, & Turner, 2012), so no connection is likely. A similar logic is true for sika deer: the maximum home range size was 0.7 km^2 for this species in the British Isles (Swanson & Putman, 2009), so no connection is likely. Moreover, this species is not native. No swans were recorded during bird surveys (see Technical Appendix 15.2 found in Volume III of this EIAR), precluding an ecological connection to the pNHA. Mallard was recorded during the breeding 2021 and non-breeding 2021/22 surveys (see Technical Appendix 15.2 found in Volume III of this EIAR). It is unlikely these ducks are from the pNHA as mallard typically travel between 1-2 km from roosts to foraging sites (Legagneux, Blaize, Latraube, Gautier, & Bretagnolle, 2009), which is much smaller than the intervening distance between the Proposed Development Site and Cable Route Options, and the pNHA.
Cloghristick Wood pNHA	000806	Overlaps with River Barrow and River Nore cSAC; no site synopsis available.	National	18.3 km SE	21.4 km SE	22.0 km SE	SAC considered within NIS.
Derryvullagh Island pNHA	001390	Intact semi-natural deciduous woodland with a well-developed flora.	National	16.7 km NE	18.7 km NE	16.5 km NE	No downstream hydrological, hydrogeological or ecological connectivity.
Dunmore Cave pNHA	000401	Maternity roost of at least 50 Natterer's bats *Myotis natteri.*	National	19.4 km SW	17.3 km SW	21.8 km SW	No downstream hydrological or hydrogeological connectivity.

Site Name	Code	Qualifying Interests	Value	Distance and direction from Site	Distance and direction from Option 1 Cable Route	Distance and direction from Option 2 Cable Route	Connectivity
							Also, no ecological connectivity, as the core sustenance zone radius for Natterer's bat is 4 km (BCT, 2020), which is much less than the intervening distance between the Proposed Development Site and Cable Route Options, and pNHA.
Emo Court pNHA	000865	Large semi-natural mixed woodland.	National	17.7 km NE	19.4 km NE	13.5 km NE	No hydrological, ecological or hydrogeological connectivity (habitats not groundwater-dependent).
Esker Pits pNHA	000832	Diversity of habitats (calcareous grassland, dry gravel banks, small ponds, scrub woodland and marsh).	National	18.2 km SW	15.8 km SW	20.5 km SW	No hydrological, ecological or hydrogeological connectivity.
Forest Wood House pNHA	000874	Overlaps with River Barrow and River Nore cSAC and part of the River Nore SPA; no site synopsis available.	National	19.6 km NW	16.7 km NW	17.2 km W	SAC considered within NIS.
Mothel Church, Coolcullen pNHA	000408	Maternity roost of at least 100 Natterer's bats	National	14.9 km SE	16.1 km SE	18.5 km SE	No downstream hydrological or hydrogeological connectivity. Also, no ecological connectivity, as the core sustenance zone radius for Natterer's bat is 4 km (BCT, 2020), which is much less than the intervening distance between the Proposed Development Site and Cable Route Options, and the pNHA.
Oakpark pNHA	000810	Breeding habitats for little grebe *Tachybaptus ruficollis*, grey heron, mute swan, water rail *Rallus arquaticus* and Eurasian coot *Fulica atra*. Wintering habitats for mallard, European golden plover, northern lapwing, Eurasian wigeon *Mareca penelope*, Eurasian teal A*nas crecca*, northern shoveler *Anas clypeata*,	National	16.5 km SE	18.5 km SE	18.5 km SE	No downstream hydrological or hydrogeological connectivity. Also, no ecological connectivity. The only QI species recorded during bird surveys at the Site were: grey heron, mallard, European golden plover and northern lapwing.

Site Name	Code	Qualifying Interests	Value	Distance and direction from Site	Distance and direction from Option 1 Cable Route	Distance and direction from Option 2 Cable Route	Connectivity
		tufted duck *Aythya fuligula* and common pochard *Aythya 50orage*.					The core[50] foraging range of golden plover and lapwing during the winter months is 12 km (Gillings & Fuller, 1999), so it is unlikely that these species seen at the Site are from the pNHA. It is also unlikely the mallards recorded are from the pNHA as they typically travel between 1-2 km from roosts to foraging sites (Legagneux, Blaize, Latraube, Gautier, & Bretagnolle, 2009), which is much smaller than the intervening distance between the Proposed Development Site and Cable Route Options, and the pNHA. A similar logic applies to grey heron, as grey herons typically travel 1.3 km between roosts and foraging sites (Gregory, 1990).
The Curragh and Goul River Marsh pNHA	000420	Overlaps with River Barrow and River Nore cSAC and part of the River Nore SPA; no site synopsis available (main habitats and species include wet meadow and Greenland white-fronted geese).	National	19.1 km SW	12.9 km SW	18.0 km SW	Considered under NIS. Also, no ecological connectivity as no Greenland white-fronted geese recorded at Site by bird surveys. Core foraging range from roost up to 8 km (SNH, 2016), which is less than the separation distance to the Proposed Development or Cable Route Options, so no connection likely.
Ardaloo Fen pNHA	000821	Overlaps with River Barrow and River Nore cSAC and part of the River Nore SPA; no site synopsis available.	National	22.5 km SW	19.4 km SW	24.3 km SW	SAC considered within NIS.
Coolacurragh Wood pNHA	000862	Undisturbed woodland dominated by native species and flora representative of poorly drained areas.	National	23.2 km SW	17.3 km SW	>20 km SW	No hydrological, ecological or hydrogeological connectivity.

Site Name	Code	Qualifying Interests	Value	Distance and direction from Site	Distance and direction from Option 1 Cable Route	Distance and direction from Option 2 Cable Route	Connectivity
Cuffsborough pNHA	000418	Feeding grounds for Greenland white-fronted geese (40-44 individuals).	National	20.7 km SW	15.2 km SW	21.9 km SW	No downstream hydrological or hydrogeological connectivity. Also, no ecological connectivity as no Greenland white-fronted geese recorded at Site by bird surveys. Core foraging range from roost up to 8 km (SNH, 2016), which is less than the separation distance to the Proposed Development or Cable Route Options, so no connection likely.
Cullahill Mountain pNHA	000831	Overlaps with Cullahill Mountain SAC; no site synopsis available.	National	25.0 km SW	19.1 km SW	24.6 km SW	SAC considered within NIS.
Grantstown Wood and Lough pNHA	000417	Lake in seral transition from fen to alder/willow carr.	National	22.4 km SW	16.5 km SW	21.1 km SW	No hydrological, ecological or hydrogeological connectivity.
Inchbeg pNHA	000836	Overlaps with River Barrow and River Nore cSAC and part of the River Nore SPA; no site synopsis available.	National	20.4 km SW	16.3 km SW	21.7 km SW	SAC considered within NIS.

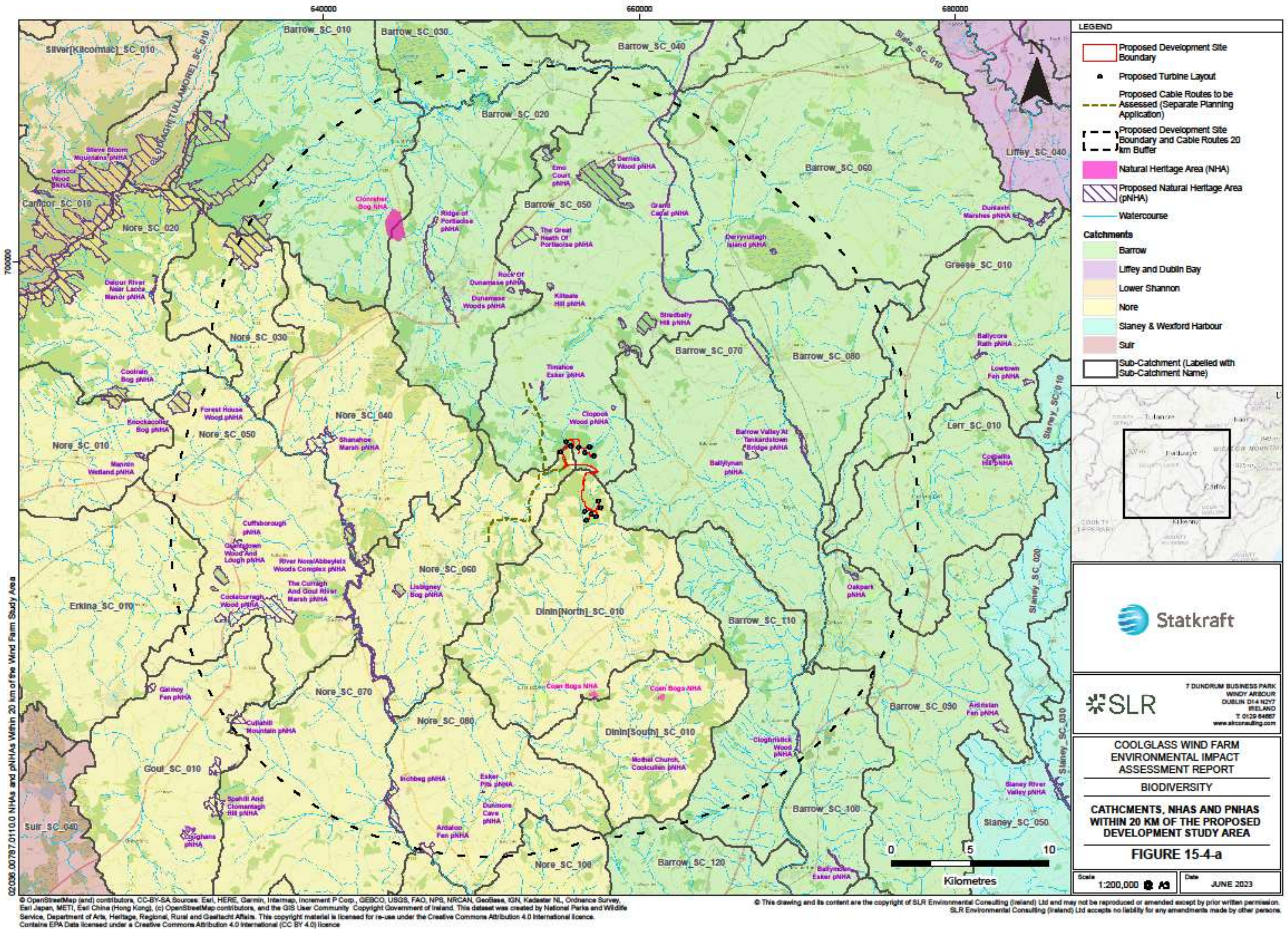
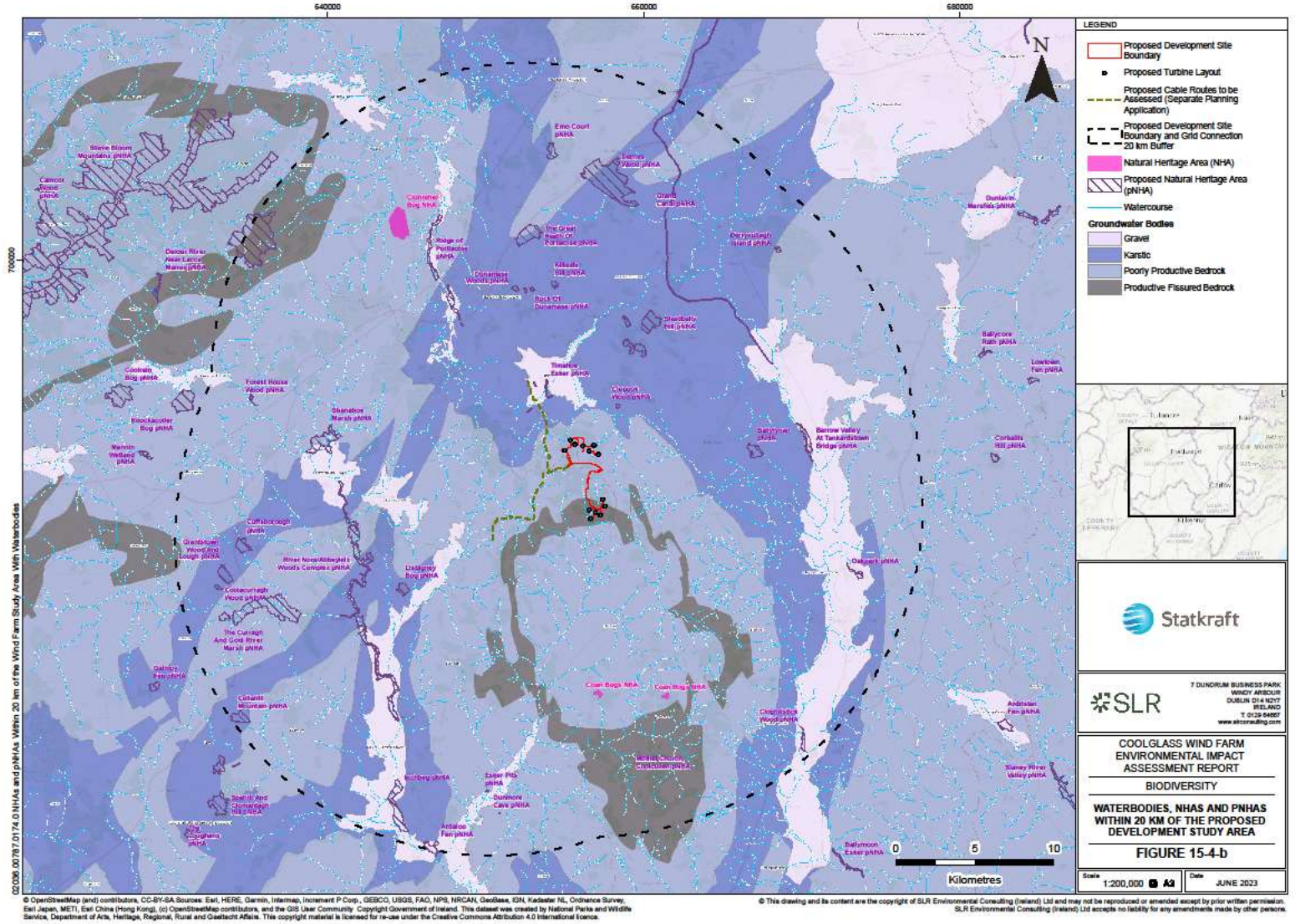


Figure 15-4: NHAs and pNHAs within 20 km of the Proposed Development Site and Cable Route Options



15.3.2 Habitats

Desktop Study

There are no previously mapped Annex 1 habitats (GeoHive, 2023) present either within the Site or along the Cable Route Options, or at any TDR node. There are also no previously mapped ancient woodland habitats immediately adjacent to the Project.

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. Most of the land within the Southern Cluster does not contribute towards any ecological network *sensu* Parker *et al.* (2016) and most of the land at the Northern Cluster contributes to just one ecological network. Thus, most of the land at the Site has a lower biodiversity value in this regard.

Field Surveys

Field surveys confirmed that no Annex 1 habitats were present within or adjacent (i.e. within 100 m) to any part of the Proposed Development or Cable Route Options.

A summary of the existing habitats within the Site, and within and bounding Cable Route Options is shown in **Table 15-7**. Habitat maps in relation to the development footprint are shown in **Figure 15-5** (habitats at TDR nodes are shown in Technical Appendix 15.9 found in Volume III of this EIAR). Further details of the following habitat types recorded are provided below.

Amenity grassland (improved) (GA2)

Amenity grassland (improved) was located along parts of both Cable Route Options, consisting mostly of lawns outside residential dwellings. Species recorded included *Festuca* grass species, common daisy *Bellis perennis*, selfheal *Prunella vulgaris*, creeping buttercup *Ranunculus repens*, red clover *Trifolium pratense* and black medick *Medicago lupulina*.

Photo 15-1: Amenity grassland (improved)

Arable crops (BC1)

Arable crops were located along parts of Option 2 Cable Route and was dominated by barley *Hordeum vulgare* monoculture.

Photo 15-2: Arable crops

Buildings and artificial surfaces (BL3)

Buildings and artificial surfaces were located within roads and buildings within the Site and comprises the majority of the two Cable Route Options. As these habitats are sealed surfaces, there were no plants associated with them.

Photo 15-3: Buildings and artificial surfaces

Conifer plantation (WD4)

Conifer plantation is located within the Site and along both Cable Route Options. The substation compound and temporary construction compound (Northern Cluster) will be located within this habitat type.

This habitat is dominated by Sitka spruce *Picea sitchensis*, although some Japanese larch *Larix kaempferi* and Norway spruce *Picea abies* were present in the wider area. There are some pedunculate oak *Quercus robur* saplings with brambles *Rubus fruticosus* agg., ivy *Hedera helix*, foxglove *Digitalis purpurea* and soft rush *Juncus effusus* in undergrowth along forest edges.

The forestry surrounding turbines is predominantly of age class 18-24, with some differences between coupes (see Technical Appendix 3.4 found in Volume III of this EIAR).

The soils underlying this habitat type were not peaty (see Chapter 8) and there was no evidence of any acid-loving plants (e.g. ling heather *Calluna vulgaris*) present, suggesting conifers were not planted on peaty habitats. Therefore, there are no underlying peat habitat types that could be restored following felling of the conifers.

Photo 15-4: Conifer plantation

Depositing/lowland rivers (FW2)

Depositing/lowland rivers are present alongside and flows under Option 1 Cable Route. Species recorded included occasional watercress *Nasturtium officinale* and water mint *Metha aquatica*. Common duckweed *Lemna minor* was rare. Aquatic bryophyte coverage was low but some *Leptodictyum riparium* was present locally on larger cobbles and boulders.

Vegetation on the banks comprised reed canary grass *Phalaris arundinacea*, creeping thistle *Cirsium arvense*, common hogweed *Heracleum sphondylium*, hairy willowherb *Epilobium hirsutum*, rosebay willowherb *Chamaenerion angustifolium*, blackthorn *Prunus spinosa*, dogrose *Rosa canina*, butterbur *Petasites hybridus*, European gorse *Ulex europeaus*, hazel *Coryllus avellana*, marsh thistle *Cirsium palustre*, osier *Salix viminalis* and grey willow *Salix cinerea*.

For a full description of aquatic habitats see Technical Appendix 15.4 found in Volume III of this EIAR.

Photo 15-5: Depositing/lowland rivers

Drainage ditch (FW4)

Drainage ditches are located within the Site alongside forestry tracks and roads, as well as along roads for both Cable Route Options and within the borrow pit quarry. Species recorded included marsh thistle, very small grey willow saplings, soft rush, shepherd's purse *Capsella bursa-pastoris* and water forget-me-not *Myosotis scorpiodes*.

Photo 15-6: Drainage ditch

Dry meadows and grassy verges (GS2)

Dry meadows and grassy verges are located along roads for both Cable Route Options. Species included cock's foot *Dactylis glomerata*, a Timothy *Phleum* sp., bents *Agrostis* sp., perennial rye grass *Lolium perenne*, false oat grass *Arrhenatherum elatius*, ribwort plantain *Plantago lanceolata*, horsetails *Equisetum* sp., silverweed *Potentilla anserina*, creeping cinquefoil *Potentilla reptans*, bush vetch *Vicia sepium*, meadowsweet *Filipendula ulmaria*, tufted vetch *Viccia cracca*, a dandelion *Taraxacum agg.*, red clover, common knapweed *Centaurea nigra*, meadow buttercup *Ranunculus acris*, creeping buttercup, lesser stitchwort *Stellaria graminea*, common bird's foot trefoil *Lotus corniculatus*, Yorkshire fog *Holcus lanatus*, white clover *Trifolium repens*, perforate St John's wort *Hypericum performatum*, marsh thistle, crested dog's-tail *Cynosurus cristatus* and hairy bittercress *Cardamine hirsuta*.

Photo 15-7: Dry meadows and grassy verges

Eroding/upland rivers (FW1)

Eroding/upland rivers are located within the Site and along both Cable Route Options. Species recorded along the banks of the rivers included common valerian *Valeriana officinalis*, blackthorn, brambles, hawthorn, honeysuckle *Lonicera pericylmenum*, dogrose, grey willow and polypody fern *Polypodium vulgare*. Instream vegetation consisted of occasional watercress and aquatic bryophytes *Scapania undulata, Racomitrium aciculare* and rare *Leptodictyum riparium*. Filamentous algae were also present on occasion, indicating artificial enrichment from fertilisers (i.e. pollution).

For a full description of aquatic habitats see Technical Appendix 15.4 found in Volume III of this EIAR.

Photo 15-8: Eroding/upland rivers

Exposed Sand, Gravel or Till (ED1)

Exposed sand, gravel or till was located adjacent to small sections of both Cable Route Options. No plants were associated with this habitat type. This was artificial, dumped gravel.

Hedgerows (WL1)

Hedgerows are located within the Site, and alongside roads and field margins for both Cable Route Options. Species recorded include hawthorn *Crataegus monogyna*, bramble, European gorse, honeysuckle, blackthorn, grey willow, elder *Sambucus nigra*, the non-native snowberry *Symphoricarpos albus*, ivy, common hogweed, hazel, sycamore *Acer pseudoplatanus*, ash *Fraxinus excelsior*, holly *Ilex aquifolium*, bilberry *Vaccinium myrtillus*, creeping thistle, cleavers *Galium aparine*, bitter vetch *Lathyrus linifolius*, meadow vetchling *Lathyrus pratensis*, broadleaved dock *Rumex obtusifolius*, cow parsley *Anthriscus sylvestris*, nettle *Urtica dioica*, rosebay willowherb, ribwort plantain, silverweed, spear thistle *Cirsium vulgare*, horsetails, creeping cinquefoil, dandelion *Taraxacum agg.*, perennial sowthistle *Sonchus arvensis*, cock's foot, Yorkshire fog, bents, dog rose, alder *Alnus glutinosa*, common knapweed, meadowsweet, oxeye daisy *Leucanthemum vulgare*, osier willow and wild privet *Ligustrum vulgare*.

Photo 15-9: Hedgerows

Immature woodland (WS2)

Immature woodland is located along Option 2 Cable Route and consists of a young pedunculate oak plantation. A clear photo was not possible as this habitat was hidden behind a hedgerow.

Improved agricultural grassland (GA1)

Improved agricultural grassland is located within the Site and as bounding habitat for of both Cable Route Options. Species included bents, creeping buttercup, white clover, redshank *Polygonum persicaria*, broadleaved dock, perennial rye grass and cock's foot.

Photo 15-10: Improved agricultural grassland

(Mixed) broadleaved woodland (WD1)

Mixed broadleaved woodland was located within the Site and along Cable Route Options. Species included pedunculate oak, non-native beech *Fagus sylvatica*, hazel, sycamore, ash, willow *Salix* sp., alder, ivy and silver birch *Betula pendula*. The conifer component consists of <25% and includes Scot's pine *Pinus sylvestris*.

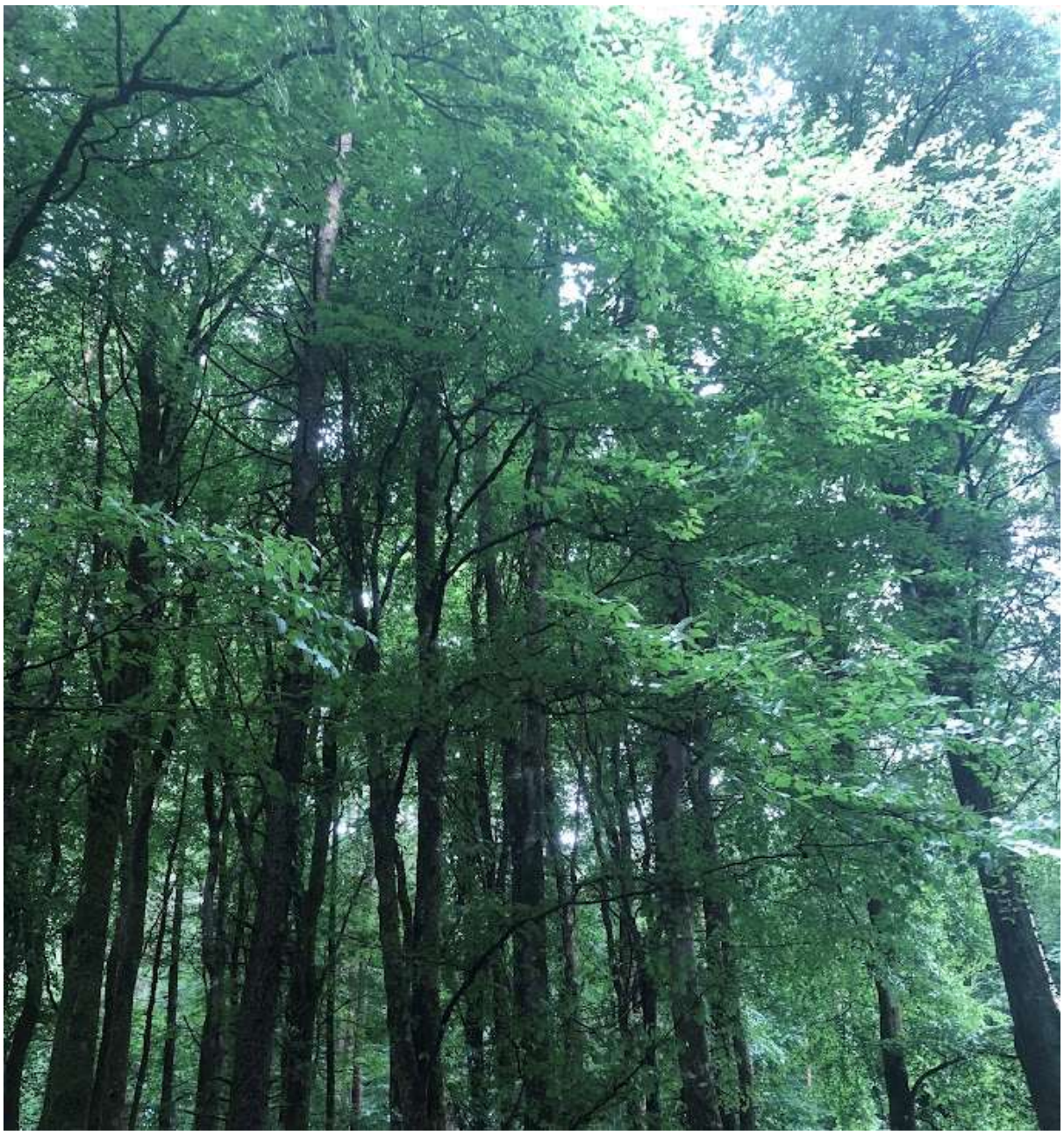


Photo 15-11: (Mixed) broadleaved woodland

Ornamental/non-native shrub (WS3)

Ornamental/non-native shrub is located within the Site and comprises a large patch of cherry laurel *Prunus laurocerasus* located off a forestry track in the Southern Cluster.

Photo 15-12: Ornamental/non-native shrub

Quarries (ED4)

Quarry habitats are located within the Site and will form the proposed borrow pit. The quarry is relatively small, 10-15 m in height consisting of slate/shale. Species present included the invasive/non-natives Japanese knotweed *Reynoutria japonica* and fuchsia *Fuchsia magellanica*. Native plants included creeping buttercup, yarrow *Achillea millefolium*, nettles, *Taraxacum* agg., brambles, bugle *Ajuga reptans*, grey willow, herb robert *Geranium robertanium*, redshank and common sorrel *Rumex acestosa*.

Photo 15-13: Quarries

Recolonising bare ground (ED3)

Recolonising bare ground is located within the Site where forestry track or bare areas have started to recolonise. It is also located alongside Option 2 Cable Route. Species recorded include *Agrostis* sp., perennial rye grass, cock's foot, *Epilobium* sp., white clover, scarlet pimpernel *Anagallis arvensis*, a sow thistle *Sonchus* sp., a dock *Rumex* sp., a dandelion, common field speedwell *Veronica persica*, redshank., meadow buttercup, creeping thistle, greater plantain *Plantago major*, meadowsweet, herb robert, common figwort *Scrophularia nodosa*, creeping buttercup, nettle, brambles, cleavers, nipplewort *Lapsana communis*, bracken, wild strawberry, a sedge *Carex* sp. and selfheal.

Photo 15-14: Recolonising bare ground

Recently-felled woodland (WS5)

Recently-felled woodland is located within the Site where Sitka spruce conifer plantation has been recently felled, with species from the recolonising bare ground habitat type present. The temporary construction compound in the Southern Cluster will be located within this habitat type.

Photo 15-15: Recently-felled woodland

Riparian woodland (WN5)

Riparian woodland was found alongside both Cable Route Options. It was dominated by willows *Salix* spp, with other trees including ash and alder.

Photo 15-16: Riparian woodland

Scattered trees and parklands (WD5)

Scattered trees and parkland is located along Option 2 Cable Route within the centre of Timahoe. Species recorded include small-leaved lime *Tilia cordata*, silver birch *Betula pendula*, a bronze maple *Acer* sp. and whitebeam *Sorbus aria* trees. Flower beds planted with lupin *Lupinus* sp., mallow *Lavatera* sp., montbretia 'Lucifer' *Crocosmia* 'Lucifer', daylilies *Hermocallis* spp., a coneflower *Rudbeckia* sp., pelargonium *Pelargonium* sp., ornamental heathers *Calluna* spp. and big-headed selfheal *Prunella grandiflora*. Amenity grasslands were of the same type as described previously.

Photo 15-17: Scattered trees and parklands

Scrub (WS1)

Scrub is located within the Site and along both Cable Route Options. Species recorded include hawthorn, bramble, European gorse, honeysuckle, blackthorn, willows, elder, snowberry, ivy, common hogweed, hazel, sycamore, ash, holly, rosebay willowherb and bilberry.

Photo 15-18: Scrub

Spoil and bare ground (ED2)

Spoil and bare ground is located within the Site, principally areas where vegetation has been removed due to agriculture e.g. where vehicles have frequently tracked over grassland. The vegetation present was similar in composition to the recolonising bare ground habitat type albeit with reduced coverage.

Photo 15-19: Spoil and bare ground

Stone walls and other stonework (BL1)

Stone walls and other stonework is located along Option 1 Cable Route. Plants recorded include ivy, oxeye daisy, cleavers, and polypody fern, harts tongue fern *Asplenium scolopendrium* and maidenhair spleenwort *Asplenium trichomanes*.

Photo 15-20: Stone walls and other stonework

Treeline (WL2)

Treeline is located adjacent to both Cable Route Options and occasionally as field boundaries within the Site. Species recorded included oak, sycamore, ash, horse chestnut *Aesculus hippocastanatum*, silver birch, beech, common alder and grey willow.

Photo 15-21: Treeline

Wet grassland (GS4)

Wet grassland is located adjacent to some areas of Option 2 Cable Route. It was dominated by *Juncus* species, with *Holcus* sp., *Agrostis* sp. and tufted hair grass *Deschampsia cespitosa* present. Other species included occasional water mint *Mentha aquatica*, grey willow saplings, a willowherb *Epilobium* sp., creeping buttercup, meadow buttercup, marsh thistle, ragged robin *Lychnis flos-cuculi* and foxglove.

Photo 15-22: Wet grassland

Table 15-7 sets out the habitat types within the study area.

Table 15-7 Habitat types within Site, plus within and bounding the Cable Route Options

Code	Fossitt Type	Potential EU Annex 1 Affiliation	Area (ha) / Length (m)				Occurrence within Development Footprint
			Site	Option 1 Cable Route	Option 2 Cable Route	Total[12]	
BC1	Arable crops	No	- / -	- / -	42.83 / -	42.83 / -	Adjacent to off-road section of Option 2 Cable Route
BL1	Stone walls and other stoneworks	No	- / -	- / 481	- / -	- / 481	Adjacent to Option 1 Cable Route
BL3	Buildings and artificial surfaces	No	15.24 / 7,536	18.12 / 7,205	11.77 / 11,892	43.31 / 26,061	As roads and buildings within Site and both cable route options
ED1	Exposed sand, gravel or till	No	- / 1,255	0.03 / -	0.30 / 268	0.33 / 1,524	Adjacent to both cable route options
ED2	Spoil and bare ground	No	0.06 / -	0.06 / -	0.15 / -	0.21 / -	Within Site and adjacent to both cable route options
ED3	Recolonising bare ground	No	1.69 / 3,990	0.07 / 977	- / -	1.77 / 4,967	Within Site and adjacent to some of Option 1 Cable Route
ED4	Quarries	No	0.49 / -	- / -	- / -	0.49 / -	Within Site only – will form borrow pit
FW1	Eroding/upland rivers	No	- / 1,405	- / 98	- / 1,276	- / 2,780	Within Site and adjacent to both cable route options
FW2	Depositing/lowland rivers	No	- / -	- / 458	- / -	- / 458	Adjacent to Option 1 Cable Route only
FW4	Drainage ditches	No	- / 9,165	- / 1,516	- / 1,517	- / 11,108	Within Site and adjacent to both cable route options
GA1	Improved agricultural grassland	No	70.24 / -	94.68 / -	69.91 / -	227.72 / -	Within Site and adjacent to both Cable Route Options; also forms part of off-road section for Option 1 Cable Route
GA2	Amenity grassland (improved)	No	0.78 / -	5.44 / 76	7.79 / 0	13.68 / 76	Small section within Site and adjacent to both Cable Route Options
GS2	Dry meadows and grassy verges	No	- / 461	0.07 / -	- / -	0.07 / 461	Adjacent to Option 1 Cable Route
GS4	Wet grassland	No	1.07 / -	1.34 / -	2.33 / -	4.74 / -	Small section within Site and adjacent to both Cable Route Options
WD1	(Mixed) broadleaved woodland	No	8.14 / -	1.61 / -	9.39 / -	18.99 / -	Within Site and adjacent to both Cable Route Options

[12] There is an area of overlap between the two Cable Route Options and there is an area within the Site that overlaps with both Cable Route Options. While the habitat dimensions for the Site and the two Cable Route Options includes these areas of overlap individually, the total column does not i.e. there is no double-counting. Note that the dimensions presented are rounded to 2 d.p. but the totals were calculated using the non-rounded data.

Code	Fossitt Type	Potential EU Annex 1 Affiliation	Area (ha) / Length (m)				Occurrence within Development Footprint
			Site	Option 1 Cable Route	Option 2 Cable Route	Total[12]	
WD4	Conifer plantation	No	247.11 / -	33.85 / -	30.07 / -	296.24 / -	Within Site and adjacent to both Cable Route Options
WD5	Scattered trees and parklands	No	- / -	0.15 / -	<0.01 / -	0.15 / -	Adjacent to both Cable Route Options
WL1	Hedgerows	No	0.11 / 4,349	6.85 / 14,012	- / 11,996	6.96 / 28,916	Within Site and adjacent to both Cable Route Options as field boundaries
WL2	Treelines	No	- / 1,360	- / 4,389	- / 5,945	- / 10,579	Within Site and adjacent to both Cable Route Options as field boundaries
WN5	Riparian woodland	No	- / -	1.65 / -	0.50 /	2.14 / -	Adjacent to both Cable Route Options near watercourses
WS1	Scrub	No	7.44 / -	7.05 / -	3.34 / -	16.88 / -	Within Site and adjacent to both Cable Route Options
WS2	Immature woodland	No	- / -	1.52 / -	1.67 / -	2.12 / -	Adjacent to both Cable Route Options
WS3	Ornamental/non-native shrub	No	0.07 / -	- / -	- / -	0.07 / -	Within Site as area of cherry laurel
WS5	Recently-felled woodland	No	32.39 / -	- / -	1.00 / -	33.39 / -	Within Site and small area next to Option 2 Cable Route

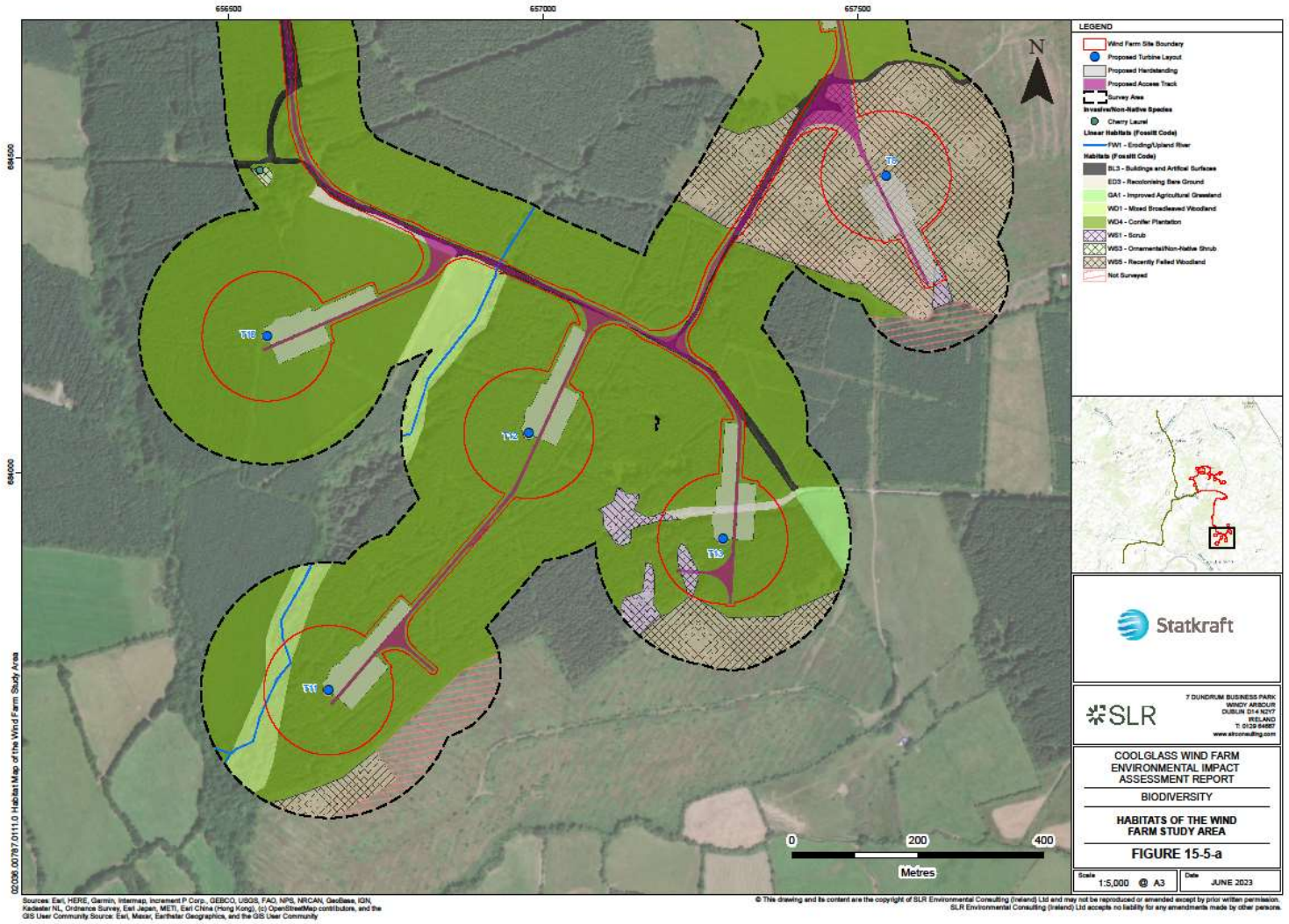


Figure 15-5: Habitats of the Site and Cable Route Options

P2

P3

P4

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P12

P13

P14

P15

P16

15.3.3 Rare Flora

Desktop Study

The data search yielded no records of rare and/or protected plants at the Site (see Technical Appendix 15.7 found in Volume III of this EIAR). It also yielded no records of rare and/or protected plants alongside either Cable Route Option or the TDR (at areas along the TDR where accommodation works will be required).[13]

Field Surveys

No rare or protected plants were recorded during field surveys at the Site, which consisted almost entirely of heavily modified conifer plantation and agricultural habitats. Similarly, no rare or protected plants were recorded alongside either Cable Route Option or the TDR (at areas along the TDR where accommodation works will be required). Based on the habitats present, there is very limited potential for any such species to be present within the Project.

15.3.4 Invasive Non-native Plants

Desktop Study

The data search yielded records of seven species of invasive or non-native plants (see Technical Appendix 15.7 found in Volume III of this EIAR): butterfly bush *Buddleja davidii*, cherry laurel, Japanese knotweed, montbretia *Crocosmia x crocosmiiflora*, New Zealand pigmy weed *Crassula helmsii*, snowberry and sycamore. There is the potential for these species to be present within the Site. There were no desktop records of invasive plants along either Cable Route Option.

Field Surveys

Japanese knotweed, cherry laurel, fuchsia, Himalayan honeysuckle *Leycesteria formosa*, Japanese rose *Rosa rugosa* and snowberry were all recorded within the Site (see **Figure 15-5**).

Canadian pondweed *Elodea canadensis* was also recorded during aquatic surveys at sample sites A15 (Stradbally Bridge) and C7 (Clogh Bridge).

Japanese knotweed, snowberry, cherry laurel, red flowering currant *Ribes sanguineum* and Himalayan honeysuckle were recorded adjacent to Option 1 Cable Route (see **Figure 15-5**).

Snowberry, montbretia, cherry laurel and Himalayan honeysuckle were recorded adjacent to Option 2 Cable Route (see **Figure 15-5**).

Snowberry, Japanese rose, cherry laurel were recorded in various locations around the TDR (at areas along the TDR where accommodation works will be required) (see Technical Appendix 15.9 found in Volume III of this EIAR).

Of the species mentioned, Japanese knotweed and Canadian pondweed are the only species listed on the Third Schedule of the European Communities (Birds and Natural Habitats) Regulations 2011-2021 (S.I. 477/2011). Japanese knotweed was found along

[13] Note that there is a recent record for blue fleabane *Erigeron acris* contained within the Biodiversity Ireland dataset, but this is erroneously listed as 'endangered' when it is actually 'least concern' (Wyse Jackson, et al., 2016).

edges of the quarry that will be used as a borrow pit. Canadian pondweed was found at aquatic survey sites outside and downstream of the Project.

15.3.2 Birds

Desktop Study

BirdWatch Ireland has created a sensitivity mapping tool, which assesses the potential sensitivity of at-risk bird populations to wind energy developments (Mc Guinness, et al., 2015). Those areas of the Proposed Development where data were available were assessed and all scored as having low sensitivity i.e. there are no known avian populations in the general area thought to be particularly sensitive to wind farm developments.

The data search yielded records of 34 species of rare (red- or amber-listed) and/or specially protected (Annex 1) birds at the Site and surrounding area (see Technical Appendix 15.7 found in Volume III of this EIAR for details on data sources). This included the results of bird surveys carried out at the Site between 2012 – 2017, as well as opportunistic data and data collected for other purposes.

There are desktop records for six Annex 1-listed species: hen harrier, European golden plover, little egret *Egretta garzetta*, merlin, peregrine falcon and red kite *Milvus milvus*.

In addition, there are records for 13 red-listed species: barn owl, bar-tailed godwit *Limosa lapponica*, common kestrel, common snipe, common swift *Apus apus*, Eurasian woodcock, grey wagtail *Motacilla cinerea*, meadow pipit *Anthus pratensis*, northern lapwing, common redshank *Tringa totanus*, redwing *Turdus iliacus*, whinchat *Saxicola rubetra* and yellowhammer *Emberiza citrinella*.

Finally, there are records for 15 amber-listed species: barn swallow *Hirundo rustica*, black-headed gull *Chroicocephalus ridibundus*, common gull *Larus canus*, common linnet *Carduelis cannabina*, common starling *Sturnus vulgaris*, European greenfinch *Chloris chloris*, goldcrest *Regulus regulus*, great cormorant *Phalacrocorax carbo*, house martin *Delichon urbicum*, house sparrow *Passer domestricus*, mallard, sand martin *Riparia riparia*, skylark *Alauda arvensis*, spotted flycatcher *Muscicapa striata* and willow warbler *Phylloscopus trochilus*.

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

NPWS also have data on two occupied peregrine nest sites recorded within the general area of the Proposed Development Site during the 2017 National Peregrine survey.

For the Cable Route Options, the only notable desktop records were for Annex 1-listed little egret and peregrine falcon, and red-listed redwing at Option 1 Cable Route. The only notable avian record for Option 2 Cable Route was for amber-listed barn swallow.

Field Surveys

Flight Activity Surveys

Full details of the flight activity survey results (including figures showing flight lines for primary target species) are provided in Technical Appendix 15.2 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). 'At risk' flights are defined as those crossing the relevant WP at Potential Collision Height (PCH), i.e. within each rotor-swept area (between 17 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 on (the PCHs for the 'best-case' scenario is based on a turbine with a 102.5 m hub height and 157 m diameter, which gives PCHs of 25 – 180 m AGL). This is the worst-case scenario because the PCH range contains the best-case scenario PCH range as well. Consequently, this allows for the assessment of all permutations within the turbine range.

Seven primary target species were recorded during flight activity surveys and of these, only hen harrier is listed as an SCI species for any SPAs within 20 km of the Site and Cable Route Options. There was no evidence that this species was using the area for roosting, rather it was commuting through the area only.

In general, there were very few 'at risk' flight events for any primary target species; this was even true for species that often fly in flocks, such as European golden plover.

Table 15-8 and **Table 15-9** summarise the cumulative numbers of birds recorded passing through the CRZ during baseline surveys undertaken during September 2017 to March 2018 and April 2021 to August 2022 inclusive, and those potentially at risk of turbine collision, for the Northern and Southern Clusters, respectively.

Table 15-8 Summary of 'At Risk' Flights of Primary Target Species by Season[14] within Northern Cluster

Species name	Period of analysis	Total flights	Within WP		Within WP at Potential Collision Height (PCH)	
			Flight lines	Flights	Flight lines	Flights
Common kestrel	Non-breeding season 2017/18 (01 Sep-31 Mar)	18	11	11	6	6
	Breeding season 2021 (01 Apr-31 Aug)	29	14	14	14	14
	Non-breeding season 2021/22 (01 Sep-31 Mar)	14	4	4	4	4
	Breeding season 2022 (01 Apr-31 Aug)	92	40	43	38	41
Common snipe	Non-breeding season 2017/18 (01 Sep-31 Mar)	2	2	2	2	2
	Non-breeding season 2021/22 (01 Sep-31 Mar)	1	0	0	0	0
	Breeding season 2022 (01 Apr-31 Aug)	4	4	4	4	4
Eurasian woodcock	Breeding season 2022 (01 Apr-31 Aug)	1	1	1	1	1
European golden plover	Non-breeding season 2017/18 (01 Sep-31 Mar)	2	1	2	1	2
	Non-breeding season 2021/22 (01 Sep-31 Mar)	2,039	1	9	0	0

[14] For a full definition of seasons used, see Technical Appendix 15.2

Species name	Period of analysis	Total flights	Within WP		Within WP at Potential Collision Height (PCH)	
			Flight lines	Flights	Flight lines	Flights
Hen harrier	Non-breeding season 2017/18 (01 Sep-31 Mar)	3	2	2	2	2
Northern lapwing	Non-breeding season 2017/18 (01 Sep-31 Mar)	1	1	1	1	1
	Breeding season 2022 (01 Apr-31 Aug)	3	0	0	0	0
Peregrine falcon	Breeding season 2021 (01 Apr-31 Aug)	6	5	5	3	3
	Non-breeding season 2021/22 (01 Sep-31 Mar)	2	2	2	1	1
	Breeding season 2022 (01 Apr-31 Aug)	9	3	3	3	3

Table 15-9 Summary of 'At Risk' Flights of Primary Target Species by Season[15] within Southern Cluster

Species name	Period of analysis	Total flights	Within WP		Within WP at Potential Collision Height (PCH)	
			Flight lines	Flights	Flight lines	Flights
Common kestrel	Non-breeding season 2017/18 (01 Sep-31 Mar)	61	10	10	10	1
	Breeding season 2021 (01 Apr-31 Aug)	29	18	19	15	16
	Non-breeding season 2021/22 (01 Sep-31 Mar)	27	12	12	1	1
	Breeding season 2022 (01 Apr-31 Aug)	10	3	3	3	3
Common snipe	Breeding season 2021 (01 Apr-31 Aug)	2	1	2	1	2
	Non-breeding season 2021/22 (01 Sep-31 Mar)	13	5	7	3	4
Eurasian woodcock	Breeding season 2021 (01 Apr-31 Aug)	1	1	1	0	0
European golden plover	Non-breeding season 2017/18 (01 Sep-31 Mar)	39	2	7	2	7
	Non-breeding season 2021/22 (01 Sep-31 Mar)	330	2	39	2	39
Northern lapwing	Non-breeding season 2021/22 (01 Sep-31 Mar)	10	1	10	1	10

[15] For a full definition of seasons used, see Technical Appendix 15.2

Species name	Period of analysis	Total flights	Within WP		Within WP at Potential Collision Height (PCH)	
			Flight lines	Flights	Flight lines	Flights
Peregrine falcon	Non-breeding season 2017/18 (01 Sep-31 Mar)	2	1	1	1	1
	Breeding season 2021 (01 Apr-31 Aug)	4	1	1	1	1
	Non-breeding season 2021/22 (01 Sep-31 Mar)	3	2	2	1	1
	Breeding season 2022 (01 Apr-31 Aug)	0	0	0	0	0

Table 15-10 summarises the secondary target species data for the Northern and Southern Clusters combined.

Table 15-10 Summary of Flights of Secondary Target Species by Season Within Both Clusters Combined

Species	Season	Total no. of 5-minute periods in which species recorded	Peak count in any 5-minute period
Black-headed gull	Breeding season 2021 (01 Apr-31 Aug)	11	23
	Non-breeding season 2021/22 (01 Sep-31 Mar	9	20
	Breeding season 2022 (01 Apr-31 Aug)	2	4
Common buzzard	Non-breeding season 2017/18 (01 Sep-31 Mar)	66	3
	Breeding season 2021 (01 Apr-31 Aug)	216	5
	Non-breeding season 2021/22 (01 Sep-31 Mar	142	6
	Breeding season 2022 (01 Apr-31 Aug)	438	5
Common gull	Non-breeding season 2021/22 (01 Sep-31 Mar	6	13
Common swift	Breeding season 2022 (01 Apr-31 Aug)	1	1
Eurasian sparrowhawk	Non-breeding season 2017/18 (01 Sep-31 Mar)	31	2
	Breeding season 2021 (01 Apr-31 Aug)	2	1
	Non-breeding season 2021/22 (01 Sep-31 Mar	32	2
	Breeding season 2022 (01 Apr-31 Aug)	17	3
European herring gull	Breeding season 2021 (01 Apr-31 Aug)	4	6
	Non-breeding season 2021/22 (01 Sep-31 Mar	6	3
	Breeding season 2022 (01 Apr-31 Aug)	14	17
Eurasian whimbrel	Breeding season 2021 (01 Apr-31 Aug)	2	1

Species	Season	Total no. of 5-minute periods in which species recorded	Peak count in any 5-minute period
Great black-backed gull	Breeding season 2022 (01 Apr-31 Aug)	2	1
Great cormorant	Breeding season 2021 (01 Apr-31 Aug)	3	1
	Non-breeding season 2021/22 (01 Sep-31 Mar	1	4
Grey heron	Non-breeding season 2017/18 (01 Sep-31 Mar)	1	1
	Breeding season 2021 (01 Apr-31 Aug)	17	2
	Non-breeding season 2021/22 (01 Sep-31 Mar	9	1
	Breeding season 2022 (01 Apr-31 Aug)	2	1
Jack snipe	Non-breeding season 2021/22 (01 Sep-31 Mar	1	1
Lesser black-backed gull	Non-breeding season 2017/18 (01 Sep-31 Mar)	3	1
	Breeding season 2021 (01 Apr-31 Aug)	14	15
	Non-breeding season 2021/22 (01 Sep-31 Mar	2	6
	Breeding season 2022 (01 Apr-31 Aug)	37	23
Mallard	Breeding season 2021 (01 Apr-31 Aug)	10	4
	Non-breeding season 2021/22 (01 Sep-31 Mar	7	2
Northern raven	Breeding season 2021 (01 Apr-31 Aug)	93	10
	Non-breeding season 2021/22 (01 Sep-31 Mar	84	4
	Breeding season 2022 (01 Apr-31 Aug)	56	8

Breeding Wader Surveys

Full results of the breeding wader surveys in 2022 are presented in Technical Appendix 15.2 found in Volume III of this EIAR. While no waders were recorded during the dedicated breeding wader surveys conducted in 2022, common snipe was recorded during flight activity surveys drumming c. 400 m southwest of turbine T6 in July 2022, which is indicative of probable breeding according to the BTO breeding status codes (BTO, Recording breeding evidence, 2023). This was after the survey period breeding wader surveys had ended. No nest was detected.

Breeding Raptor Surveys

Full results of the breeding raptor surveys in 2021 and 2022 are presented in Technical Appendix 15.2 found in Volume III of this EIAR. A summary is presented below.

Common buzzard

In 2021, several territories were recorded within the Site. A pair was also heard calling in suitable breeding woodland habitat, indicating probable breeding. However, no nests were detected inside or within 2 km of the Site.

In 2022, 16 sightings were recorded. It is likely that at least one pair held a territory to the north of the Site and one bird was recorded dropping into the forestry with prey within the Site. No nests were detected inside or within 2 km of the Site.

Common kestrel

In 2021, this species was recorded flying over suitable breeding habitat within 500 m from the Site, but no confirmed evidence of breeding was detected.

In 2022, six kestrel were recorded foraging within 2 km of the Site. A disused quarry c. 400 m to the north of the Site was recorded as a potential roost. No evidence of breeding was detected.

Eurasian sparrowhawk

In 2021, a pair were heard calling in suitable breeding woodland habitat between 500 m – 2 km from the Site, indicating probable breeding. However, no nests were detected either within or adjacent to the Site.

In 2022, it was suspected that there was a potential territory to the north (1.4 km outside of the Site boundary) of the Site, but no evidence of breeding was detected.

Peregrine falcon

In 2021, two peregrine were observed: the first was of an immature female flying over the Site. The second was of an adult female at a quarry 3.3 km from the Site, indicating probable breeding. No evidence of breeding peregrine was recorded within 2 km of the site.

In 2022, a disused quarry c. 400 m to the north of the Site was recorded as a potential roost. However, no evidence of occupancy or activity was detected.

Swan and Goose Feeding Distribution Surveys

Full results of the swan and goose feeding distribution surveys are presented in Technical Appendix 15.2 found in Volume III of this EIAR.

No swans or geese were recorded during feeding distribution surveys carried out in the winter of 2021/22.

Winter Walkover Surveys

Full results of the winter walkover survey are presented in Technical Appendix 15.2 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 15-11** below.

Table 15-11 Summary of Species Recorded During Winter Walkover

Species	Peak Count
Common snipe	14
Goldcrest	23
Common linnet	2
Meadow pipit	11
Redwing	15
Common starling	100
Eurasian woodcock	1

Incidental Sightings

Two observations of Eurasian woodcock were made during bat transect and habitat surveys in 2022. The observation during the bat transect was in the Northern Cluster c. 700 m southeast of turbine T1 and the bird was roding, suggesting that a territory is present nearby and indicating probable breeding, although no nests or any other evidence of confirmed breeding was found. It is likely that the territory is to the east of the access track linking local road L3851 to turbine T1. The observation made during the habitat surveys was c. 430 m north of turbine T4 along a forestry track in the day and was of a flushed, non-roding bird.

Mallard, grey heron, little grebe, common moorhen *Gallinula chloropus*, European golden plover, black-headed gull, common gull and European herring gull were all seen outside the 500 m survey area during 2021/22 feeding distribution surveys for swans and geese.

There was a single northern lapwing recorded in an agricultural field c. 2 km to the west of the Site during a breeding raptor survey. No evidence of breeding was recorded.

A meadow pipit was seen during bat detector surveys near (c. 150 m) turbine T4 location in the summer of 2021.

A grey wagtail was also seen at the borrow pit location during habitat surveys in the summer of 2022.

No evidence of barn owl was observed during any of the bat roost surveys or any other survey type.

No kingfishers or kingfisher nests were seen during any of the aquatic ecology surveys. No nesting habitat was recorded during habitat surveys within the Site or during the walkover surveys for the Cable Route Options. Limited kingfisher foraging habitat was available at aquatic survey locations B7, B8 and B9 at Option 1 Cable Route. All other aquatic survey locations adjacent to the Proposed Development footprint were assessed as having limited foraging potential.

15.3.3 Terrestrial Mammals (Excluding Bats)

Desktop Data

The data search yielded records of nine species of rare and/or protected mammals (see Technical Appendix 15.7 found in Volume III of this EIAR): Eurasian badger, Eurasian pygmy shrew *Sorex minitus*, Eurasian red squirrel, Irish hare *Lepus timidus*, otter, pine marten, red fox *Vulpes vulpes*, west European hedgehog *Erinaceus europaeus* and wood mouse *Apodemus sylvaticus*. There is the potential for these species to be present within the Site.

There are also records of five species of invasive or non-native mammals: bank vole *Myodes glareolus*, European rabbit *Oryctolagus cuniculus*, feral goat *Capra aegagrus hircus*, greater white-toothed shrew *Crocidura russula* and sika deer.

For the Cable Route Options, the only desktop record was for pine marten at Option 2 Cable Route (see Technical Appendix 15.7 found in Volume III of this EIAR).

Field Surveys

Eight species of mammals were recorded during the dedicated mammal surveys (see **Figure 15-6**). A summary is provided for each species below.

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: Eurasian pygmy shrew, west European hedgehog, wood mouse, bank vole, European rabbit and sika deer.

Badger

Latrines, excavation and tracks were recorded in both clusters. No badger setts were recorded within 100 m of the Project. The woodland and hedgerow habitats present provide foraging and breeding habitats.

Pine marten

Pine marten was seen during static detector surveys for bats in the Southern Cluster (two individuals) and pine marten roadkill was also detected. Pine marten scat was also recorded in the Northern Cluster and during surveys along Option 2 Cable Route. No dens (breeding places) were recorded within 100 m of the Project. The woodlands provide foraging and breeding habitats.

Red squirrel

Signs of foraging (split hazel nuts) were recorded in the Southern Cluster near an area of conifer plantation that had grown over an old hedgerow where a few hazel trees were still present. No dreys (breeding places) were recorded within 100 m of the Project. The woodlands provide foraging and breeding habitats.

Irish hare

Irish hares were seen during habitat and bat transect surveys in the Northern Cluster near turbine T1. The grassland habitats are suitable for foraging, with forest/scrub areas providing shelter.

Greater white-toothed shrew

A dead shrew was recorded along a forestry track during habitat surveys in the Northern Cluster. Grasslands, woodlands and hedgerows all provide foraging and breeding habitats.

Otter

The results for this species are discussed in the aquatic ecology section below.

Fallow deer

Fallow deer *Dama dama* was recorded by trail camera in the Northern Cluster, with deer droppings found through this cluster. A pair of shed fallow deer antlers were also found not far from the location of the trail camera in the Southern Cluster. The woodland and grassland habitats present offer foraging habitat for this species.

Sika deer

Surveys carried out as part of the forestry assessment detected this species in the Northern Cluster. The woodland and grassland habitats present offer foraging habitat for this species.

Red fox

Red foxes were recorded by the trail camera in the Southern Cluster with fox scat widespread throughout both turbine clusters. There are a wide variety of suitable habitats within the Site for this opportunistic hunter.

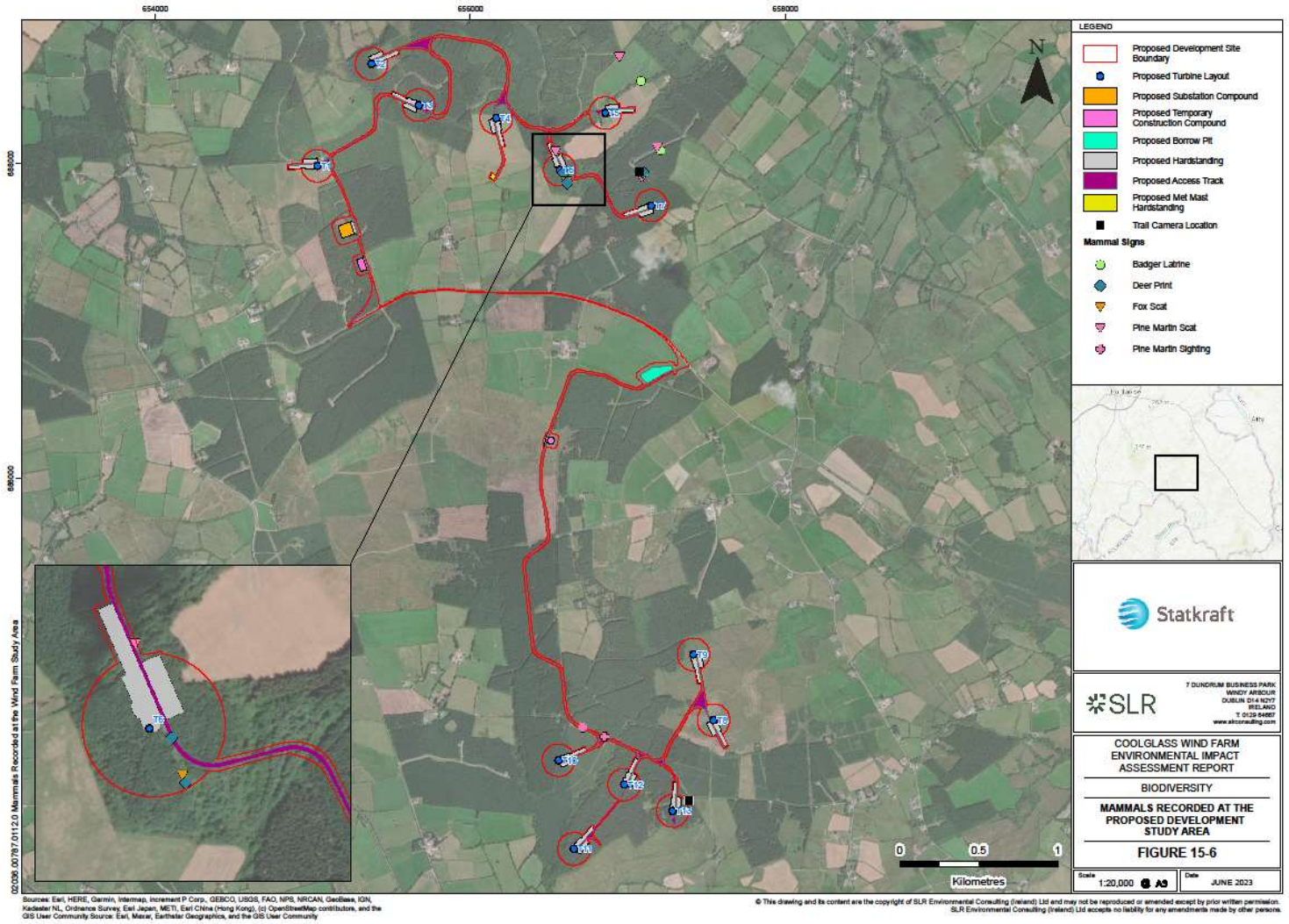

Figure 15-6: Mammals Recorded at the Site Study Area

15.3.4 Bats

Desktop Data

The bat landscapes suitability index (Lundy *et al.*, 2011) across all bat species showed that the mean score (out of 100) was 28.56 and 26.67 for the Northern and Southern Clusters, respectively.

The data search yielded records of eight species of bats (see Technical Appendix 15.7 found in Volume III of this EIAR). There is the potential for these species to be present within the Site. In addition, surveys carried out for the Proposed Development in 2018 have shown these species have been recorded using the Site historically.

Data supplied by Bat Conservation Ireland showed there were 11 recorded bat roosts located within 10 km from the Site and Cable Route Options. The closest roost is a mixed-species roost for pipistrelles (common and unidentified), brown long-eared bats, Natterer's bat and Leisler's bat. The remaining roosts are for Daubenton's bat (two separate roosts), brown long-eared bat (two separate roosts) and whiskered bat. Only the mixed species roost is likely to have ecological connectivity to the Site i.e. the core sustenance zones (CSZ)[16] for brown long-eared bat, Natterer's bat, soprano pipistrelle and Leisler's bats, as measured from the mixed species roost, all overlap with the Site, which is 2.6 km from the roost. The data showed there were two known roosts adjacent (i.e. 0 m) to Option 2 Cable Route. One is a roost for Daubenton's bat and one is the mixed roost for brown long-eared bat, Natterer's bat, soprano pipistrelle and Leisler's bat described above. The data did not show any recorded roosts within 100 m of Option 1 Cable Route.

A review of previous survey data from Fehily Timoney and Company showed that in the Northern Cluster, there were no structures or caves that were of significance for roosting bats within 279.35 m (200 m plus blade length) of the Site. This search area was based on guidance (NatureScot 2021) that states all roosts located within 200 m plus blade length of the developable area should be searched for. As the largest blade length was 79.35 m, this search area accounted for all other turbine permutations with a smaller blade length.

Field Surveys

Roost assessment

There are no buildings or underground features that could be used by roosting bats within the Northern Cluster. Similarly, none of the trees within the Northern Cluster were assessed as having any roosting potential above 'low potential', consisting predominantly of conifers.

At the Southern Cluster, there was only one tree that was classed as having any roosting potential above 'low potential'. This was one mature ash tree located c. 80 m SW of turbine T12 and within the Site footprint. This tree had a few large cavities near its base that could be potentially used by roosting bats (the tree appeared to be healthy), although no droppings or staining was visible. It was surrounded by forestry and the environment was

[16] 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 02/08/2023]

quite cluttered, making it unlikely to be a major bat roost. Consequently, this tree was classed as having no more than moderate roost potential.

There were also two other potential roosts in the Southern Cluster. The first was an old gable wall covered with ivy. It was determined that this structure was of low suitability for bats (no signs of bats were present). The second consisted of two abandoned farm sheds, both with corrugated roofs and covered with ivy. No bat droppings or staining was visible and it was judged that the structure was of moderate suitability for bats at best. These two structures (both gable wall and sheds) are located outside of the Site footprint.

There was also one other abandoned farm shed near the borrow pit location and inside the Site footprint. This had a corrugated roof and had three walls still standing, with extensive ivy cover. This structure could not be inspected safely, so a bat emergence survey was conducted, which recorded no evidence that the structure was used by bats.

Along Option 1 Cable Route, sites 19, 20, 21 and 24 are low culverts and were classified as having no roost potential. Sites 19, 22 and 23 are stone bridges and had moderate potential, with some ivy on the exterior but concrete undersides, limiting roosting potential to the sides of the bridge only. There were also some abandoned houses with high roost potential towards the end of the grid route, although they were not located within the Option 1 Cable Route footprint.

Along Option 2 Cable Route, site 15 was classified as having high potential, consisting of a sandstone bridge with numerous crevices within the bridge suitable for roosting bats. All other sites had no potential, consisting of low culverts.

See Technical Appendix 15-3 found in Volume III of this EIAR for further information.

Ground-level static detector survey

Eight bat species were recorded at the Site during static detector surveys conducted in summer and autumn of 2021 and spring of 2022: brown-long eared bat, common pipistrelle, Daubenton's bat, Leisler's bat, Nathusius' pipistrelle, Natterer's bat, soprano pipistrelle, and whiskered bat. A mean of 983 bat passes per night were recorded across all locations and across all seasons.

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.

Common pipistrelle was the most frequently recorded species, with peak activity (largest number of mean calls per night) recorded at location 11 in the summer session and at location 10 in the spring session. The summer peak at location 11 (conifer plantation/forest edge habitats) was not driven by one or two nights, with a high number of calls per night recorded consistently. The spring peak at location 10 (conifer plantation/forest edge habitats) was driven largely by two nights, with 1,057 and 1,652 calls recorded on 3 and 4 June 2022, respectively.

Leisler's bat was the next most frequently recorded across all turbine locations and seasons. Peak Leisler's activity was in the spring session at location 4 (improved agricultural grassland) and in the summer session at location 5 (improved agricultural grassland). In spring, there was one night with very high levels of Leisler's bat activity at location 4: 4 June 2022 with 762 calls recorded. In summer at location 5, there were multiple nights with high bat activity i.e. it was not the results from one night driving the pattern seen in the data.

Soprano pipistrelle was the third most frequently recorded species, with peak activity across all seasons recorded at locations 4 and 5 in spring. High bat activity on one date explained these two peaks, with 87 calls recorded at location 4 on the 26 May 2022 and 82 calls recorded at location 5 on 27 May 2022.

The Site is located on the range edge of Nathusius' pipistrelle and this species was rarely recorded.

Across all bat species recorded, the autumn season had much lower levels of bat activity than the spring or summer seasons.

Transect activity survey

Common pipistrelle, Daubenton's bat, Leisler's bat, Nathusius' pipistrelle, soprano pipistrelle and whiskered bat were recorded during transect surveys. In the Northern Cluster, flight lines typically were of common and soprano pipistrelle commuting along forest edges and hedgerows with consistent foraging activity located near one large tree and occasional foraging occurring near forest edge habitats. Leisler's bat, Nathusius' pipistrelle and whiskered bat were also recorded but generally in lower numbers and not always present. In the Southern Cluster, flight lines were typically of common and soprano pipistrelle commuting along forest edges and with consistent foraging activity at the same and over the bridge spanning the Brennanshill watercourse. Leisler's bat, Daubenton's bat, Nathusius' pipistrelle and whiskered bat were also recorded but they were not always present.

Bat activity relative to other survey sites

The habitats at the Site constitutes 'moderate risk' bat habitats, as defined within the NatureScot (2021) guidance. The Site contains multiple linear features (hedgerows, treelines, forest edges, firebreaks and streams) considered to be of value to foraging/commuting bats and provides connectivity to the wider landscape. In addition, the Site is located at the range edge of Nathusius' pipistrelle.

No assessment of bat activity relative to other survey locations using the Ecobat tool was possible (see section 15.2.6). 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.

15.3.5 Other Protected Fauna

Desktop Data

Reptiles

The data search yielded no records of any species of reptile (see Technical Appendix 15.7 found in Volume III of this EIAR). The only native reptile to Ireland is common lizard *Zootoca vivpara*. This species is mainly associated with coastal and heathland habitats in Ireland (Farren, Prodöhl, Laming, & Reid, 2010), both of which are absent from the Site.

There were no desktop records for any reptile species at either Cable Route Options.

Amphibians

The data search yielded records of one species of amphibian (see Technical Appendix 15.7 found in Volume III of this EIAR), the common frog *Rana temporaria*. There is the potential for these species to be present within the 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 present.

While there are no desktop records for this species, there is also some limited foraging and breeding habitat for smooth newt *Lissotriton vulgaris* present in similar habitats (Buckley, 2012).

There were no desktop records for either species at either of the Cable Route Options.

Invertebrates

The data search yielded records of two species of rare or threatened invertebrates (see Technical Appendix 15.7 found in Volume III of this EIAR): marsh fritillary *Euphydryas aurinia* (Annex 2; vulnerable) and Gooden's nomad bee *Nomada goodeiana* (endangered).

There is the potential for the bee species to be present within the Site, but not marsh fritillary, as there are no habitats supporting Devil's bit scabious *Succisa pratensis* (the caterpillar foodplant) present.

There are also desktop records for invasive New Zealand flatworm *Arthundyus triangulatus* for the Site.

There were no desktop records of rare, threatened or invasive invertebrates for either Cable Route Options.

Field Surveys

Reptiles

No reptiles were recorded during other ecological surveys.

Amphibians

Common frog was recorded during habitat surveys in 2022, with mating frogs and frogspawn seen in puddles in the forestry tracks and drainage ditches in the Northern Cluster. Smooth newt was recorded as an incidental during aquatic surveys in some small pools c. 200 m west of the Fallowbeg Upper stream (aquatic survey site A1; see **Figure 15-2**).

Invertebrates

There were no rare/protected or invasive invertebrate species recorded during terrestrial surveys. The habitats present were unsuitable for marsh fritillary and so it is likely the desktop record is outside the survey area.

While they were not recorded by field surveys, it is likely that Gooden's nomad bee is also present based on desktop data and the availability of suitable foraging/breeding habitats.

15.3.6 Fisheries and Aquatic Ecology

Desktop Data

The desktop data available for fisheries and aquatic ecology is shown in full in Appendix 15.4 found in Volume III of this EIAR. A summary is provided below.

The following fish species have been recorded historically in the survey area: brown trout *Salmo trutta*, stone loach *Barbatula barbatula*, minnow *Phoxinus phoxinus*, three-spined

stickleback *Gasterosteus aculeatus*, Atlantic salmon, dace *Leuciscus leuciscus* and lampreys *Lampetra* spp.

White-clawed crayfish and otter have been recorded historically in the survey area. Nore freshwater pearl mussel have also been recorded but mainly upstream of the Site and Grid Route Options.

Field Surveys

See Confidential Technical Appendix 15.4 found in Volume III of this EIAR for the full fisheries and aquatic ecology survey results and Figure 15-2 for a drawing of where streams and rivers are located. A summary is provided below.

Habitats

An aquatic vegetation community representative of the Annex 1 habitat 'Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation or aquatic mosses [3260]' (or watercourses with floating river vegetation) was present at site A15 on the Stradbally River at Stradbally Bridge (c. 6.8 km downstream of Option 2 Cable Route and c. 11.1 km downstream of the Site). This site supported abundant water crowfoot *Ranunculus* sp. (40% cover) and a high cover of aquatic bryophytes such as *Fontinalis antipyretica*, in addition to other indicator species such as water starwort *Callitriche sp*. (Kelleher, 2011; Weekes, et al., 2018). The aquatic survey site is located within the River Barrow and River Nore SAC (002162) for which watercourses with floating river vegetation is listed as a qualifying interest (NPWS, Conservation Objectives: River Barrow and River Nore SAC 002162. Version 1.0., 2011). As a precaution, the entire SAC watercourse is interpreted to be the Annex 1 habitat and not just the patches of floating river vegetation within it.

Q-sampling

No protected or rare macro-invertebrate species (according to national red lists) were recorded in the biological water quality samples taken from n=25 wetted riverine sites. Of these sites, six (sites A11 on the Stradbally River, B3 and B8 on the Owveg River, C3 on the Brennanshill River, C6 on the Clogh River and D1 on the Douglas River) achieved good status, five (sites A1, A6 and A15 on the Stradbally River and B10 the Owveg River and C2 on the Clogh River) achieved moderate status and the rest achieved poor status.

Macrophytes and aquatic bryophytes

No rare or protected macrophytes or aquatic bryophytes were recorded at the n=33 survey sites.

Pearl mussels

No freshwater pearl mussel eDNA was detected in the Stradbally River (site A15), Owveg River (B10), Clogh River (C7) or Douglas River (D1) samples. Suitability was poor or absent throughout the survey sites (likely due to heavy siltation, enrichment, historical modifications, spate channels, ephemeral channels etc.). These results were in keeping with the known distribution of this species within the wider survey area, i.e. only known from the River Nore.

However, whilst the historical range of the species in the River Nore extends from Poorman's Bridge to Ballyragget (Poorman's Bridge is c.12 km west of the Site and Ballyragget is c. 18 km south of Poorman's Bridge), stage 1 and 2 surveys completed for this report recorded no live mussels along c.4 km of the Nore between Archer's Island and

Ballyragget Bridge. This survey has reaffirmed that no live freshwater pearl mussels have been found in the River Nore downstream of the River Erkina confluence (near Durrow) since 2007.

Electro-fishing

Of the n=33 survey sites, 17 did not support fish at the time of the survey due to dry or semi-dry channels. A summary of fish species recorded is provided below.

Salmonids

Except for sites A12 on the Cremorgan Stream and B76 on the Owveg River, salmonids were recorded at 15 surveys sites. Salmonid populations were typically small where encountered. Atlantic salmon were present at low densities on the Stradbally River (A15) and Owveg River (B3 and B10). The Stradbally and Crooked rivers draining to the north of the Site supported the highest densities of brown trout and Atlantic salmon. The Stradbally, Crooked, Owveg, Clogh, and to a lesser extent, Douglas rivers, provided the best quality salmonid habitat.

Lamprey

Lamprey ammoecetes (brook and/or river lamprey) were recorded on the Crooked River (A6), Stradbally River (A11 and A15), Owveg River (B10) and Clogh River (C4, C6 and C7). Few sites featured optimal conditions for lampreys, and ammoecetes were typically in low densities due to suboptimal or limited nursery habitat. The highest densities were recorded at sites C4 and C6 on the Clogh River, which was considered as the most important watercourse for lamprey in the wider survey area.

European eel

European eel *Anguilla anguilla* were only recorded in low densities at sites B7 and B8 on the Owveg River, despite widespread suitability elsewhere. This limited distribution is thought to be a result of low summer flows, as well as abundant instream migration barriers within the wider Nore_SC_060, Nore_SC_080 and Dinin[North]_SC_010 river sub-catchments. The large instream distance (>100 – 140 km) between the survey area and the sea also partly explains the paucity of eel observations (Degerman, Tamario, Watz, & Calles, 2019).

Other fish species

Minnow *Phoxinus phoxinus*, stone loach *Barbatula barbatula* and three-spined stickleback *Gasterosteus arculaetus* were also recorded in low densities in the Crooked River, Stradbally River, Cremorgan Sream, Owveg River, Clogh River and Douglas River. Perch *Perca fluviatilis* was recorded in the Clogh River only.

White-clawed crayfish

Small populations of white-clawed crayfish were recorded from sites B7 and B8 on the Owveg River. Whilst site B7 (Spink Bridge) supported a low number of adult crayfish, only a single juvenile was recorded from site B8.

Environmental DNA analysis detected white-clawed crayfish in the Owveg River (site B10) and Clogh River (C7) but not in the Stradbally River (A15) or Douglas River (D1). No white-clawed crayfish remains were identified in field inspection of 12 no. otter spraint sites and a latrine at sites recorded across the Stradbally River, Cremorgan Stream and Clogh River.

eDNA

Composite water samples collected from the Stradbally River (site A15), Owveg River (B10), Clogh River (C7) and Douglas River (D1) returned a negative result for freshwater pearl mussel eDNA. These results were considered as evidence of the species' absence at, or upstream of, the sampling locations and support the absence of records for the species within the wider survey area.

White-clawed crayfish eDNA was detected at sites B10 on the Owveg River (c. 7.7 km downstream of Site and c.1.8 km downstream of Option 1 Grid Connection) and C7 on the Clogh River (c. 4.6 km downstream of Site and not hydrologically connected to Grid Route Options). However, no crayfish eDNA was detected in the Stradbally River at Stradbally Bridge (site A15) or Douglas River (D1).

Otter

Despite some good habitat suitability at numerous survey locations, otter signs were only recorded at a total of four sites.

Regular otter spraint sites were recorded at sites A12 on the Cremorgan Stream (3 no. spraint sites), A14 and A15 on the Stradbally River (total of 7 no. sites) and site C7 on the Clogh River (2 no. sites). A latrine and couch (resting) area were also identified under Stradbally Bridge at site A15. Of these locations, only site A12 is adjacent to the Project (Option 2 Cable Route). Sites A14, A15 and C7 are all at least 4 km instream distance from the Project.

No breeding (holts) areas were identified in the 150 m vicinity of the survey sites.

Invasive aquatic species

The invasive macrophyte Canadian pondweed was recorded at site A15 on the Stradbally River at Stradbally Bridge and site C7 on the River Clogh at Clogh Bridge. The species is very widespread in Ireland and is listed on the Third Schedule of the European Communities (Birds and Natural Habitats) Regulations 2011-2021 (S.I. 477/2011). It is considered a high-risk invasive species in Irish waters (O'Flynn, Kelly, & Lysaght, 2014).

15.3.7 Environmental DNA analysis detected the non-native pathogen crayfish plague (*Aphanomyces astaci*) in the Stradbally River and Clogh River at sites A15 and C7.Evaluation of Ecological Features

An evaluation of ecological features within the ZoI is provided in **Table 15-12** below.

Only those evaluated as an 'Important Ecological Feature' (IEF) are brought forward for impact assessment. These also include those protected by law or policy.

Table 15-12 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 Barrow and River Nore cSAC.	River Barrow and River Nore cSAC: NIS determined that the only source-receptor pathways were with hydrological connections to two riparian habitats (water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation 3260, hydrophilous tall herb fringe communities of plains and of the montane to alpine levels 6430) and freshwater aquatic species (Desmounlin's whorl snail 1016, freshwater pearl mussel 1029, white-clawed crayfish 1092, sea lamprey 1095, brook lamprey 1096, river lamprey 1099, twaite shade 1103, salmon 1106, otter 1355 and Nore pearl mussel 1990).	International	Part of European Natura 2000 network	Y
	River Nore SPA	River Nore SPA: supports a nationally important population of kingfisher. NIS determined that the only source-receptor pathways were hydrological connections to riparian habitats that could be used by breeding and foraging kingfishers A229.	International	Part of European Natura 2000 network	Y
	Clopook Wood pNHA and Grand Canal pNHA.	Clopook Wood pNHA: the only source-receptor pathways are ecological, via badgers which could forage at the Site. Grand Canal pNHA: the only source-receptor pathways are hydrological and ecological. Riparian habitats (tall herb, reed fringe and open water) and species (opposite-leaved pondweed, otter and smooth newt) are linked to the Site and Option 2 Grid Route via Fallowbeg Upper stream and Cremorgan stream. Mobile otter and smooth newt also could move along watercourses.	National	Non-designated Irish national conservation site	Y
Habitats	BC1 arable crops	See Table 15-7 for information on habitat extent and location.	Site	Highly modified and disturbed habitat providing limited value to other ecological receptors.	N

Feature type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
	BL1 stonewalls and other stone works		Site	Artificial habitat providing limited value to other ecological receptors.	N
	BL3 buildings and artificial surfaces		Site	Artificial habitat providing limited value to other ecological receptors.	N
	ED1 exposed sand, gravel or till		Site	Highly modified and disturbed habitat providing limited value to other ecological receptors.	N
	ED2 spoil and bare ground		Site	Highly modified and disturbed habitat providing limited value to other ecological receptors.	N
	ED3 recolonising bare ground		Site	Highly modified and disturbed habitat providing limited value to other ecological receptors.	N
	ED4 active quarries and mines		Site	Artificial habitat providing limited value to other ecological receptors.	N
	FW1 eroding/upland rivers		Regional / county	Provides connectivity and ecological corridors between features of higher ecological value e.g. bats and aquatic receptors. Breeding and foraging habitat for aquatic receptors.	Y
	FW2 depositing/lowland rivers		Regional / County / International	Provides connectivity and ecological corridors between features of higher ecological value e.g. bats and aquatic receptors. Breeding and foraging habitat for aquatic receptors. Owveg River near Option 1 Cable Route is part of River Barrow and River Nore SAC.	Y

Feature type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
	FW4 drainage ditch		Local	Used for breeding by amphibians and for foraging/commuting by bats (potentially all species recorded at Site). Provides connectivity and ecological corridors between features of higher ecological value.	Y
	GA1 improved agricultural grassland		Site	Habitat dominated by introduced grass species with low species diversity.	N
	GA2 amenity grassland (improved)		Site	Habitat dominated by introduced grass species with low species diversity.	N
	GS2 dry meadows and grassy verges		Site	Habitat generally consists of mown roadside verges with limited importance to other ecological receptors.	N
	GS4 wet grassland		Site	Habitat used for agriculture and species richness is generally low.	N
	WD1 mixed broadleaved woodland		Local	Specialised and varied habitat provides a home for a wide range of species. Helps maintain links and ecological corridors between features of higher ecological value.	Y

Feature type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
	WD4 conifer plantation		Site	Habitat of low diversity. While providing some potential breeding/foraging habitat for arboreal red squirrel and predatory pine marten, conifer plantations have been shown to have a negative effect on the populations of red squirrel (Twining, Sutherland, Reid, & Tosh, 2022) and the broadleaved woodlands in the wider area are likely to be more important for both of these species in this regard. No red squirrel dreys or pine marten dens were recorded in conifer plantation in the study area. Similarly, this habitat can be used by Eurasian woodcock, but typically only in early stages, with forest rides and glades more important for this species than mature conifer plantation itself.	N
	WD5 scattered trees and parkland		Site	Habitat dominated by low-diversity amenity grassland with a few non-native trees likely offering limited value for biodiversity.	N
	WL1 hedgerows		Local	Specialised and varied habitat provides a home for a wide range of species. Helps maintain links and ecological corridors between features of higher ecological value.	Y
	WL2 treelines		Local	Specialised and varied habitat provides a home for a wide range of species. Helps maintain links and ecological corridors between features of higher ecological value.	Y

Feature type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
	WN5 riparian woodland		Local	Specialised and varied habitat provides a home for a wide range of species. Helps maintain links and ecological corridors between features of higher ecological value.	Y
	WS1 scrub		Local	Habitat provides breeding and foraging habitat for a wide range of species.	Y
	WS2 immature woodland		Local	Habitat consists of young oak saplings, which ultimately will provide breeding and foraging opportunities for a wide range of species. However, not within the Project.	Y
	WS3 ornamental/ non-native shrub		Negligible	Habitat consists of non-native, high-impact invasive cherry laurel.	N
	WS5 recently-felled woodland		Site	Highly modified and disturbed habitat with low species diversity.	N

Feature type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
Birds	European golden plover	Annex 1 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 Laois population: 1,415 wintering individuals and 3 breeding pairs; Baseline surveys: Flight activity surveys: peak count of 2,000 birds in one flock (winter 2021/22); not recorded in breeding season surveys; Breeding wader surveys: no breeding European golden plover recorded at or nearby Site.	National (wintering)	Peak counts (N=>2,000 birds) during winter baseline surveys represent less than the 1% criteria for international importance (N=9,300) but more than the 1% criteria for national importance (N=920) stated by I-WeBS. The peak winter count is also significant within the context of the ROI wintering population (2.8%). While the winter peak count is indeed large, most of the flight activity was away from turbine locations. Based on above, the population within the study area is considered to be of national importance as a precaution for the winter season.	Y

Feature type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
	Hen harrier	Annex 1 Birds Directive; BoCCI 4: Amber list (qualifying criteria: moderate decline in breeding population of 29% over longer time period); ROI population: 108 – 157 breeding pairs (Ruddock, et al., 2016) and 219 – 313 resident individuals (NPWS, 2021); County Laois population: 5 individuals (resident and wintering seasons); Mean population 2017 to 2020: 10 breeding pairs (NPWS, 2021); Baseline surveys: Flight activity surveys: three flights (winter 2017/18); Breeding raptor surveys: no hen harrier recorded during surveys.	National (wintering)	Qualifying species at one SPA within 20 km (Slieve Bloom Mountains SPA), although those birds recorded at the Site are not known to be part of the SPA population. 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 suggesting roosting occurred within 2 km of the Site). As a precaution, the cumulative number of birds recorded in any single season has been used as the peak count, as hen harrier are not flocking birds. However, this could equally be a single bird observed on three separate occasions. The peak count (N=3) is significant within the context of the ROI wintering population (1.4%).	Y

Feature type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
	Merlin	Annex 1 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 Laois population: 4 pairs; Baseline surveys: three flights of single birds (winter 2017/18); Breeding raptor surveys: no merlin recorded during surveys.	Regional / County (wintering)	Flight activity was at a low level throughout the study period and were focused in an area that has been dropped from the current Site layout. All flights were recorded in winter, suggesting a few birds moving through the wider area while foraging (there was no evidence to suggesting roosting occurred within 2 km of the Site). As a precaution, the cumulative number of birds recorded in any single season has been used as the peak count, as merlin are not flocking birds. The peak count (N=3) is not >1% within the context of the ROI winter population (0.75%) (which is assumed to be the same as the ROI breeding population) but is significant within the context of the regional/county winter population (37.5%).	Y

Feature type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
	Peregrine falcon	Annex 1 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 Article 12 report (NPWS, 2022) estimates an ROI population of 515 pairs, so this has been assumed here; County Lois population: 10 pairs; Baseline surveys: Flight activity surveys: 10 flights (breeding 2021), six flights (breeding 2022), three flights (winter 2017/18) and seven flights (winter 2021/22); Breeding raptors surveys: female observed at a quarry 3.3 km from Site (probable breeding).	Regional / County (breeding / wintering)	Flight activity was at a low level throughout the study period. As a precaution, the cumulative number of birds recorded in any single season has been used as the peak count, as peregrine falcon is not a flocking bird. Nearest breeding location 3.3 km from Site, which is a lot greater than the 750 m minimum distance required to avoid disturbance (Goodship & Furness, 2022). The peak count (N=10 for breeding and N=7 for wintering) is not >1% within the context of the ROI breeding or wintering population (0.97% and 0.68%, respectively) but is of regional/county importance (34% and 48.5%, respectively).	Y

Feature type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
	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 Laois population: 135 pairs; Baseline surveys: Flight activity surveys: 92 flights (breeding 2021), 52 flights (winter 2021/22), 102 flights (breeding 2022) and 49 flights (winter 2017/18); Breeding raptors surveys: no confirmed breeding was recorded.	Regional / County (breeding / wintering)	As a precaution, the cumulative number of birds recorded in each season has been used as the peak count, as kestrel are not flocking birds. The peak count (N=52) is not >1% within the context of the ROI breeding population (0.34%) but is of regional/county importance (19.3%). The peak count (N=102) is not >1% within the context of the ROI wintering population (0.76%) but is of regional/county importance (37.8%).	Y

Feature type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
	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 Laois population: 850 wintering individuals and 40 breeding pairs; Baseline surveys: Flight activity surveys: peak count 22 birds (winter 2021/22) and two birds (breeding 2022); Breeding wader surveys: no evidence recorded.	Regional / County (breeding / wintering)	Flight activity was at a low level throughout the study period. Peak counts (N=22 birds) during winter baseline surveys represent less than the 1% criteria for international importance (N=72,300) and less than the 1% criteria for national importance (N=850) stated by I-WeBS. The peak count is also not significant within the context of the ROI wintering population (0.05%). The same is true for the breeding season peak count (N=2); it is not >1% in the context of the ROI breeding population (0.05%). However, the peak counts are significant in the context of the County Laois winter (2.6%) and breeding (2.5%) populations. No evidence of breeding was recorded. Based on above, the population within the study area is considered to be of no more than regional/county importance for both the winter and breeding seasons.	Y

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[17]. Consequently, we have assumed that the true winter population is likely to be the same as the breeding population i.e. 8,550 individuals; County Laois population: 171 individuals; Baseline surveys: Flight activity surveys: peak count 2 birds (breeding 2021), 2 birds (winter 2021/22), 1 bird (breeding 2022) and 17 birds (winter 2017/18). Breeding wader surveys: not breeding recorded during dedicated surveys but drumming observed c. 400 m southwest of turbine T6, indicating probable breeding. Winter walkover surveys: peak count 14 birds (winter 2018/18).	Regional / County (breeding and wintering)	Flight activity was at a very low level throughout the study period. The winter peak count (N=17) is not significant within the context of the ROI wintering population (0.2%) and the breeding season peak count (N=2) is not >1% within the context of the ROI breeding population (0.02%). Both are significant within the context of the regional winter (9.9%) and breeding population (1.2%). Likely one breeding pair present, but c. 400 m from the nearest source of disturbance, which is the minimum distance required to avoid disturbance (Pearce-Higgins, Stephen, Langston, Bainbridge, & Bullman, 2009) Based on the above, the population within the study area is of regional importance for the winter and breeding seasons.	Y

[17] https://www.bto.org/sites/default/files/shared_documents/publications/research-reports/2004/rr355.pdf Accessed 05/07/2023

Feature type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
	Eurasian woodcock	BoCCI 4: Red list (qualifying criteria: severe decline in breeding range of 73% over longer time period); ROI population: no reliable estimates are available (Fitzgerald, Burke, & Lewis, 2021; Lewis, et al., 2019; NPWS, Annex 2: Bird species' status and trends reporting format for the period 2008-2012, 2022); County Laois population: no reliable estimates are available; Baseline surveys: Flight activity surveys: peak count 1 bird (breeding season 2021) and 1 bird (breeding season 2022). Breeding wader surveys: no breeding recorded during dedicated surveys, but roding was observed c. 700 m southeast of turbine T1, indicating probable breeding. Winter walkover surveys: peak count 1 bird (winter 2017/18).	Regional / County (breeding) and Local (wintering)	Flight activity was at a very low level throughout the study period. It is difficult to assess the value of the breeding peak count (N=1) in the context of the ROI and County Laois population, as there are currently no reliable woodcock population estimates for Ireland. Possibly at least one breeding pair present, but c. 700 m from nearest source of disturbance. Based on the above, the population within the study area is of regional / county importance for the breeding season as a precaution, but of local importance for the non-breeding season.	Y
	Swift	BoCCI 4: Red list (qualifying criteria: severe decline in breeding population of 56% over short time period); ROI population; 51,728 individuals (2006-2016: (Lewis, et al., 2019)); County Laois population: 1,035 individuals; Baseline surveys: Flight activity surveys: recorded as secondary species with peak count 1 bird (breeding season 2022).	Local (breeding)	Flight activity was at a very low level throughout the study period. The breeding peak count (N=1) is not significant within the context of the ROI population (0.002%) or County Laois population (0.1%). Based on the above, the population within the study area is of local importance for the breeding season.	Y

Feature type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
	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; localised 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 Laois population: 404 wintering individuals and 186 breeding pairs (breeding colony known to be between Athy and Carlow); Baseline surveys: Flight activity surveys: recorded as secondary species with peak count 21 birds (breeding season 2021), 20 birds (winter season 2021/22) and 4 birds (breeding season 2022).	County / Regional (breeding and wintering)	Flight activity was generally at a low level throughout the study period. The breeding peak count (N=4) is not significant within the context of the ROI population (0.02%) but it is for the County Laois population (1.1%). The winter season peak count (N=21) is not significant within the context of the ROI population (0.1%) but it is for the County Laois population (5.2%). Based on the above, the population within the study area is of county / regional importance for the breeding and winter season.	Y
	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 (2016/16: (Fitzgerald, Burke, & Lewis, 2021)) and 4,366 breeding pairs (2012: (NPWS, 2022)); County Laois population: 60 wintering individuals and 87 breeding pairs; Baseline surveys: Flight activity surveys: recorded as secondary species with peak count 1 bird (breeding season 2021) and 4 birds (winter season 2021/22).	County / Regional (wintering) and Local (breeding)	Flight activity was generally at a low level throughout the study period. The breeding peak count (N=1) is not significant within the context of the ROI population (0.01%) or County Laois population (0.6%). The winter season peak count (N=4) is not significant within the context of the ROI population (0.1%) but it is within the context of the County Laois population (6.7%). Based on the above, the population within the study area is of county / regional importance for the winter season and of local importance for the breeding season.	Y

Feature type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
	Common gull	BoCCI 4: Amber list (qualifying criteria: moderate decline in breeding population of 25% over longer time period); ROI population; 8,032 wintering individuals (2016/17: (Fitzgerald, Burke, & Lewis, 2021)) and 1,927 breeding pairs (2012: (NPWS, 2022)); County Laois population: 161 wintering individuals. There are no known breeding colonies in County Laois; however, the number of summering non-breeders is estimated to be 77 birds; Baseline surveys: Flight activity surveys: recorded as secondary species with peak count 12 birds (winter season 2021/22).	County / Regional (wintering)	Flight activity was generally at a low level throughout the study period. The winter peak count (N=12) is not significant within the context of the ROI population (0.1%) but it is within the context of the County Laois population (7.5%). Based on the above, the population within the study area is of county / regional importance for the winter season only.	Y
	Herring gull	BoCCI 4: Amber list (qualifying criteria: unfavourable conservation status in Europe with global population concentrated in Europe; moderate decline in breeding population of 29% and 50% over short and longer time periods); ROI population; 14,060 wintering individuals (2016/17: (Fitzgerald, Burke, & Lewis, 2021)) and 2,319 breeding pairs (2012: (NPWS, 2022)); County Laois population: 281 wintering individuals. There are no known breeding colonies in County Laois; however, the number of summering non-breeders is estimated to be 93 birds; Baseline surveys: Flight activity surveys: recorded as secondary species with peak count 6 birds (breeding season 2021), 3 birds (winter season 2021/22) and 17 birds (breeding season 2022).	County / Regional (breeding and wintering)	Flight activity was generally at a low level throughout the study period. The winter peak count (N=3) is not significant within the context of the ROI population (0.02%) but it is for the County Offaly population (1.1%). The breeding peak count (N=17) is not significant within the context of the ROI breeding population (0.4%) but it is for the County Offaly population (18.3%). Based on the above, the population within the study area is of county / regional importance for both breeding and winter seasons.	Y

Feature type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
	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: F (Fitzgerald, Burke, & Lewis, 2021)) and 4,239 breeding pairs (2012: (NPWS, 2022)); County Laois population: 73 wintering individuals. There are no breeding colonies in County Laois; however, the number of summering non-breeders is estimated to be 170 birds; Baseline surveys: Flight activity surveys: recorded as secondary species with peak count 1 bird (winter season 2017/18), 15 birds (breeding season 2021), 6 birds (winter 2021/22) and 23 birds (breeding season 2022).	County / Regional (breeding and wintering)	Flight activity was generally low throughout the study period. The winter peak count (N=6) is not significant within the context of the ROI population (0.2%); however, it is within the context of the County Laois population (8.2%). The breeding peak count (N=23) is not significant within the context of the ROI population (0.3%), but it is significant within the context of the County Laois population (13.6%). Based on the above, the population within the study area is of county / regional importance for both breeding and winter seasons	Y
	Mallard	BoCCI 4: Amber list (qualifying criteria: moderate decline of winter population of 41% over short time period); ROI population; 8,098 wintering individuals (2016/17: (Fitzgerald, Burke, & Lewis, 2021)) and 15,400 breeding pairs (2008-2011; (NPWS, 2022)); County Laois population: 162 wintering individuals and 308 breeding pairs; Baseline surveys: Flight activity surveys: recorded as secondary species with peak count 4 birds (breeding season 2021) and 2 birds (winter 2021/22).	County / Regional (wintering) and Local (breeding)	Flight activity was generally low throughout the study period. The winter peak counts (N=2) are not significant in the context of the ROI population (0.02%) but are for the County Laois population (1.2%). The breeding peak counts (N=4) are not significant in the context of the ROI population (0.01%) or County Laois population (0.65%). Based on the above, the population within the study area is of regional / county importance for the winter season and local importance for the breeding seasons	Y

Feature type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
	Grey wagtail	BoCCI 4: Red list (qualifying criteria: severe decline in breeding population of 50% over short time period); ROI population; 50,768 individuals (2011-2016: (Lewis, et al., 2019)); County Laois population: 1,015 individuals; Baseline surveys: Incidental: peak count 1 bird recorded as incidental during habitat surveys (breeding season 2022).	Local (breeding)	The peak count (N=1) is not significant in the context of the ROI population (0.002%) or County Laois population (0.1%). Based on the above, the population within the study area is of local importance.	Y
	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 Laois population: 27,040 individuals; Baseline surveys: Winter walkover surveys: peak count 11 birds (winter season 2017/18). Also a single bird was recorded as an incidental during bat surveys (breeding season 2022).	Local (breeding)	The winter season peak count (N=11) is not significant in the context of the ROI population (0.0008%) or County Laois population (0.04%). The same is true for the breeding season peak count (N=1), which is not significant for the ROI population (0.00007%) or County Laois population (0.004%). Based on the above, the population within the study area is of local importance.	Y
	Linnet	BoCCI 4: Amber list (qualifying criteria: unfavourable conservation status in Europe with global population concentrated in Europe); ROI population; 459,892 individuals (2011-2016: (Lewis, et al., 2019)); County Laois population: 9,198 individuals; Baseline surveys: Winter walkover surveys: peak count 11 birds (winter season 2017/18).	Local (wintering)	The peak count (N=11) is not significant in the context of the ROI population (0.002%) or County Laois population (0.1%). 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
	Redwing	BoCCI 4: Red list (qualifying criteria: species of global conservation concern); ROI population; no reliable estimates are available (NPWS, 2022; Lewis, et al., 2019); County Laois population: no reliable estimates are available; Baseline surveys: Winter walkover surveys: peak count 15 birds (winter season 2017/18).	Local (wintering)	It is difficult to assess the value of the winter peak count (N=15) in the context of the ROI and County Laois population, as there are currently no reliable redwing population estimates for Ireland. This species favours open fields in lowland areas. As the majority of the Site consists of conifer plantation, with only a few open fields present, it is unlikely the habitats 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.	Y
	Common starling	BoCCI 4: Amber list (qualifying criteria: unfavourable conservation status in Europe with global population concentrated outside of Europe); ROI population; 2,066,904 individuals (2011-2016: (Lewis, et al., 2019)); County Laois population: 41,338 individuals; Baseline surveys: Winter walkover surveys: peak count 100 birds (winter season 2017/18).	Local (wintering)	The peak count (N=100) is not significant in the context of the ROI population (0.005%) or County Laois population (0.2%). 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
	Goldcrest	BoCCI 4: Amber list (qualifying criteria: unfavourable conservation status in Europe with global population concentrated in Europe); ROI population: 601,806 individuals (2011 – 2016: (Lewis, et al., 2019)); County Laois population: 12,036 individuals; Baseline surveys: Winter walkover surveys: 23 birds (winter season 2017/18).	Local (wintering)	The peak count (N=23) is not significant in the context of the ROI population (0.004%) or County Laois population (0.2%). Based on the above, the population within the study area is of local importance.	Y
	All other bird species	Green-listed, so detailed population level not presented.	Site	Green-listed, so widespread and common and 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 Laois population: 1,680 individuals; Clopook Woods pNHA population: no information available. Baseline surveys: no badger setts were recorded within 100 m of any proposed infrastructure. A latrine was recorded NE of turbine T5 at a field boundary. Scat was recorded along a forestry track north of turbine T7.	Local	No badger setts were recorded near any proposed infrastructure but the presence of a latrine indicates that badgers are present in the local area. Badger activity does not appear to be high in the study area (i.e. lack of well-worn trails, excavation etc). 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

Feature type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
	Otter	Annex 2 and IV Habitats Directive; Wildlife Act (1976) (as amended); Red list: Least Concern; ROI population: 16,000-22,000 individuals (Marnell, Looney, & Lawton, 2019); County Laois population: 320 – 440 individuals; River Barrow and River Nore SAC population: no information available; Grand Canal pNHA population: no information available; Baseline surveys: Regular otter spraint sites were recorded at aquatic survey site A12 on the Cremorgan Stream (3 no. spraint sites), which is adjacent to cable route 2. Spraints were also recorded at survey sites A14, A15 and C7, which are all at least 4 km instream distance from the Site and Cable Route Options. A latrine and couch (resting) area were also identified under Stradbally Bridge at site A15. 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. Otters use the Cremorgan Stream for feeding/commuting, which is adjacent to Option 2 Cable Route.	Local importance (Site population) County / Regional (downstream population)	Otters are a QI species for the River Barrow and River Blackwater SAC and it is likely that ex-situ populations are present at the Cremorgan Stream given that it is hydrologically linked to Option 2 Cable Route (c. 6.9 km instream distance). If the number of aquatic survey sites with otter signs at the Cremorgan Stream represents a likely estimate of the Site population (N=5), then the local otter population is not significant in the context of the ROI population (0.006%) or the County Laois population (0.3%). If the number of aquatic survey sites with otter signs at the downstream represents a likely estimate of the downstream population (N=4), then the downstream otter population is not significant in the context of the ROI population (0.25%) but it is in the context of the County Laois population (1.25%). Based on the above, the Site population within the study area is of local importance and the downstream population is of county/regional importance.	Y

Feature type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
	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 significant underestimated; County Laois population: 60 individuals (but likely underestimated); Baseline surveys: no dens were recorded within 100 m of any proposed infrastructure. Scat was recorded along various forestry tracks in the Northern Cluster and live sightings were made in the Southern Cluster also along forestry tracks. It is likely that they forage within the conifer plantation, hunting red squirrels and other prey.	County / Regional	No pine marten dens were recorded near any proposed infrastructure; however, this species is present within the study area and uses the conifer plantation habitats, which are widespread and common in the wider area. This species has the best possible conservation status i.e. is common and widespread. Assuming a local population of 3-4 individuals, then the population is not of national importance (0.13%); however, it is likely of regional / county importance (6.7%). Based on the above, the population within the study area is of regional / county importance.	Y
	Red squirrel	Wildlife Act (1976) (as amended); Red list: Least Concern; ROI population: 40,000 individuals (Marnell, Looney, & Lawton, 2019); County Laois population: 800 individuals; Baseline surveys: no dreys were recorded within 100 m of proposed infrastructure. Split hazel nuts were recorded in the southern cluster in forestry near turbine T13.	Local	No red squirrel dreys were recorded near any proposed infrastructure; red squirrel signs were recorded in the Southern Cluster, so this species does use the conifer plantation habitat 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

Feature type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
	Hedgehog	Wildlife Act (1976) (as amended); Red list: Least Concern; ROI population: there is no population estimate available (Marnell, Looney, & Lawton, 2019); County Laois population: no estimate available; Baseline surveys: none recorded but desktop records and suitable habitat present.	Local	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
	Irish hare	Wildlife Act (1976) (as amended); Red list: Least Concern; ROI population: 223,000 individuals (Marnell, Looney, & Lawton, 2019); County Laois population: 4,460 individuals; Baseline surveys: sightings recorded in Northern Cluster along forestry track near construction compound and near turbine T1.	Local	A few adult hares were recorded in the Northern Cluster. 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 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 conservation status - widespread and common, so do not require further assessment.	N

Feature type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
Bats	Brown long-eared bat	Annex 4 Habitats Directives; Wildlife Act (1976) (as amended); Red list: Least Concern; ROI population: 64,000 – 115,000 individuals (Marnell, Looney, & Lawton, 2019)); County Laois population: 1,280 – 2,300 individuals; Baseline surveys: not recorded during transect surveys. Recorded by ground-level detectors across all seasons and turbine locations. The mean bat passes/night never exceeded 2.5 across all turbine locations and seasons. No roosts were located within the development footprint.	Local	Very low levels of activity within the study area – no evidence the habitats represent important foraging or commuting features for this species. No roosts within the development footprint. Based on the above, the population within the study area is of local importance.	Y
	Common pipistrelle	Annex 4 Habitats Directives; Wildlife Act (1976) (as amended); Red list: Least Concern; ROI population: 1 – 2 million mature individuals (Marnell, Looney, & Lawton, 2019); County Laois population: 20,000 – 40,000 individuals; Baseline surveys: recorded during transect surveys at both turbine clusters during every season (peak count 78 and 45 calls in summer at northern and southern transects, respectively). Forest edge and hedgerow habitats used for foraging and commuting. Recorded by ground-level detectors across all seasons and turbine locations (the most frequently recorded species; largest mean passes per night across all seasons was 182 at turbine 11). No roosts were located within the work footprint.	Local	Moderate levels of activity within the study area and evidence linear forest edge/firebreak habitats used for foraging and commuting. No roosts 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
	Daubenton's bat	Annex 4 Habitats Directives; Wildlife Act (1976) (as amended); Red list: Least Concern; ROI population: 81,000 – 103,000 mature individuals (Marnell, Looney, & Lawton, 2019); County Laois population: 1,620 – 2,060 individuals; Baseline surveys: recorded during transect surveys at southern cluster in summer only (single pass). Recorded by ground-level detectors across all seasons and turbine locations, except for turbine T3, where the species was not recorded at all. The mean bat passes/night never exceeded 12 across all turbine locations and seasons. No roosts were located within the works footprint.	Local	Very low levels of activity within the study area – no evidence the habitats represent important foraging or commuting features for this species. No roosts within the works footprint. Based on the above, the population within the study area is of local importance.	Y
	Leisler's bat	Annex 4 Habitats Directives; Wildlife Act (1976) (as amended); Red list: Least Concern; ROI population: 81,000 – 103,000 mature individuals (Marnell, Looney, & Lawton, 2019); County Laois population: 1,620 – 2,060 individuals; Baseline surveys: recorded during transect surveys at both turbine clusters during spring and summer only (peak count 11 and 16 passes in spring at northern and southern transects, respectively). Forest edge habitats used for commuting. Recorded by ground-level detectors across all seasons and turbine locations (but most activity in open habitat locations; largest mean passes per night across all seasons was 35 at turbine 4). No roosts were located within the works footprint.	Local	Moderate levels of activity within the study area and evidence linear forest edge/firebreak habitats used for commuting. No roosts 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
	Nathusius' pipistrelle	Annex 4 Habitats Directives; Wildlife Act (1976) (as amended); Red list: Least Concern; ROI population: 10,000 – 18,000 individuals (Marnell, Looney, & Lawton, 2019) or 100 x 1 km^2 cells (NPWS, 2019); County Laois population: 200 - 360 individuals or 2 x 1 km^2 cells; Baseline surveys: recorded during transect surveys at both turbine clusters during spring only (peak count 12 and 1 passes at northern and southern transects, respectively). Forest edge and hedgerow habitats used for occasional foraging and commuting. Recorded by ground-level detectors across all seasons and turbine locations (generally low numbers; largest mean passes per night across all seasons was 9 at turbine 1). No roosts were located within the works footprint.	County / Regional	Very low levels of activity within the study area and evidence linear forest edge/firebreak habitats used for foraging and commuting. No roosts within the works footprint. Site located on geographic range edge. However, number of grid cells species likely present in is reasonably low Based on the above, the population within the study area is of county / regional importance.	Y
	Natterer's bat	Annex 4 Habitats Directives; Wildlife Act (1976) (as amended); Red list: Least Concern; ROI population: no estimates available (Marnell, Looney, & Lawton, 2019); County Laois population: no estimates available; Baseline surveys: not recorded during transect surveys. Recorded by ground-level detectors across all seasons and turbine locations. The mean bat passes/night never exceeded 3 across all turbine locations and seasons. No roosts were located within the works footprint.	Local	Very low levels of activity within the study area – no evidence the habitats represent important foraging or commuting features for this species. No roosts 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
	Soprano pipistrelle	Annex 4 Habitats Directives; Wildlife Act (1976) (as amended); Red list: Least Concern; ROI population: 0.54 – 1.2 million mature individuals (Marnell, Looney, & Lawton, 2019); County Laois population: 10,800 – 24,000 individuals; Baseline surveys: recorded during transect surveys at both turbine clusters during every season (peak count 32 and 24 passes in summer at northern and southern transects, respectively). Forest edge and hedgerow habitats used for occasional foraging and commuting. Recorded by ground-level detectors across all seasons and turbine locations (generally low numbers; largest mean passes per night across all seasons was 12 at turbine 11). No roosts were located within the works footprint.	Local	Low levels of activity within the study area and evidence linear forest edge/firebreak habitats used for commuting. No roosts 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
	Whiskered bat	Annex 4 Habitats Directives; Wildlife Act (1976) (as amended); Red list: Least Concern; ROI population: no estimates of numbers available (Marnell, Looney, & Lawton, 2019) but there is an estimate of 185 x 1 km^2 cells (NPWS, 2019); County Laois population: 3.7 x 1 km^2 cells; Baseline surveys: recorded in very low numbers at northern and southern transects in autumn only (three and one passes, respectively). Recorded by ground-level detectors across all seasons and turbine locations, except for turbine T3, where the species was not recorded at all. The mean bat passes/night never exceeded 6 across all turbine locations and seasons. No roosts were located within the works footprint.	County / Regional	Very low levels of activity within the study area – no evidence the habitats represent important foraging or commuting features for this species. No roosts within the works footprint. However, number of grid cells species likely present in is reasonably low. Based on the above, the population within the study area is of county / regional importance.	Y
Other Protected Fauna	Common frog	Annex V Habitats Directives; Wildlife Act (1976) (as amended); Red list: Least Concern; ROI population: no estimates available but thought to be stable or increasing (King, et al., 2011); County Laois population: no estimates available; Baseline surveys: recorded spawning in puddles and drainage ditches in and adjacent to forestry tracks.	Local	Spawning adults were recorded in Northern Cluster. Suitable foraging and breeding habitat is present within the study area in the form of damp grassland, drainage ditches and ephemeral puddles. Much of this habitat is also present within the wider landscape. 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

Feature type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
	Smooth newt	Wildlife Act (1976) (as amended); Red list: Least Concern; ROI population: no estimates available but thought to be stable (King, et al., 2011); County Laois population: no estimates available; Baseline surveys: recorded during aquatic surveys in pools c. 200 m west of the Fallowbeg Upper stream (aquatic survey site A1).	Local	Adults were recorded in Northern Cluster. Suitable foraging and breeding habitat is present within the study area in the form of damp grassland, drainage ditches and ephemeral puddles. Much of this habitat is also present within the wider landscape. 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
	Gooden's nomad bee	Red list: Endangered; ROI population: no estimates available (Fitzpatrick, Murray, Byrne, Paxton, & Brown, 2006); County Laois population: no estimates available; Baseline surveys: desktop records only – not recorded during surveys but suitable habitats present in study area.	Local	While not recorded during any field surveys, there are suitable habitats present within the study area (the species is found in a wide variety of habitats). 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
Fisheries and Aquatic Ecology	White-clawed crayfish	Annex 2 and V of Habitats Directive; Wildlife Act (1976) (as amended); ROI population: 860 x 1 km^2 grid cells (NPWS, 2019); County Laois population: 17 x 1 km^2 grid cells; River Barrow and River Nore SAC population: no estimates available; Baseline surveys: recorded in small populations in Owveg River (sites B7 and B8) and eDNA confirmed presence at Owveg River (site B10) and Clogh River (site C7).	County / Regional (Site and downstream population)	This species is a QI for the River Barrow and River Nore SAC. While small populations were recorded, those along the Owveg and Clogh rivers are near the SAC, so are almost certainly part of SAC populations. If the number of aquatic survey sites with crayfish presence represents a likely estimate of the Site population (N=2), then the Site crayfish population is not significant in the context of the ROI population (0.1%) but it is for the County Laois population (5.9%). If the number of aquatic survey sites with crayfish presence the downstream represents a likely estimate of the downstream population (N=4), then the downstream crayfish population is not significant in the context of the ROI population (0.5%) but it is in the context of the County Laois population (23.5%). Based on the above, the Site population within the study area and the population downstream are both of county/regional importance.	Y

Feature type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
	Floating river vegetation habitats	Annex 1 of Habitats Directive; The full extent of this habitat type within the River Barrow and River Nore SAC is unknown; Located within site A15 (Stradbally River), which is downstream of Option 2 Cable Route.	County / Regional	Annex 1 habitat within SAC. Approximately 1% of the Site overlaps with the SAC river and none of this habitat type was recorded in these locations, so it is only the downstream habitat that needs to be considered. Only 1.18 km^2 of this habitat exists in Ireland (NPWS, 2019); however, it is acknowledged that the full extent of this habitat type within the River Barrow and River Nore SAC is unknown. If the entire riparian component of the SAC is assumed to consist of this habitat type (assuming a worst-case scenario), then it is unlikely that the habitat recorded downstream of the Project at survey site A15 is of anything greater than county/regional importance.	Y

Feature type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
	Atlantic salmon	Annex 2 and V of Habitats Directive; Red list status: Vulnerable; ROI population: 250,000 individuals (King, et al., 2011) and 25,315 x 1 km^{s} cells (NPWS, 2019): County Laois population: 5,000 individuals or 506 x 1 km^{2} cells; River Barrow and River Nore SAC population: no estimates available; Baseline surveys: recorded in low densities at sites A15 (Stradbally River), and B3 and B10 (Owveg River).	Local (Site and downstream populations)	This species is a QI for the River Barrow and River Nore SAC. The only sites where this species was present were within the SAC, so they are part of the SAC population. If the number of aquatic survey sites with salmon presence represents a likely estimate of the Site population (N=1), then the Site salmon population is not significant in the context of the ROI population (0.004%) or the County Laois population (0.2%). If the number of aquatic survey sites with salmon presence the downstream represents a likely estimate of the downstream population (N=3), then the downstream salmon population is not significant in the context of the ROI population (0.01%) or the County Laois population (0.6%). Based on the above, the Site population within the study area and the population downstream are both of local importance.	Y

Feature type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
	Brook lamprey	Annex 2 of Habitats Directive; Red list status: Least Concern; ROI population: no estimates available (King, et al., 2011) but 1,221 x 1 km^2 cells (NPWS, 2019); County Laois population: no estimate available but 24 x 1 km^2 cells; River Barrow and River Nore SAC population: no estimates available; Baseline surveys: recorded in low densities at sites A6 (Crooked River), A11 and A15 (Stradbally River), B10 (Owveg River), and C7 (Clogh River). Ammocoetes were recorded in particularly high densities in sites C4 and C6 (Clogh River).	County / Regional (Site and downstream populations)	This species is a QI for the River Barrow and River Nore SAC. The survey sites with the highest densities of ammoecetes were in the Clogh River, with site C7 near the SAC, so they are highly likely to be part of the SAC population. If the number of aquatic survey sites with brook lamprey presence represents a likely estimate of the Site population (N=2), then the Site brook lamprey population is not significant in the context of the ROI population (0.16%) but it is for the County Laois population (8.3%). If the number of aquatic survey sites with brook lamprey presence the downstream represents a likely estimate of the downstream population (N=7), then the downstream brook lamprey population is not significant in the context of the ROI population (0.57%) but it is for the County Laois population (29.2%). Based on the above, the Site population within the study area and the population downstream are both of county / regional importance.	Y

Feature type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
	River lamprey	Annex 2 and V of Habitats Directive; Red list status: Least Concern; ROI population: no estimates available (King, et al., 2011) but 1,221 x 1 km^2 cells (NPWS, 2019); County Laois population: no estimate available but 24 x 1 km^2 cells. River Barrow and River Nore SAC population: no estimates available; Baseline surveys: recorded in low densities at sites A6 (Crooked River), A11 and A15 (Stradbally River), B10 (Owveg River), and C7 (Clogh River). Ammocoetes were recorded in particularly high densities in sites C4 and C6 (Clogh River).	County / Regional (Site and downstream populations)	This species is a QI for the River Barrow and River Nore SAC. The survey sites with the highest densities of ammoecetes were in the Clogh River, with site C7 near the SAC, so they are highly likely to be part of the SAC population. If the number of aquatic survey sites with river lamprey presence represents a likely estimate of the Site population (N=2), then the Site river lamprey population is not significant in the context of the ROI population (0.16%) but it is for the County Laois population (8.3%). If the number of aquatic survey sites with river lamprey presence the downstream represents a likely estimate of the downstream population (N=7), then the downstream river lamprey population is not significant in the context of the ROI population (0.57%) but it is for the County Laois population (29.2%). Based on the above, the Site population within the study area and the population downstream are both of county / regional importance.	Y

Feature type	Feature	Feature Information	Value	Justification for Evaluation	Important Ecological Feature? Y/N
	European eel	Red list status: Critically Endangered; ROI population: no estimates available (King, et al., 2011); County Laois population: no estimate available; Baseline surveys: recorded in low densities at sites B7 and B8 (Owveg River).	County / Regional (Site and downstream populations)	This species has a very poor conservation status and is found near Option 2 Cable Route watercourse crossings. Given that the Site 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 Site population within the study area and the population downstream are both of county / regional importance.	Y
	Brown trout	Red list status: Least Concern; ROI population: no estimates available (King, et al., 2011); County Laois population: no estimate available; Baseline surveys: recorded in low densities at sites B2, B3, B8 and B10 (Owveg River), C2 and C4 (Clogh River), C3 (Brennanshill River), C6 and C7 (Clogh River) and D1 (Douglas River).	Site	This species has the best possible conservation status. Brown trout also act as host species for pearl mussel spp., which are QIs for River Barrow and River Nore SAC. However, there are no records of freshwater pearl mussel in the catchment. Based on the above, the population within the study area is of site importance only.	N
	Three-spined stickleback, stone loach, minnow, perch	Red-list status for three-spined stickleback and minnow are of 'Least Concern' and stone loach and perch are non-natives.	Site	Afforded no legal protection and/or have best possible conservation status - widespread and common, so do not require further assessment.	N

15.4 Potential Impacts on Biodiversity

This section assesses the likely significant effects of the Proposed Development on the important ecological features as outlined in **Table 15-12.** Direct and indirect effects are considered for each of the three phases (construction, operation and decommissioning), as well as for the 'do nothing' scenario and in-combination with other projects or plans.

Works associated with the TDR relate to the trimming of small amounts of vegetation and/or removal of street furniture and there are no watercourses nearby. Works associated with the amenity trail relate to minor enhancements to the surface of the existing trail and signage. No nature conservation sites, or important habitats or species will be affected, and there is no potential for significant effects on biodiversity receptors. Consequently, impacts from accommodation works along the TDR and minor works to the amenity trail are not discussed further.

15.4.1 Do Nothing Scenario

The Proposed Development Site encompasses 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.

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

15.4.2 Potential Construction Phase Effects

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.

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.

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.

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

Sources of direct effects:

- Clearance of vegetation, soil and rock for access roads, hardstands and turbine bases;
- Clearance 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.

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

SACs (both cSAC and full) and SPAs are considered fully in the accompanying Natura Impact Statement (NIS) (see Technical Appendix 15.10 found in Volume III of this EIAR). The NIS confirmed that, with mitigation measures, the Proposed Development, either alone or in combination with any other plan or project, would not undermine the conservation objectives or have an adverse effect on the integrity of any Natura 2000 site.

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 pNHAs have been indirectly but fully considered within the NIS, with same conclusion as for the Natura 2000 sites.

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

Direct effects

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.

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

Indirect effects

Clopook Wood pNHA has a remote ecological connection via badgers. As there are not predicted to be any significant effects on badgers (see section on Mammals below), there are no significant effects predicted for Clopook Wood pNHA.

Grand Canal pNHA has a downstream hydrological connection. Thus, there is the potential for riparian tall herb, reed fringe and open water habitats within this designated site to be affected by the Proposed Development. The same is true for opposite-leaved pondweed, otter and smooth newt. There is also an ecological connection via mobile otter.

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.

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 and smooth newt. Sedimentation could also reduce suitability for opposite-leaved pondweed, which requires clear, base-rich waters.

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).

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.

Thus, in the absence of mitigation, construction works could result in *significant, negative* indirect sediment/pollution-mediated effects on riparian habitats and species within the Grand Canal pNHA *at the national scale*.

It is unlikely any of the invasive species recorded during surveys could be spread to the Grand Canal pNHA. Invasive Canadian pondweed was only recorded at sites A15 and C7, which are downstream of the Proposed Development and located away from any proposed construction works.

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

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 IEF habitats, see **Table 15-13**.

Most of the terrestrial habitats projected to be lost either temporarily or permanently are of lower value (i.e. not IEFs) and are common in the wider landscape. There are no rare or threatened plant species within the study area.

In the absence of mitigation, enhancement or compensation, the loss of mixed broadleaved woodland WD1, treelines WL1, hedgerows WL2 and scrub WS1 habitats will have a *significant negative effect* at the *local scale*.

There will be no loss of immature woodland WS2.

The loss of lower-value commercial conifer plantation WD4 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 habitats and creation of open habitats is likely to have a *significant, positive permanent effect* at the local scale.

No riparian (FW1 or FW2) or riparian woodland (WN5) habitats will be lost. Likely effects on ecology relating to water quality within watercourses are detailed below (section Fisheries and Aquatic Ecology).

Some drainage ditches FW4 will be lost as forestry tracks are widened but will be replaced following construction. The loss of drainage diches will have a *temporary, significant negative effect* at the *local scale*.

The overwhelming majority of habitats within the Site 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 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*. There will be no loss of riparian habitats and so there will be no effect on riparian habitats acting as ecological corridors.

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 IEF 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.

Table 15-13 Habitat Loss of IEF Habitats

Habitat type	Total area / length within development boundary (ha / m)	Total area / length lost due to development[18] (ha / m)
FW1 eroding/upland rivers	- / 2,780	- / -
FW2 depositing/lowland rivers	- / 458	- / -
FW4 drainage ditches	- / 11,108	- / 3,922
WD1 mixed broadleaved woodland	18.99 / -	1.24 / -
WL1 hedgerows	6.96 / 28,916	- / 938
WL2 treelines	- / 10,579	- / 141
WN5 riparian woodland	2.14 / -	- / -
WS1 scrub	16.88 / -	1.29 / -
WS2 immature woodland	2.12 / -	0.05 / -

Indirect effects

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'. It is unlikely that any of the terrestrial habitats within the study area are sensitive to this impact, so no *significant effects* are likely.

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 *local scale* on hedgerow WL1 and treeline WL2 habitats.

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 at the proposed borrow pit, near an abandoned house along the north-eastern part of the amenity trail and along one section of Option 1 Cable Route at Headens along the R430 road. 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. Thus, this species could easily be spread elsewhere in the Site and could have *significant negative effects* on drainage ditch FW4, terrestrial mixed broadleaved woodland WD1, hedgerow WL1, treeline WL2, riparian woodland WN5 and scrub WS1 habitats *at the local scale*. It can also erode riverbanks after winter dieback and can reduce animal species

[18] Based on the Vestas 162 candidate turbine model.

richness. Thus, it could also have *significant negative effects* on riparian eroding/upland FW1 and depositing/lowland rivers FW2 *at the regional/county scale*.

Canadian pondweed was recorded at survey sites A15 and C7, which are located at considerable distance from any construction works. Thus, the risk of spreading this species is unlikely.

Other invasive or non-native species such as cherry laurel, fuchsia, snowberry, Japanese rose, Himalayan honeysuckle and red flowering current are also at risk of being spread by construction activity. While these are not subject to the same legal restrictions as Japanese knotweed and Canadian pondweed, it is good practice to avoid their spread.

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, O'Flynn, & Maguire, 2013; O'Flynn, Kelly, & Lysaght, 2014). Some cherry laurel was recorded adjacent to conifer plantation habitats and rarely along the north-eastern amenity trail and at TDR nodes (see Technical Appendix 15.9 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.

Japanese rose is classed as having a medium risk of impact (Kelly, O'Flynn, & Maguire, 2013). This species was found within hedgerows near houses within the Site and rarely at TDR nodes. Japanese rose mainly affects coastal habitats where it outcompetes native flora, but it can also invade hedgerows. This species mainly spreads via escape from gardens. Without mitigation this species could be spread via the movement of soil infected with seeds and viable roots.

Himalayan honeysuckle is classed as having medium risk of impact (Kelly, O'Flynn, & Maguire, 2013). This species was found within a hedgerow along Option 1 Cable Route and near the north-eastern part of the amenity trail. It mainly spreads by dispersal of fruits by birds. This species forms dense thickets that outcompete native vegetation and is found mainly in hedgerows and waste ground, occasionally in woodland. Without mitigation this species could be spread via the movement of soil infected with seeds and viable roots.

Snowberry is classed as having a low risk of impact (Kelly, O'Flynn, & Maguire, 2013) and is mainly found within hedgerows. This species was found along hedgerows within the Site, along both Cable Route Options and occasionally at TDR nodes. Snowberry can form dense thickets, outcompeting native plants. It spread predominantly through vegetative growth in its roots.

Fuchsia is classed as a non-native and has not been assessed in terms of invasiveness impact risk. This species was found in the quarry proposed to be used as a borrow pit and next to a road to be used as an access track in the southern cluster. It is mainly found within hedgerows but also readily colonises disturbed ground. It is often spread via dumping of garden waste. Without mitigation this species could be spread via the movement of soil infected with viable roots.

Red flowering currant is classed as a non-native and has not been assessed in terms of invasiveness impact risk. This species was found in a hedgerow along Option 1 Cable Route near a garden. It tends to spread via escape from gardens. Without mitigation this species could be spread via the movement of soil infected with viable roots.

Accidentally spreading (i.e. in the absence of mitigation) cherry laurel, Japanese rose, Himalayan honeysuckle, snowberry, fuchsia and red flowering currant could have *significant negative effects* at the *local scale* for drainage ditches FW4, mixed broadleaved

woodland WD1, hedgerows WL1, treelines WL2, riparian woodland WN5, scrub WS1 and immature woodland WS2.

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

Birds

Direct effects

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

Nest damage or destruction

No nests for IEF bird species were recorded by surveys. It is possible that common snipe and Eurasian woodcock are breeding on or near the Site. Damage or destruction to active bird nests could contravene Section 22 of the Wildlife Acts 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.

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

Construction of the Site will lead to a total loss of 73.4 ha of habitats. Most of the habitats lost are commercial conifer plantation WD4 (46.1 ha) and improved agricultural grassland GA1 (9.8 ha) habitats, which were not brought forward as IEFs (i.e. they were of low value).

As the grid connection for both Cable Route Options will be almost entirely buried underground within or immediately adjacent to existing roads, only a small amount of arable crop BC1, improved agricultural grassland GA1, conifer plantation WD4 and hedgerow WL1 habitats will be lost as a result of the grid connection work. Habitat loss at the TDR nodes will be minor. Habitats are not predicted to be lost at the amenity trail, as only minor upgrades to existing tracks will occur.

Based on the results of the surveys between October 2017 and August 2022 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 Site or at least 500 m outside;
- Other wildfowl, wader and raptor species were generally recorded in low numbers, with abundant similar displacement habitat available in the wider area;
- No hen harrier or merlin were recorded roosting during surveys and most of the habitats within the study area are unsuitable as roosts for these species; and
- No evidence was recorded of breeding raptors, waders or wildfowl near proposed infrastructure.

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

- Common snipe were recorded drumming (breeding display flight) in an area located c. 400 m SW of turbine T6;

- Eurasian woodcock was recorded roding (breeding display flight) in the Northern Cluster c. 700 m southeast of turbine T1; and
- A female peregrine falcon was observed at a quarry c. 3.3 km from the Site.

The loss of habitats such as hedgerows WL1 and improved agricultural grasslands GA1 means that wintering IEFs redwing, meadow pipit, goldcrest, linnet and starling could be displaced. Any open grassland species, such as meadow pipit could be displaced if these habitats are lost due to in situ compensatory woodland planting.

However, *significant effects are unlikely* as there are ample alternative foraging/roosting habitats in the vicinity of the Site.

The loss of woodland habitats could displace the woodland bird assemblage; 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 likely to be *neutral* except for goldcrest, a conifer woodland specialist. However, the effects of habitat loss on goldcrest are unlikely to be significant due to widespread displacement habitats within and around the Site.

The timing of vegetation removal in the works corridor could displace meadow pipit and grey wagtail if breeding. No breeding habitats (e.g. streams and rivers) for grey wagtail will be lost, so *significant effects are unlikely*. The same is true for meadow pipit, as any potential breeding habitats due to be lost (e.g. scrub and pasture) are abundant and widespread within the wider area, allowing for ample displacement.

No significant effects during construction are predicted for IEFs European golden plover, hen harrier, merlin, common kestrel, northern lapwing, swift, black-headed gull, great cormorant, common gull, herring gull, lesser black-backed gull and mallard.

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

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

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.

Significant disturbance/displacement effects are unlikely to occur along either Cable Route Option, with underground cables proposed to be buried within or adjacent to existing roads or heavily modified cultivated habitats (e.g. cultivated lands, conifer plantation or agricultural grasslands). 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 Route Options do not pass through any sites designated for their ornithological interest.

Potential effects due to the Site itself are likely to be greatest during the breeding season (predominantly between March and August, depending on the species under consideration). However, *significant effects are unlikely*. This is because sensitive IEF bird

species were not recorded breeding (or probably breeding) within the relevant ZoI, all were recorded in low numbers and all the habitats found within the Site occur frequently in the wider area.

To avoid disturbing common snipe, a buffer of 400 m is required in the breeding season (Pearce-Higgins, Stephen, Langston, Bainbridge, & Bullman, 2009). No published buffer exists for Eurasian woodcock, but a 700 m separation distance is likely sufficient as the maximum buffer required for other wader species is 500 m (Goodship & Furness, 2022). To avoid disturbing breeding peregrine falcon, a buffer of up to 750 m is required (Goodship & Furness, 2022). Thus, disturbance/displacement of breeding common snipe, Eurasian woodcock and peregrine falcon 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. Many of the other breeding IEF bird species are not sensitive to construction related disturbance (swift, mallard, grey wagtail, common starling, and goldcrest) or breed in open habitats away from where most construction activity will occur (linnet and meadow pipit).

Disturbance to foraging and roosting wintering birds is considered even less likely due to the low numbers of birds recorded within and surrounding the Site and habitats regularly used by these birds are widely available in the surrounding landscape (see habitat loss, Section 15.4.2) and so no significant effects are likely. Many of these species are in any event not vulnerable to construction related disturbance (black-headed gull, great cormorant, common gull, herring gull, and lesser black-backed gull, redwing, common starling, and goldcrest) or occur in open habitats away from where most construction activity will occur (linnet and meadow pipit).

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.

Based on the above, unmitigated disturbance/displacement effects during construction are *unlikely to be significant* for all IEF bird species (European golden plover, hen harrier, merlin, peregrine falcon, common kestrel, northern lapwing, common snipe, Eurasian woodcock, swift, black-headed gull, great cormorant, common gull, herring gull, lesser black-backed gull, mallard, grey wagtail, meadow pipit, linnet, redwing, common starling and goldcrest).

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 have therefore been proposed to mitigate for potential construction disturbance effects (see Section 15.6.1).

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

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.

As concluded by Chapter 9, 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.

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

Terrestrial Mammals (Excluding Bats)

Direct effects

Direct effects on mammals during construction 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).

No mammal dwellings were recorded within 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 badgers setts. Therefore, there are *no likely direct effects* for badger, red squirrel or pine marten.

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*.

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).

Fallow deer do not inhabit single dwellings. Fawns are born in long grass or bracken where they remain hidden for the first week or two of their lives until strong enough to run with the herd. The mothers leave the fawns on their own, returning to feed them several times a day (VWT, 2023). It is unlikely that any mothers and fawns will be disturbed/killed by construction activities, as limited suitable breeding habitats occur within the works footprint, therefore there are no likely significant effects on fallow deer.

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

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

Tree removal may reduce habitat availability for arboreal pine marten and red squirrels but could offer new foraging opportunities for badger, Irish hare, hedgehog and fallow deer. It is unlikely that the loss of conifer plantation will result in significant effects on pine marten

and red squirrel. Pine marten hunt over a large area and there are abundant displacement habitats available both within and outside the study area. There are also abundant woodland habitats for red squirrel as well. The removal of any other habitats used by badger, hedgehog, Irish hare and fallow deer 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.

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

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 and fallow deer are unlikely to suffer any significant effects due to disturbance from construction activities.

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, Irish hare and fallow deer, *no significant effects* are likely.

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).

Bats

Direct effects

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

No confirmed bat roosts were recorded within the Site within the works footprint. There was an abandoned farm shed located at the entrance of the quarry to be used as the borrow pit. However, an emergence survey confirmed that this structure was not used a bat roost. So, no *direct effects* on potential bat roosts are *likely*.

Along Cable Route Options, cables will be laid within existing road network, with only a few areas towards the end of each route requiring excavation outside of this. Where cables will go over bridges, there is the potential for bats to be disturbed at aquatic surveys sites B7, B8 and B9 for Option 1 Cable Route, and A12 for option 2. However, as no interference with watercourse crossings is proposed (i.e. only trench excavation and fill works), no *direct effects* on potential bat roosts are *likely*. No other potential bat roosts are located within the works footprint along either Cable Route Option.

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 were 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*.

Any differences between the range of turbine permutations assessed will result in negligible changes to the direct effects predicted for IEF bats.

Indirect effects

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, no night-time working is proposed as part of embedded mitigation measures, so no disturbance is *likely* (see Section 15.6.1). Further, the species utilising the Site 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.

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 Site.

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

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

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

Breeding smooth newt habitats will not be destroyed as they were recorded in pools c. 200 m from the works footprint. It is unlikely there will be significant mortality effects for adult smooth newt.

Spawning common frog could be affected where breeding on forestry tracks. 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.

There are no other rare or protected species recorded by field surveys within vicinity of the works footprint. While Gooden's nomad bee could be present, none were recorded by surveys. Therefore, it is *unlikely* that any *significant negative effects* will occur for this species.

Any differences between the range of turbine permutations assessed will result in negligible changes to the direct effects predicted for IEF 'other protected fauna'.

Indirect effects

Indirect effects on amphibians and Gooden's nomad bee could include loss of foraging habitats. For amphibians, habitats that could be used for foraging include drainage ditches FW4 and wetter parts of improved agricultural grassland (GA1). All these habitats are widely available in the study area and wider landscape. While Gooden's nomad bee could be present, this species occupies a wide variety of habitats with abundant displacement habitats available. Therefore, it is *unlikely* that any *significant negative effects* will occur for common frog, smooth newt or Gooden's nomad bee.

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

Fisheries and Aquatic Ecology

Direct effects

Direct impacts 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 Site and the loss of freshwater habitats due to removal or blockage of watercourses.

There are no IEF aquatic features located within the Proposed Development Site boundary and so direct effects on Annex 1 floating river vegetation habitat, Atlantic salmon, brook and river lamprey, European eel and white-clawed crayfish are *unlikely*.

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.

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

Indirect impacts 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 Annex 1 floating river vegetation habitat, Atlantic salmon, Lampreys and white-clawed crayfish via hydrological connections. This could reduce the water quality, which could have negative effects on aquatic receptors.

Annex 1 floating river vegetation habitat can be adversely affected by accidental nutrient enrichment and siltation, both of which could occur during construction.

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 as a result 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),

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.

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 need to be considered when designing mitigation for the Proposed Development.

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.

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

Unmitigated secondary effects are therefore likely to be *significant* at the *county / regional* scale for Annex 1 floating river vegetation habitat, river and brook lamprey, white-clawed crayfish, European eel, and otter. The same is true for Atlantic salmon at the *local scale*.

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.

15.4.3 Potential Operational Phase Impacts

Direct effects are likely to occur due to the operation of the turbines, hardstands, access tracks and 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.

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

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

Potential effects resulting from the operational phase are as follows.

Direct effects:

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

Indirect effects:

- Collection/drainage of surface water runoff;
- 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 substation lighting.

Designated Sites

SACs and SPAs are considered fully in the accompanying Natura Impact Statement (NIS) (see Technical Appendix 15.10 found in Volume III of this EIAR). 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.

Nationally designated sites (not included within an SAC and SAC) that are within the ZoI with connectivity are Clopook Wood pNHA and Grand Canal pNHA.

Direct effects

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

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

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

Indirect effects

No significant effects on badgers are predicted (see section on Mammals below) and so therefore there can be no effects on Clopook Wood pNHA.

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.

Accidental hydrocarbon release is also possible via accidental spillage from service vehicles entering the Proposed Development Site. No toxic materials such as cement or concrete will enter any watercourses.

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 aquatic receptors from Grand Canal pNHA as described in Section 15.4.2. While it is likely that considerable dilution will occur before any pollutants reach the Grand Canal pNHA, it is precautionary to assume that unmitigated downstream effects could be *significant* at the *national scale* for tall herb, reed fringe and open water habitats, plus otter, smooth newt and opposite-leaved pondweed species.

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

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

There are no groundwater-dependent habitats within the Site. Therefore, it is *unlikely* there will be any *significant indirect effects* on any terrestrial habitats during the operational phase.

Any differences between the range of turbine permutations assessed will result in negligible changes to the indirect effect assessment for IEF habitats.

Birds

Direct effects

Potential direct effects include:

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

There is no statistical model available for the assessment of collision mortality of birds with guyed meteorological (met) masts. However, as there is only a single met mast within the Proposed Development and low avian flight activity levels, the turbines themselves are likely to represent the key source of collision mortality for birds. No operational effects are likely for the Cable Route Options, which will be buried underground and located almost entirely within or adjacent to the existing road network. The remaining Proposed Development elements are considered in further detail below.

Disturbance / displacement and barrier effects

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

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

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.

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

As such, the assessment concentrates on common snipe and Eurasian woodcock, which may breed within the Site based on the limited observations recorded, and peregrine falcon which is probably breeding at a quarry located c. 3.3 km from the Site. Whilst other IEF bird species may suffer some disturbance 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 Site and the lack of breeding and/or communal roosting within or nearby the Site (see Section 15.4.2).

Other species (such as European golden plover, hen harrier, merlin, common kestrel, northern lapwing, swift, black-headed gull, great cormorant, common gull, herring gull, lesser black-backed gull, mallard, grey wagtail, meadow pipit, linnet, redwing, starling and goldcrest, as well as the woodland bird assemblage in general) are therefore not considered in further detail here.

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, Eurasian woodcock and peregrine falcon

There will be *negligible* and *not significant* disturbance/displacement and barrier effects for foraging common snipe, Eurasian woodcock and peregrine falcon. This is due to the wide availability of displacement habitats in the wider landscape. It is unlikely that any of these species are present in numbers at carrying capacity (suitable grasslands for snipe that could be lost due to the Proposed Development only consist of 0.48 ha and this habitat type is very common in the wider landscape; similarly suitable conifer plantation for woodcock that could be lost due to the Proposed Development consist of 33.7 ha and this habitat type is very common in the wider landscape; and none of the habitats within the Proposed Development Site are particularly important for generalist peregrine falcon). Of greater importance are the potential impacts on nesting common snipe, Eurasian woodcock and peregrine falcon.

While no confirmed nests were recorded during surveys, display behaviour suggests potential breeding for common snipe c. 400m from the nearest turbine and Eurasian woodcock c. 700 m from the nearest turbine (both based on data collected in 2022). The presence of a female peregrine in suitable nesting habitat indicated probable breeding at a quarry c. 3.3 km from the nearest turbine.

As mentioned before, there is an advised upper limit of 400 m for disturbance to nesting common snipe (Pearce-Higgins, Stephen, Langston, Bainbridge, & Bullman, 2009). No buffer exists for Eurasian woodcock, but a 700 m separation distance is likely sufficient, as the maximum buffer required for other wader species is 500 m (Goodship & Furness, 2022). To avoid disturbing breeding peregrine falcon, a buffer of up to 750 m is required (Goodship & Furness, 2022). Thus, disturbance/displacement of breeding common snipe, Eurasian woodcock and peregrine falcon is unlikely to occur as breeding activity was located beyond the ZoI for disturbance from operational activities.

While the common snipe and Eurasian woodcock using the current breeding areas are unlikely to be significantly affected by the Proposed Development, it could constrain them from using other areas within the Site in the future. However, it is considered that this is *unlikely* to have a *significant effect* on common snipe and Eurasian woodcock, as there are still ample amounts of suitable nesting habitat both inside and outside the Site that will be sufficiently removed from turbines (see amounts of habitat due to be lost that could be used by these species in relation to alternative habitats above). Peregrine is unlikely to move into the Site in the future, as no suitable quarries exist. The quarry to be used for the borrow pit lacks suitable ledges in which the birds could use as nests.

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 and Eurasian woodcock at the Site are infrequent. Consequently, these species do not seem to be making regular flights across the Site, suggesting that it is unlikely that barrier effects will occur. If these species start breeding elsewhere within the Site, then barrier effects could occur, although they are *likely* to be only *negligible* and *at the local scale*, as there is plenty of suitable breeding and foraging habitat within and outside of the Site.

Hötker *et al.* (2006) found that 25 out of 35 wind farm studies had evidence for a barrier effect on raptor movements, which was statistically significant. While peregrine clearly do fly through the Site, there is nothing in the data to suggest that the habitats are optimal for

foraging, breeding or roosting. There is plenty of suitable breeding and foraging habitat within and outside of the Site. Therefore, any barrier effects for peregrine are likely to be *negligible* and *at the local scale*.

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 Site, it is *likely* that any disturbance/displacement or barrier effects on common snipe, Eurasian woodcock and peregrine falcon during the operation of the Proposed Development *will not be significant*.

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, Eurasian woodcock and peregrine falcon.

Collision with wind turbines

Collision of a bird with turbine rotors is almost certain to result in the death of the bird. In low density populations (e.g. raptors) this could have a greater negative effect on the local population than in higher density populations (e.g. passerines) because a higher proportion of the local population would be affected in a low density population (Beston, Diffendorfer, Loss, & Johnson, 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.

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).

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

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.

Passerines nesting within a wind farm site would be expected to be regularly flying between wind turbines and could therefore be expected to be most at risk of collision. However, passerines tend to fly below Potential Collision Height (PCH) and evidence suggests that passerines collide with wind turbines relatively infrequently. Moreover, most of the species concerned are of low or negligible conservation value or have relatively large populations and high reproductive rates. Collision is therefore mainly considered in relation

to species of high sensitivity, e.g. target raptor species and species not particularly manoeuvrable in flight, such as geese and swans.

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

- European golden plover;
- Common kestrel;
- Peregrine falcon;
- Northern lapwing; and
- Common snipe.

For all other species (hen harrier and Eurasian woodcock), 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*.

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

The results of the CRM are described below for each of the species modelled, along with an assessment of whether predicted collision rates are likely to be significant. Further information about predicted collision rates is provided in the avian CRM report (Technical Appendix 15.8 found in Volume III of this EIAR).

Rationale for prediction of effect

Without application of methods such as Population Viability Analysis (PVA) it is not known to what extent the populations of target species can sustain additional levels of mortality. It has been assumed, (as recommended by (Percival, 2003)), that any impact not increasing adult mortality by more than 1% of the existing background mortality rate is insignificant. It should be noted that this method is highly precautionary when applied to non-breeding populations, as it uses the highest survival rates (i.e., for adult birds) for context. Where survival rates are high, a smaller number of collisions with turbines are needed for the excess mortality to be >1% of the background levels, i.e., the threshold for a potentially significant effect. Using adult survival rates (which are higher than juvenile survival rates), makes it more likely to identify a potentially significant effect of turbine collisions on the avian population under consideration. Similarly, all flight lines within 500 m of the turbines are considered for modelling, which is likely to produce an overestimate of the true collision risk. Avoidance rates used are highly precautionary and the default 98% avoidance rate used (see Technical Appendix 15.8) is not based on empirical evidence. Again, this is likely to produce an overestimate of true collision risk.

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, common kestrel, peregrine falcon, northern lapwing and common snipe. This is because the differences in potential collision heights are very small.

However, the very minor differences are presented in Technical Appendix 15.8 for full transparency, with the worst-case results presented here (i.e. the highest predicted collision estimates).

European golden plover

Forty-five European golden plover collisions have been reported at European wind farms between 2002-2022, none of which were in the GB or Ireland (Dürr, 2022). Although there may be other, unpublished reports of collisions of this species, European golden plover collisions nevertheless appear to be a relatively uncommon event.

The European golden plover flight activity survey data for the Proposed Development are shown on drawings within the baseline survey reports (Technical Appendix 15.2 found in Volume III of this EIAR). Flight activity was low, with 29 flight lines recorded across the two years of surveys and were generally not associated with the proposed turbine locations, although some of these flight lines were within the 500 m buffer for the turbines.

Collision risk analysis has been carried out on flight activity data from the 2017/18 and 2021/22 non-breeding seasons. Based on these data, five European golden plover flight lines (involving 38 flights) were recorded at PCH within the CRZ during surveys.

Assuming an avoidance rate of between 98% - 99.8%, there was a mean annual collision rate of 0.3111 to 0.0311 collisions (approximately one collision every 3.21 to 32.1 years) predicted. As outlined in Technical Appendix 15.8, a 99.8% avoidance rate has also been applied, which reflects the empirical evidence from four UK wind farms. This evidence shows the default 98% avoidance rate is likely to be too low for European golden plover.

This has been assessed in the context of the ROI and county/regional population (there are no designated sites within the ZoI for European golden plover). For information on the populations see **Table 15-12**. For designated sites, a precautionary assumption has been made that all birds flying through the Site are from the relevant designated site population.

The predicted annual mortality has been put in the context of background annual mortality (27%, (BTO, Bird Facts, 2023)), with an increase in 1% on background mortality generally accepted to represent a significant decline in populations at the relevant spatial scale or designated site (Percival, 2003). This has been undertaken for wintering populations, as no European golden plover were recorded in the breeding season surveys.

It is likely that, if realised, the predicted collision rate of 0.331 birds per year would result in the following:

- ROI population: 0.002% to 0.0002% increase on background mortality for wintering population (not likely to be significant); and
- County/regional population: 0.08% to 0.008% increase on background mortality for wintering population (not likely to be significant).

Therefore, collision is *unlikely* to have a *significant effect* on this species.

Common kestrel

Six hundred and seventy-three common kestrel collisions have been reported at European wind farms between 2002-2022 (Dürr, 2022), 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.

Collision risk analysis has been carried out on flight activity data using data from the 2017/18 non-breeding, 2021 breeding, 2021/22 non-breeding and 2022 breeding seasons. Based on these data, 96 kestrel flight lines (involving 100 flights) were recorded at PCH within the CRZ during surveys.

Assuming a 95% avoidance rate, there was a mean annual collision rate of 0.9546 (approximately one collision every 1.05 years) predicted. This has been assessed in the context of the ROI and county/regional population (there are no designated sites within the ZoI for common kestrel). For information on the populations see **Table 15-12**. For designated sites, a precautionary assumption has been made that all birds flying through the Site are from the relevant designated site population.

The predicted annual mortality has been put in the context of background annual mortality for adults (31% for adults, (BTO, Bird Facts, 2023)), with an increase in 1% on background mortality generally accepted to represent a significant decline in populations at the relevant spatial scale or designated site (Percival, 2003).

It is likely that, if realised, the predicted collision rate of 0.9546 birds per year would result in the following:

- ROI population: 0.02% increase on background mortality for breeding/wintering population (not likely to be significant); and
- County/regional population: 1.1% increase on background mortality for breeding/wintering population (likely to be significant).

Therefore, taken at face value, collision is likely to have a significant effect at the county/regional scale for the breeding and wintering populations. This is likely to represent an overestimate of true collision risk, as the collision risk modelling is based on several precautionary assumptions and the percentage increase on background mortality is only just above the 1% threshold. When juvenile instead of adult survival rates are used, there is a 0.52% increase on background mortality for the breeding/wintering population. The true predicted collision rate is therefore likely to have between an 0.52% and 1.1% on background mortality, depending on the ratio of juveniles to adults in the population.

The realised effect of collision is *unlikely to be significant*.

Peregrine falcon

Forty-one peregrine collisions have been reported at European wind farms, one of which was in GB (in Scotland) (Dürr, 2022). 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.

Collision risk analysis has been carried out on flight activity data using data from the 2017/18 and 2021/22 non-breeding, and 2021 and 2022 breeding seasons. Based on these data, 11 peregrine flight lines (involving 11 flights) were recorded at PCH within the CRZ during surveys.

Assuming a 98% avoidance rate, there was a mean annual collision rate of 0.0727 (approximately one collision every 13.76 years) predicted. This has been assessed in the context of the ROI and county/regional population (there are no designated sites within the ZoI for peregrine falcon). For information on the populations see **Table 15-12**. For designated sites, a precautionary assumption has been made that all birds flying through the Site are from the relevant designated site population.

The predicted annual mortality has been put in the context of background annual mortality for adults (19%, (BTO, Bird Facts, 2023)), with an increase in 1% on background mortality generally accepted to represent a significant decline in populations at the relevant spatial scale or designated site (Percival, 2003).

It is likely that, if realised, the predicted collision rate of 0.0727 birds per year would result in the following:

- ROI population: 0.04% increase on background mortality for breeding/wintering population (not likely to be significant); and
- County/regional population: 1.9% increase on background mortality for breeding/wintering population (likely to be significant).

Therefore, collision is likely to have a *significant effect* at the *county/regional scale* for the breeding and wintering populations. This is likely to represent an overestimate of true collision risk, as the collision risk modelling is based on several precautionary assumptions. The realised effect of collision is likely to be much lower than predicted and the percentage increase on background mortality is only just above the 1% threshold. When juvenile instead of adult survival rates are used, there is a 0.88% increase on background mortality for the breeding/wintering population. The true predicted collision rate is therefore likely to have between an 0.88% and 1.9% on background mortality, depending on the ratio of juveniles to adults in the population.

Similarly, as mentioned above, NPWS has no records of this species being killed by wind turbine strike in Ireland between 2007 and 2019.

The realised effect of collision is likely to be much lower than predicted and is *unlikely to be significant*.

Northern lapwing

Twenty-eight northern lapwing collisions have been reported at European wind farms between 2002-2022, none of which were in GB or Ireland (Dürr, 2022). Although there may be other, unpublished reports of collisions of this species, northern lapwing collisions nevertheless appear to be an uncommon event.

Collision risk analysis has been carried out on flight activity data using data from the 2017/18 and 2021/22 non-breeding seasons. Based on these data, two northern lapwing flight lines (involving 11 flights) were recorded at PCH within the CRZ during surveys.

Assuming a 98% avoidance rate, there was a mean annual collision rate of 0.1237 (approximately one collision every 8.08 years) predicted. This has been assessed in the context of the ROI and county/regional population (there are no designated sites within the ZoI for northern lapwing). For information on the populations see **Table 15-12**. For designated sites, a precautionary assumption has been made that all birds flying through the Site are from the relevant designated site population.

The predicted annual mortality has been put in the context of background annual mortality (29.5%, (BTO, Bird Facts, 2023)), with an increase in 1% on background mortality generally accepted to represent a significant decline in populations at the relevant spatial scale or designated site (Percival, 2003).

It is likely that, if realised, the predicted collision rate of 0.1237 birds per year would result in the following:

- ROI population: 0.001% increase on background mortality for wintering population (not likely to be significant) and 0.01% increase for breeding population (not likely to be significant); and
- County/regional population: 0.05% increase on background mortality for wintering population (not likely to be significant) and 0.52% increase for breeding population (not likely to be significant).

Therefore, collision is *unlikely* to have a *significant effect* for the breeding and winter populations.

Common snipe

Nineteen common snipe collisions have been reported at European wind farms between 2002-2022, with one in GB (Wales) and none in Ireland (Dürr, 2022).

Collision risk analysis has been carried out on flight activity data using data from the 2017/18 2021/22 non-breeding seasons, and 2021 and 2022 breeding seasons. Based on these data, ten snipe flight line (involving 12 flights) were recorded at PCH within the CRZ during surveys.

Assuming a 98% avoidance rate, there was a mean annual collision rate of 0.43 (approximately one collision every 2.3 years) predicted. This has been assessed in the context of the ROI and county/regional population (there are no designated sites within the ZoI for common snipe). For information on the populations see **Table 15-12**. For designated sites, a precautionary assumption has been made that all birds flying through the Site are from the relevant designated site population.

The predicted annual mortality has been put in the context of background annual mortality for adults (52% for adults, (BTO, Bird Facts, 2023)), with an increase in 1% on background mortality generally accepted to represent a significant decline in populations at the relevant spatial scale or designated site (Percival, 2003).

It is likely that, if realised, the predicted collision rate of 0.43 birds per year would result in the following:

- County/regional population: 0.49% increase on background mortality for breeding and non-breeding population (not likely to be significant at this scale).

Therefore, the effect of collision is *unlikely to be significant*.

Indirect effects

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.

As concluded by Chapter 9, 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.

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

Terrestrial Mammals (Excluding Bats)

Direct effects

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 Section 15.3.3, 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 or fallow deer, which prefer grassland or bracken habitats.

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

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

Any differences between the range of turbine permutations assessed will result in negligible changes to the direct effects predicted for IEF mammals.

Indirect effects

Generally, mammals including badgers are thought to be tolerant of operational wind farms, with little disturbance/displacement from the turbines themselves or personnel.

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 abundance of suitable displacement habitats in the wider area, this is unlikely to occur.

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, Irish hare and fallow deer, *no significant effects* are *likely*.

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

Bats

Direct effects

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).

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 directs 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 15-7**. Felling will take place in the construction phase (see Section 15.4.2 for effects on bats), with smaller scale vegetation removal required throughout the operational phase (see Section below for indirect effects on bats).

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.

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

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

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 these features. In Europe, 2,569 and 455 fatalities were recorded for common pipistrelle and soprano pipistrelle, respectively (Dürr, 2022). Mathews *et al*. (2016) found that both pipistrelle species were most recorded as fatalities at operational wind farms in the UK.

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).

Overall, common pipistrelle and soprano pipistrelle populations are classified as having 'medium vulnerability' to wind farm developments. Combined with a site risk level of 'medium', this gave an overall risk assessment of 'medium' for common pipistrelle and soprano pipistrelle.

Some of the infrastructure proposed for the Proposed Development is close to features used for foraging and commuting, especially in the northern cluster near the temporary construction compound and substation.

Across all turbines, the seasons with the highest common and soprano pipistrelle activity levels were spring and summer. Turbines T1, T4, T5, T10, T11 and T13 had the highest common pipistrelle activity but turbines T3, T7, T8, T9 and T12 had lower common pipistrelle activity. Turbines T4, T5, T7 and T10 had highest soprano pipistrelle activity but turbines T3, T8, T9, T12 and T13 had lower soprano pipistrelle activity.

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

Nathusius' pipistrelle

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 migration. In Europe, 1,662 fatalities were recorded (Dürr, 2022). Rydell *et al*. (2010) found that the species made up 13% of fatalities at operational wind farms in the UK.

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).

Overall, Nathusius' pipistrelle populations are classified as having 'high vulnerability' to wind farm developments. Combined with a site risk level of 'medium', this gave an overall risk assessment of 'medium' for Nathusius' pipistrelle.

Some of the infrastructure proposed for the Proposed Development is close to features occasionally used for foraging and commuting, especially in the northern cluster near the temporary construction compound and substation.

Across all turbines, the season with the highest Nathusius' pipistrelle activity levels was spring. Turbines T1 and T4 had the highest activity and all other turbines had lower activity.

Without mitigation, operational phase impacts are *likely* to have *significant effects* on Nathusius' pipistrelle populations *at the local level*.

Leisler's bat

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, 753 fatalities were recorded (Dürr, 2022). 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.

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).

Overall, Leisler's bat populations are classified as having 'high vulnerability' to wind farm developments. Combined with a site risk level of 'medium', this gave an overall risk assessment of 'medium' for Leisler's bat.

Proposed Development infrastructure is generally not close to any features used by foraging or commuting Leisler's bats.

Across all turbines, the seasons with the highest Leisler's bat activity levels were spring and summer. Turbines T4 and T5 had the highest activity and all other turbines had lower activity.

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

Populations of bats within the *Myotis* genus are thought to be at low risk of direct effects from operational turbines (NatureScot, 2021). In Europe, 11, four and six fatalities were recorded for Daubenton's bat, Natterer's bat and whiskered bat, respectively (Dürr, 2022). Mathews *et al*. (2016) found *Myotis* species were among the least recorded bat fatalities at operational wind farms in the UK. Most *Myotis* bat species fly at heights of 20-30 m, prefer cluttered habitats and high levels of manoeuvrability (Mathews, Richardson, Lintott, & Hosken, 2016; Rydell, et al., 2010).

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

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, eight fatalities were recorded (Dürr, 2022). Mathews *et al*. (2016) found brown long-eared bats were among the least recorded bat fatalities at operational wind farms in the UK.

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

Indirect effects due to operational lighting could disturb or displace roosting or foraging bats. However, the installation of additional lighting on the turbines themselves is to be minimal. There may be additional lighting at the substation, which could displace light-sensitive bat species.

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 Site (Nathusius' pipistrelle, Natterer's bat, Daubenton's bat, whiskered bat and brown long-eared bat). These three species were the most frequently recorded bats.

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

Any differences between the range of turbine permutations assessed will result in negligible changes to the indirect effect assessment for IEF bats.

Other Protected Fauna

No direct or indirect impacts on common frog, smooth newt and Gooden's nomad bee are predicted during the operational phase.

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

No IEF aquatic habitats or species are located within the red-line boundary, therefore it is *unlikely* there will be any significant direct effects during the operational phase.

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

Potential indirect effects include release of suspended solids or hydrocarbons into watercourses as described in Section 15.4.2, which could travel downstream to IEFs including Annex 1 floating river vegetation habitat, Atlantic salmon, brook and river lamprey, European eel, white-clawed crayfish and otter. The same secondary effects therefore apply as described for the construction phase.

In the absence of mitigation, there could be *significant* effects on Annex 1 floating river vegetation habitats, Atlantic salmon, brook and river lamprey, white-clawed crayfish and otter at the *international scale* and at the *national scale* for European eel.

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.

15.4.4 Potential Decommissioning Phase Impacts

Some effects are predicted to be similar to the effects described for the construction e.g. disturbance 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.

Other effects are also predicted to be similar to the construction phase (as similar activities will take place) but of slightly lower magnitude e.g. 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.

For brevity, a full list of effects is given in Section 15.4.2 for the construction phase and it can be assumed that the same effects will occur for the decommissioning phase.

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.

15.5 Cumulative Impact Assessment

A full list of wind farms and other projects within 20 km of the Proposed Development are shown in Technical Appendix 1.2 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 IWEA (2012) guidelines. A summary is provided in **Table 15-14** below.

Table 15-14 Other Developments within 20 km of the Proposed Development

Proposed Development Type	Name	Distance (km) / direction	Details	Hydro- or hydrogeological Connection
Wind Farm	Cullenagh Wind Farm	3.5 / W	Unconstructed; 18 consented turbines (2014)	Y - Both the Proposed Development and Cullenagh Wind Farm drain to watercourses upstream of the River Barrow and are partially located in the same bedrock aquifer.
	Pinewoods Wind Farm	5.2 / SW	Unconstructed; 11 consented turbines; grid connection, substation and ancillary works.	Y - Both the Proposed Development and Pinewoods Wind Farm drain to watercourses upstream of the River Nore and are located in the same bedrock aquifer.
	Gortahile Wind Farm	11 / SE	Constructed; 8 operational turbines (2014)	Hydrological only – Both the Proposed Development and Gortahile Wind Farm drain to watercourses upstream of the River Nore.
	Lisdowney Wind Farm (Kilkenny)	11 / SW	Modification for the redesign of a previously approved development of 4 no. turbines and associated infrastructure.	No hydro- or hydrogeological connection.
	Seskin Wind Farm	15 / SE	Unconstructed; 7 no. proposed turbines	No hydro- or hydrogeological connection.
	White Hills Wind Farm	16 / SE	Unconstructed; 7 no. proposed turbines, planning application submitted.	Hydrological only - Both the Proposed evelopment and White Hills Wind Farm drain to watercourses upstream of the Rive Nore.
	Farranrory Wind Farm and Grid Connection	17 / SW	Granted, 7 no. turbines and 33.8 km grid connection (2021)	No hydro- or hydrogeological connection.

Proposed Development Type	Name	Distance (km) / direction	Details	Hydro- or hydrogeological Connection
	Bilboa Wind Farm	17 / SW	Unconstructed; 5 no. partially consented turbines (2022); grid connection, substation and ancillary works.	Hydrological only – Both the Proposed Development and Bilboa Wind Farm drain to watercourses upstream of the Rive Nore.
Other	Michael Johnson	4 / E	Granted; restoration of existing quarry to agricultural grassland	No hydro- or hydrogeological connection.
	Bord Na Móna Powergen Ltd	14 / NW	Third party appealed; development of renewable gas facility	Hydrological only - Both the Proposed Development and Bord Na Móna Powergen Ltd site drain to watercourses upstream of the River Barrow.
	Lagan Materials Ltd (Spink Quarry)	3 / SE	Conditional; continued use and operation of existing quarry	Hydrological only – Both the Proposed Development and Spink Quarry drain to watercourses upstream of the Rive Nore.

15.5.1 Potential Construction Phase Cumulative Impacts

Likely cumulative effects resulting from the construction phase are limited to water quality changes to watercourses draining the Proposed Development Site. 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 s*ignificant* for both downstream nature conservation sites (e.g. the River Barrow and River Nore SAC, River Nore SPA and Royal Canal pNHA) and aquatic receptors (e.g. Annex 1 floating river vegetation, Atlantic salmon, brook lamprey, river lamprey, European eel, white clawed-crayfish and otter).

There are several operational, consented and proposed and developments with hydro- or hydrogeological connections to the Proposed Development (see **Table 15-14**).

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

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 (e.g. White Hill wind farm).

In terms of water quality, six (sites A11 on the Stradbally River, B3 and B8 on the Owveg River, C3 on the Brennanshill River, C6 on the Clogh River and D1 on the Douglas River) achieved good status, five (sites A1, A6 and A15 on the Stradbally River and B10 the Owveg River and C2 on the Clogh River) achieved moderate status and the rest achieved poor status.

There is one Section 4 discharges to water linked to the watercourses that drain from the Proposed Development Site: Env 2 – WP27 Spink Quarry Ltd (downstream of Proposed Development and upstream of aquatic site C7).

There is one site with an Industrial Emissions (IE) licence linked to watercourses connected to the Proposed Development (upstream of aquatic site C7 adjacent to the Slatt_Lower tributary, which joins the Clogh 15 River): P0527 Flemings' Fireclays Manufacturing Ltd. No wastewater is discharged from this facility and only stormwater is discharged into the Slatt_Lower following treatment.

Overall, considering the existing effects of diffuse water pollution and in the absence of mitigation, secondary cumulative effects on freshwater ecology are likely to be *significant* at the *international level* for Annex 1 floating river vegetation, Atlantic salmon, brook lamprey, river lamprey, white-clawed crayfish and otter. The same is true for the Grand Canal pNHA and European eel but at the *national level*.

Natura 2000 sites are considered fully in the NIS (Technical Appendix 15.10 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 as a result 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.

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.

15.5.2 Potential Operational Phase Cumulative Impacts

Operational impacts will occur as a result of the turbines, hardstands, access track and substation. As the grid connection will be located underground, there will be no operational impacts due to underground cabling/ducting.

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 Site is within a landscape highly modified by agriculture and forestry, any effects due to habitat loss are *fully reversible*.

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 Barrow and River Nore SAC and River Nore SPA, plus Grand Canal pNHA;
- 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

There are several operational, consented and proposed and developments with hydro- or hydrogeological connections to the Proposed Development (see **Table 15-14**). Similarly, Laois and Kilkenny 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.

The main source 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 route 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.

Without mitigation, the Proposed Development alone could potentially have *significant negative effects* on downstream designated sites (River Barrow and Nore SAC, River Nore SPA, Grand Canal pNHA) and receptors including Annex 1 floating river vegetation habitats, Atlantic salmon, brook lamprey, river lamprey, European eel, white-clawed crayfish and otter (see Section 15.4.2). The same is true when considered in combination with other projects. There is potential for *significant negative effects* at the *regional/county scale* for Annex 1 floating river vegetation habitats, brook and river lamprey, white-clawed crayfish, European eel and otter. The same is true but for the *local scale* for Atlantic salmon. The same is true for Grand Canal pNHA but at the *national scale*.

Natura 2000 sites are considered fully in the NIS (Technical Appendix 15.10 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 as a result 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.

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

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.

There are eight no. wind farm developments located in proximity to the Proposed Development (see **Table 15-14**) however only some have details of collision risk assessments undertaken, as summarised below.

Cullenagh Wind Farm

According to the EIS written in 2013 by Roger Goodwillie, bird surveys carried out to inform the planning application recorded almost entirely passerine or corvid species, whose populations are not considered at risk from collision impacts.

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 Cullenagh impact assessment. A quantitative cumulative collision risk assessment is therefore not possible. Predicted risk of collision effects on birds was described as 'low risk'. Therefore, it is *unlikely* that any *significant cumulative effects* will occur in combination with the Proposed Development.

Pinewoods Wind Farm

According to the EIAR written in 2021 by SLR Consulting Ireland Ltd, bird surveys carried out to inform the planning application recorded the following target species: common kestrel, Eurasian sparrowhawk and Eurasian woodcock.

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 Pinewoods impact assessment. A quantitative cumulative collision risk assessment is therefore not possible. Negligible collision effects were predicted for common kestrel, Eurasian sparrowhawk and Eurasian woodcock. Therefore, it is *unlikely* that any *significant cumulative effects* will occur in combination with the Proposed Development.

Gortahile Wind Farm

According to the EIS written in 2004 by Ecopower Developments Ltd bird surveys carried out to inform the planning application recorded no species susceptible to impacts from wind farms in the locality.

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 Gortahile impact assessment. A quantitative cumulative collision risk assessment is therefore not possible. Predicted risk of collision effects was described as non-significant and no susceptible species were

mentioned. Therefore, it is *unlikely* that any *significant cumulative effects* will occur in combination with the Proposed Development.

Lisdowney Wind Farm (Kilkenny)

The EIS, produced in 2012 identified low risk of collision for peregrine, hen harrier, buzzard, kestrel and sparrowhawk; however, no collision risk modelling was undertaken and therefore these risks were not quantified. Lisdowney is small wind farm within only four turbines which supports the conclusions of the EIS. Therefore, it is *unlikely* that any *significant cumulative effects* will occur in combination with the Proposed Development.

Seskin Wind Farm

Bird surveys have been conducted for this proposed wind farm over two years however these have not been published, neither have collision risk assessments. As this application will follow that for Coolglass Wind Farm, there is insufficient information regarding likely significant effects. This project is located 15 km away, so it is *unlikely* that any *significant cumulative effects* will occur in combination with the Proposed Development.

White Hill Wind Farm

According to the EIAR written in 2022 by Ecology Ireland Wildlife Consultants bird surveys carried out to inform the planning application recorded the following target species: common kestrel, European golden plover, hen harrier and peregrine.

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 White Hill impact assessment. A quantitative cumulative collision risk assessment is therefore not possible. Predicted risk of collision effects was described as non-significant negative for European golden plover, slight neutral for hen harrier and peregrine falcon and moderate negative for common kestrel. Therefore, it is *unlikely* that any *significant cumulative effects* will occur in combination with the Proposed Development.

Farranrory Wind Farm and Grid Connection

According to the EIAR written in 2020 by Jennings O'Donovan and Partners Ltd, bird surveys carried out to inform the planning application recorded the following target species: common buzzard and common kestrel. No collision risk modelling was undertaken and therefore these risks were not quantified. Based on the low level of flight activity recorded, any impacts were predicted to be of very low significance to these two species. Therefore, it is *unlikely* that any *significant cumulative effects* will occur in combination with the proposed development

Bilboa Wind Farm

According to the response to a Further Information Request written in 2021 by Fehily Timoney and Co. 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, grey heron, hen harrier, lesser black-backed gull and peregrine falcon.

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 0.04 long-term imperceptible effect;
- Common kestrel 0.04 long-term imperceptible effect;
- Common snipe 0.01 long-term imperceptible effect;
- Eurasian sparrowhawk 0.01 long-term imperceptible effect;
- European golden plover 0.46 long-term not significant effect;
- Grey heron 0.00 long-term imperceptible effect;
- Hen harrier 0.00 long-term imperceptible effect;
- Lesser black-backed gull 0.03 long-term imperceptible effect; and
- Peregrine falcon 0.00 long-term imperceptible effect.

Therefore, it is *unlikely* that any *significant cumulative effects* will occur in combination with the Proposed Development.

Cumulative collision risk

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 has been undertaken in below in **Table 15-15** for IEF birds present at the Proposed Development Site where collision risk modelling has been undertaken. It must be acknowledged that these 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 Technical Appendix 15.8) is not based on empirical evidence. Again, this is likely to produce an overestimate of true collision risk.

Note that collision estimates from two avoidance rates are presented for European golden plover in acknowledgment that the default 98% avoidance rate is much lower than empirical estimates.

Table 15-15 Cumulative collision risk

Species	Number of collisions / year								Significance
	Coolglass wind farm	Cullenagh wind farm	Pinewoods wind farm	Gortahile wind farm	Bilboa wind farm	White Hill wind farm	Farronrory wind farm	Cumulative	
Common kestrel	0.95	-	Negligible	-	0.04	Moderate negative	Very low negative	0.99	Not likely to be significant (0.54 - 1.2% increase in background mortality, depending on whether juvenile vs. adult survival rates are used) for breeding and wintering populations, as the modelling relies on a number of highly precautionary assumptions and the true estimate is likely to be a <1% increase in background mortality (see Section 15.4.3).
Common snipe	0.43	-	-	-	0.01	-	-	0.44	Not likely to be significant (0.5% increase in background mortality for regional / county scale) for wintering and breeding.
European golden plover	0.31 – 0.031	-	-	-	0.46 – 0.046	Non-significant, negative	-	0.77 to 0.077	Not likely to be significant at the national or regional / county scale for wintering populations. Not recorded in breeding season.
Northern lapwing	0.12	-	-	-	N/A	-	-	0.12	Not likely to be significant at the national or regional / county scale for wintering and breeding populations.
Peregrine falcon	0.07	-	-	-	0.00	Slight neutral	-	0.07	Not likely to be significant (0.88 - 1.9% increase in background mortality, depending on whether juvenile vs. adult survival rates are used) for breeding and wintering populations, as the modelling relies on a number of highly precautionary assumptions and true

Species		Number of collisions / year							Significance
	Coolglass wind farm	Cullenagh wind farm	Pinewoods wind farm	Gortahile wind farm	Bilboa wind farm	White Hill wind farm	Farronrory wind farm	Cumulative	
									estimate is likely and the true estimate is likely to be a <1% increase in background mortality (see Section 15.4.3).

For all other avian IEFs, it is *unlikely* there will be any *significant effects* due to the operation of the Proposed Development.

Cumulative effects on SPAs are fully considered within the NIS. The conclusion from the NIS was that, with mitigation, there would not be an adverse effect on the integrity of any Natura 2000 sites as a result 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.

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

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.

Potential cumulative operational effects needs 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.

There are eight no. wind farm developments located in proximity to the Proposed Development (see **Table 15-14**) with details of collision risk assessments undertaken for each wind farm summarised below.

Cullenagh Wind Farm

According to the EIS written in 2013 by Roger Goodwillie, common pipistrelle, soprano pipistrelle, Natterers' bat, Leisler's bat and whiskered bat were all recorded by surveys. Of these, common pipistrelle was most recorded. Soprano pipistrelle was widely encountered and Natterers' bat was recorded in small numbers. Leisler's bat and whiskered bat were largely absent from the wind farm site itself.

Pinewoods Wind Farm

According to the EIAR written in 2021 by SLR Consulting Ireland Ltd, only low numbers of bats were recorded on-site and it was *unlikely* any *significant effects* would occur to bat populations due to wind farm operation.

Gortahile Wind Farm

No mention of bats was made in the EIS written in 2004 by Ecopower Developments Ltd.

Lisdowney Wind Farm (Kilkenny)

The survey work for the EIS for Lisdowney did not include a bat survey and the EIS did not include full impact assessment for bats. However, he EIS did include desk study records for common bat species (common pipistrelle, soprano pipistrelle, Leisler's, Natterer's and Daubenton's bats). and concluded that they may be present locally and that impacts were uncertain.

Seskin Wind Farm

Bat surveys have been conducted for this proposed wind farm over one year however these have not been published, neither have collision risk assessments. As this application will follow that for the Proposed Development, it will need to consider the cumulative effects of the consented and proposed wind farms at that time.

White Hill Wind Farm

According to the EIAR written in 2022 by Ecology Ireland Wildlife, high collision-risk common and soprano pipistrelle plus Leisler's bat were recorded during surveys. The impact assessment predicted *significant, slight, long-term negative effects* that were *localised* to all four of these bat species due to operational impacts in the absence of mitigation.

Farranrory Wind Farm and Grid Connection

According to the EIAR written in 2020 by Jennings O'Donovan and Partners Ltd, the following bat species were recorded by surveys: Leisler's bat, common pipistrelle and soprano pipistrelle. The impact assessment predicted Leisler's bat and common pipistrelle were at *medium risk* from collision, whereas soprano pipistrelle was at *low risk* in the absence of mitigation.

Bilboa Wind Farm

According to the response to a EIAR written in 2020 by Fehily Timoney and Co., high collision-risk common, soprano and Nathiusus' pipistrelle, plus Leisler's bat, were all present at the wind farm site. The impact assessment predicted *significant, long-term negative effects* that were *reversible* and *at the local scale* to all four of these bat species due to operational impacts in the absence of mitigation.

Cumulative risk to bats

Without mitigation, the additive effects of the Proposed Development in-combination with the other eight wind farms 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 should be mitigated against. It can be difficult to predict bat behaviour post-construction (Richardson, Lintott, Hosken, Economou, & Mathews, 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).

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.

15.5.3 Potential Decommissioning Phase Cumulative Impacts

These will be similar to construction phase and/or of lower magnitude.

15.6 Mitigation Measures

The developer will be responsible for implementing proposed mitigation and compensation during construction and the operator will be responsible for the same during operation and decommissioning.

15.6.1 Mitigation Measures during Construction

Designated Nature Conservation Sites, Fisheries and Aquatic Ecology

Mitigation measures to prevent adverse effects on downstream Natura 2000 sites during construction are provided in full in the NIS (Technical Appendix 15.10 found in Volume III of this EIAR). These will ensure no deterioration in the quality of water entering the River Barrow and River Nore SAC, the River Nore 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.

These measures are taken from Chapter 9 and the CEMP (Technical Appendix 3.2 found in Volume III of this EIAR).

Within the design of the proposal, good practice environmental and pollution control measures will be employed regarding current best practice guidance such as the following:

- CIRIA C648, 'Control of Pollution from Linear Construction Project' (2006);
- CIRIA C532, 'Control of water pollution from construction sites: guidance for consultants and contractors' (2001);
- CIRIA C741, 'Environmental good practice on site guide' (2015, 4th edition);
- CIRIA C697, 'SuDS and Maintenance Manual; (2007);
- IFI, 'Requirements for the Protection of Fisheries Habitats during Construction and Development Works at River Sites' (2016); and
- Design took account of IFI consultation to minimise the number of watercourse crossings and to ensure there were appropriate set-back distances between any infrastructure and watercourses (see Chapter 9).

Mitigation measures in the NIS include implementing the requirements in the following guidance:

- Forestry and Water Quality Guidelines – Forestry Service (DMNR, 2000)13;
- Code of Best Forest Practice – Ireland;
- Forestry and Freshwater Pearl Mussel Requirements – Site Assessment and Mitigation Measures (Forest Service, 2009) 15; and
- Forest Operations & Water Quality Guidelines (Coillte, 2009).

The Forest Service of the Department of Agriculture, Fisheries and Food implements the principles of Sustainable Forest Management through its environmental guidelines 'Code for best forestry practice Ireland' and its inspection and monitoring procedures. The Forest Service also has guidance in relation to freshwater pearl mussel: 'Forestry and Freshwater Pearl Mussel Requirements – Site Assessment and Mitigation Measures' to further develop its commitment to environmental protection. This document gives specific mitigation measures which are mandatory in specific locations and circumstances in the designated Freshwater Pearl Mussel catchments such as the Barrow and Nore. Within these catchments particular emphasis is placed upon the area that lies within 6 km hydrological distance of an identified Freshwater Pearl Mussel (FPM) population. From the River Barrow and River Nore SAC Conservation objectives, the location of Pearl mussel is between 13 km and 20 km from the Proposed Development, and therefore the mitigation methods for FPM will not be required and the 'Forest Service Guideline' will be implemented instead.

A Construction Environment Management Plan (CEMP) and a Surface Water Management Plan (SWMP) incorporating all relevant mitigation measures included in the NIS and the EIAR will be implemented and followed to ensure compliance with the conservation objectives of the River Barrow and River Nore SAC and the River Nore SPA. The CEMP and SWMP is submitted with this application and will be agreed in conjunction with IFI, NPWS and the Planning Authority. The CEMP will be a key construction document that the contractor will be required to comply with in order to ensure the environment is protected. Any further requirements set out as conditions of consent will be included and there will be a schedule of environmental commitments that will include mitigations measures. The CEMP will be used an Environmental Audit Checklist Tool to ensure compliance by the appointed contractor and will be completed during environmental monitoring of the works.

Drainage will be based on a Sustainable Drainage System (SuDS) through minimising, interception, treatment dispersal and dilution. The SWMP specifies how water pollution will not occur as a result of construction activity for the Proposed Development. It has also been designed to regulate the rate of surface water run- off, encourage settlement of sediment locally and to minimise the quantity of sediment laden storm water.

Erosion control (i.e. preventing sediment runoff) is more effective than sediment control for the prevention of water pollution, this principle will be adopted in the SWMP. Erosion control measures are less likely to fail during times of high rainfall, require less maintenance and are more cost effective. The works programme will include the ensuring the following controls are in place before site clearance or earth works are commenced:

- Erosion control;
- Sediment control;
- Drainage control; and
- Runoff control.

Once works on site have commenced, the area of exposed ground will be minimised, runoff will be prevented from entering the site from adjacent ground, appropriate control and containment measures will be undertaken. Monitoring and maintenance of erosion and sediment controls will occur throughout the Proposed Development. Establishing vegetation as soon as practical where soil is exposed will also be a priority.

All silt and erosion control measures will be based on the peak flow set out in CIRIA (2006).

Erosion and sediment control details

Measures to control erosion and sediment deposition will be incorporated into each element of the Proposed Development. The works have been broken down into the following stages:

- Upgrading of existing drainage network;
- Upgrading of existing access tracks and roadside swales;
- New access tracks;
- Crane hardstanding areas and turbine foundations;
- Substation compound/ temporary construction compound; and
- Cable trenches.

The following measures will be used for each element of work (where relevant):

- Installation of interception drains will be installed upslope of proposed work areas;
- Silt traps will be installed at discharge points form trackside swales;
- Blocking of any drains that collect discharge from roadside swales and discharge directly into water courses;
- Perimeter swales will be installed to collect dirty surface water runoff from crane hardstanding area/ turbine bases including locations of proposed: check-dams, cross-drains, sediment traps and discharge points[19];
- Settlement ponds will be installed to facilitate the treatment of potential silt laden water; and
- Application of a capping layer of crushed limestone/sandstone to both existing and newly constructed access tracks will be installed to protect underling shale material more prone to sedimentation when used by traffic.

Best practice pollution control measures

The following best practice pollution control measures will be employed during the construction phase when working in or near (50 m) the minor watercourses in the study area to prevent the transport of deleterious substances to River Barrow and River Nore SAC, River Nore SPA and Grand Canal pNHA and mobile aquatic receptors:

- Release of suspended solids to all surface waters will be controlled by interception (e.g. silt traps) and management of site run-off. Any surface water run-off must be treated to ensure that it is free from suspended solids, oil or any other polluting materials;
- Silty water will be treated using silt trays/settlement ponds and temporary interceptors and traps will be installed until such time as permanent facilities are constructed;
- Straw bales or silt fences will be appropriately located near watercourses to help prevent untreated surface water run-off entering any watercourse;
- All fuels, lubricants and hydraulic fluids will be kept in secure bunded areas away from watercourses. The bunded area will accommodate 110% of the total capacity of the containers within it;
- Containers will be properly secured to prevent unauthorised access and misuse. An effective spillage procedure will be put in place with all staff properly briefed;
- Any waste oils or hydraulic fluids will be collected, stored in appropriate containers and disposed of offsite in an appropriate manner;
- Fuelling and lubrication will not be conducted within 50 m of watercourses;
- Storage areas, machinery depots and site offices will be located at least 50 m from the nearest watercourse;
- Foul drainage from the site offices and facilities will be properly treated and removed to a suitable treatment facility;

[19] All such features to be assigned unique reference number to facilitate ongoing inspection and monitoring of same during the course of the works.

- Spill kits will be made available close to streams and all staff will be properly trained on correct use;
- Disposal of raw or uncured waste concrete will be controlled to ensure that watercourses or other sensitive areas will not be impacted; and
- Attenuation ponds and a constructed wetland shall be designed, allowing 24 hr settlement before discharge into the surrounding watercourses.

Works adjacent to, within or over water courses will following guidelines will be followed for construction of new tracks (no instream works are proposed):

- Guidelines on Protection of Fisheries during Construction Works in and Adjacent to Waters (IFI, 2016)[20]; in summary these are:
    - Use of clear span bridges and bottomless culverts in preference to insufficient water depth culverts, culverts with perched inlets, outfalls and excessive slopes.
    - Bridge foundations should be designed and positioned at least 2.5 metres form the river bank, so there is no impact on riparian habitat.
    - If a clear span bridge is not viable, any culvert for a crossing structure needs to be made of metal or concrete pipes a minimum of 900mm diameter and be laid in a manner to maintain the existing stream profile.
    - If culverts are used, these should be positioned where the watercourse is straightest and aligned with the bed.
    - Allow sufficient depth over bridge aprons/ sour slabs, to allow fish movement.
    - Any crossing should avoid physical alterations to stream channels that could alter hydrological characteristics, change stream profile (specifically width, depth, gradient and speed).
    - Any crossing should have capacity to convey the full range of flood flows likely to be encountered, without the crossing being overtopped and allow for passing of debris that might arise).
    - Crossings need to be covered in clean inert material to allow safe crossing of the widest items of plant and equipment, without cover material being dislodged and entering the water.
    - Time in water works between July and September .
    - Creation of fords for access is prohibited.
    - Crossing of water courses at natural fords is not permitted.
    - Bank protection works are often required upstream and downstream of new structures to ensure no undercutting or destabilisation, rock armour is preferred to gabions.
    - Pre- cast concrete should be used whenever possible to prevent risks to aquatic life.
    - When cast in place concrete is required, all work must be done in the dry and effectively isolated from flowing water for a period sufficient to ensure no leachate from concrete.

[20] Inland Fisheries Ireland (2016) Guidelines on protection of fisheries during construction works in and adjacent to waters

  - Designated impermeable cement washout areas must be provided.
  - Abstraction of water for dust suppression should not occur where invasive aquatic species have been identified, to prevent spreading of such species and should only occur in large enough waters identified to allow abstraction without adverse effect.

- Guidelines for the crossing of watercourses during the construction of national road schemes (NRA, 2005)[21].In summary these are:
  - Avoid disturbing watercourses and riverbanks above and below crossings
  - Implementing measures to control or minimise risk of siltation including bunding and diversion of site run-off to settlement ponds, stripping of top soil and covering temporary stockpiles
  - Culverts should be constructed to allow the passage of fish and mammals;
  - Temporary crossings should not impede fish passage; and
  - Where temporary watercourse crossings are required, suitable materials should be used for construction to not give rise to rutting, ponding and silt run-off; and to direct silt run-off to silt lagoons with precise measures specified according to gradient, with buffer zones incorporated between ponds and watercourses.

Additional measures for conserving water quality and aquatic life

Disturbed Sediment Entrainment Mats (SEDIMATS) will be used in all watercourses that drain from the site. These will provide a further level of protection in relation to silt release. These will be installed by the manufacturer's instructions at locations agreed by the NPWS, IFI and the Planning Authority.

Additional measures to protect water quality will be implemented. Lagoon-type sediment trap and plant filtration beds are a recommendation in the Altmüller and Dettmer (2006) study, this will be incorporated into the SWMP and implemented. Although the Altmüller and Dettmer study specifically looked at FPM and the populations are between 13 km (direct-line) and 20 km (instream) distance from the Proposed Development, these measures will further protect water quality and aquatic life.

The CEMP will include details of the machinery and methodology to be employed to undertake the proposed works. This includes details on the exact location of storage materials, and equipment, how access will be managed to limit disturbance outside of the Proposed Development area, protection of water quality with the avoidance of spills and the use of bio-degradable oils. All construction machinery operating near any watercourse will be systematically checked to avoid leaks of oils, hydraulic fluids and fuels.

There will also be a method statement in relation to cleaning machinery and the avoidance of importing/spreading non-native invasive species. Any plant or equipment that may have worked in environments where invasive species are present (including but not restricted to crayfish plague, zebra mussel *Dreissena polymorpha*, curly waterweed *Lagarosiphon major*, Japanese knotweed (and other members of the knotweed family), Indian balsam *Impatiens glandulifera*, giant hogweed *Heracleum mantegazzianum*, *rhododendron ponticum* and New Zealand flatworm), will be suitably cleaned by high pressure hose,

[21] National Roads Authority (NRA) Guidelines for the crossing of watercourses during the construction of national road schemes.

disinfected and dried before being used on site to prevent the spread of invasive species. Water used for this washing process will always be intercepted and prevented from draining back into watercourses.

Any stockpiling of material, topsoil or spoil will be within the proposed site compound. All storage and stockpiling of material must be at a minimum of 10 m from any surface water drainage on the site.

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.

Removal of brash and felled trees near to watercourses and drainage ditches will ensure that no significant acidification of downstream watercourses will occur.

Habitats

The location of the site layout does not overlap with high-value terrestrial habitats and is located almost entirely within commercial conifer plantation and improved grassland. Cable route options are located almost entirely within existing roads and only small lengths will go through commercial conifer plantation, improved grassland and arable cropland. Construction for the majority of the proposed access tracks will involve upgrading existing forestry and farm tracks.

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 trees and hedgerows to be removed has been minimised.

Any treelines or hedgerows removed will be replaced in-situ elsewhere in the Proposed Development Site 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.

To avoid widespread disturbance to habitats, access within the Proposed Development site 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.

Rare Flora

No rare flora were recorded during surveys and so no mitigation measures are required.

Invasive Plants

A Habitat and Species Management Plan (HASMP) will be used to prevent the spread of invasive and non-native species and is contained in Technical Appendix 15.11 found in Volume III of this EIAR. In particular, quarry material must be treated to ensure that invasive third-schedule Japanese knotweed (plus other non-native plants) is not spread during construction works and any works near watercourses must not spread invasive third-schedule Canadian pondweed.

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.

Birds

To avoid widespread disturbance to birds, access will be restricted to the footprint of the proposed works corridor. Measures proposed in Section 15.6.1 will prevent deterioration of water quality and adverse effects on birds relying on downstream habitats, such as grey wagtail and kingfisher.

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;
- 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 for cutting vegetation or tracking over with an excavator; and
- A suitably experienced Ecologist will be employed for the duration of the construction period to make contractors aware of the ornithological sensitivities of the Proposed Development Site and to undertake surveys for nesting birds throughout the construction period, enforcing exclusion areas as required.

Terrestrial Mammals (Excluding Bats)

Measures proposed in 15.6.1 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.

A pre-construction walkover survey of the Proposed Development Site 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.

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 Ecologist will be employed for the duration of the construction period to make contractors aware of the mammalian sensitivities of the Proposed

Development Site 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.

Bats

All hedgerows and treelines that will be lost due to construction will be replaced within the Proposed Development Site (see Section 15.7.1 and Technical Appendix 15.11). This will ensure that there is no net loss of commuting and foraging routes for bats.

Along the Cable Route Options, immediately in advance of construction works, an ecologist will undertake a comprehensive survey of bridges / structures / trees with moderate to high bat roosting potential (see Technical Appendix 15.3 found in Volume III of this EIAR) and emergence surveys will be carried out to determine if bats are present following Collins (2016) guidelines.

No active bat roosts were recorded within the Site. However, given that a period is likely to elapse prior to the commencement of construction, it is acknowledged that roosting bats could occupy 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.

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.

For any 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.

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. 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 exist the roost; and
- Leaving these sections in place for at least 24 hours in suitable weather.

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. In general the following applies:

- 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.

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.

Other Protected Fauna

Pre-construction checks will be undertaken for spawning frogs if construction works are undertaken in February. Adults and spawn will be translocated under NPWS licence to suitable alternative locations if present. Pitfall traps and drift fences will be used to capture adult frogs.

Amphibian-proof fencing close to any ponds/pools will be used to prevent frogs from accessing any parts of the Proposed Development most hazardous to amphibians during the construction phase.

15.6.2 Mitigation Measures during Operation

Designated Nature Conservation Sites, Fisheries and Aquatic Ecology

Mitigation measures to protect water quality are shown in Chapter 9 and in Technical Appendix 3.2 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 and can be added to:

- 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.

This will prevent any negative effects on downstream aquatic receptors and designated sites.

Birds

Reduction in habitat suitability

The species assessed most likely to collide with operational turbines was common kestrel.

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 96 m to 103 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.

Full details are included in Technical Appendix 15.11 found in Volume III of this EIAR.

Terrestrial Mammals (Excluding Bats)

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 Site using like-for-like planting. This will ensure no net loss of linear habitats.

Mitigation measures to protect water quality in Chapter 9 and Technical Appendix 3.2 found in Volume III of this EIAR will avoid significant downstream effects on otter. See Section 15.6.1 for further details.

Bats

Bat mitigation buffers

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:

$$b = \sqrt{(50 + bl)^2 - (hh - fh)^2}$$

Where b = buffer radius, bl = blade length, hh = hub height, fh = feature height (all in metres).

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 woodland habitats and treelines, this height was assumed to be 20 m based on the heights of the conifer plantation being felled during surveys. For hedgerows and scrub, this height was 5 m based on the maximum height of hedgerows being maintained by landowners during surveys.

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 79.35 m and a hub height of 99 m. This corresponds to a woodland and treeline buffer radius of 103 m and a hedgerow buffer radius of 89 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 as a result of their dimensions.

Details of the buffers required for each turbine are shown below in **Table 15-16** and **Figure 15-7.**

Table 15-16 Details of bat mitigation buffers required for each turbine

Turbine Number	Habitat feature	Area (ha) / length (m) to be removed
T1	Hedgerows	- / 21
	Treelines	- / 118
	Mixed broadleaved woodland	0.1 / -
	Conifer plantation	1.0 / -
	Scrub	0.3 / -
T2	Conifer plantation	1.9 / -
	Recently-felled woodland	1.5 / -
T3	Conifer plantation	5.6 / -
	Mixed broadleaved woodland	0.1 / -
T4	Conifer plantation	1.3 / -
	Scrub	0.3 / -
T5	Hedgerows	- / 297
	Treelines	- / 23
	Conifer plantation	0.3 / -
	Mixed broadleaved woodland	0.3 / -
T6	Conifer plantation	3.0 / -
	Mixed broadleaved woodland	0.1 / -
T7	Conifer plantation	3.3 / -
T8	Recently felled woodland	3.3 / -
T9	Conifer plantation	3.3 / -
T10	Conifer plantation	3.3 / -
T11	Conifer plantation	2.9 / -
	Mixed broadleaved woodland	0.4 / -
T12	Conifer plantation	3.3 / -
T13	Conifer plantation	2.9 / -
	Scrub	0.2 / -

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. Excess soil will be deposited over stumps to flatten the ground.

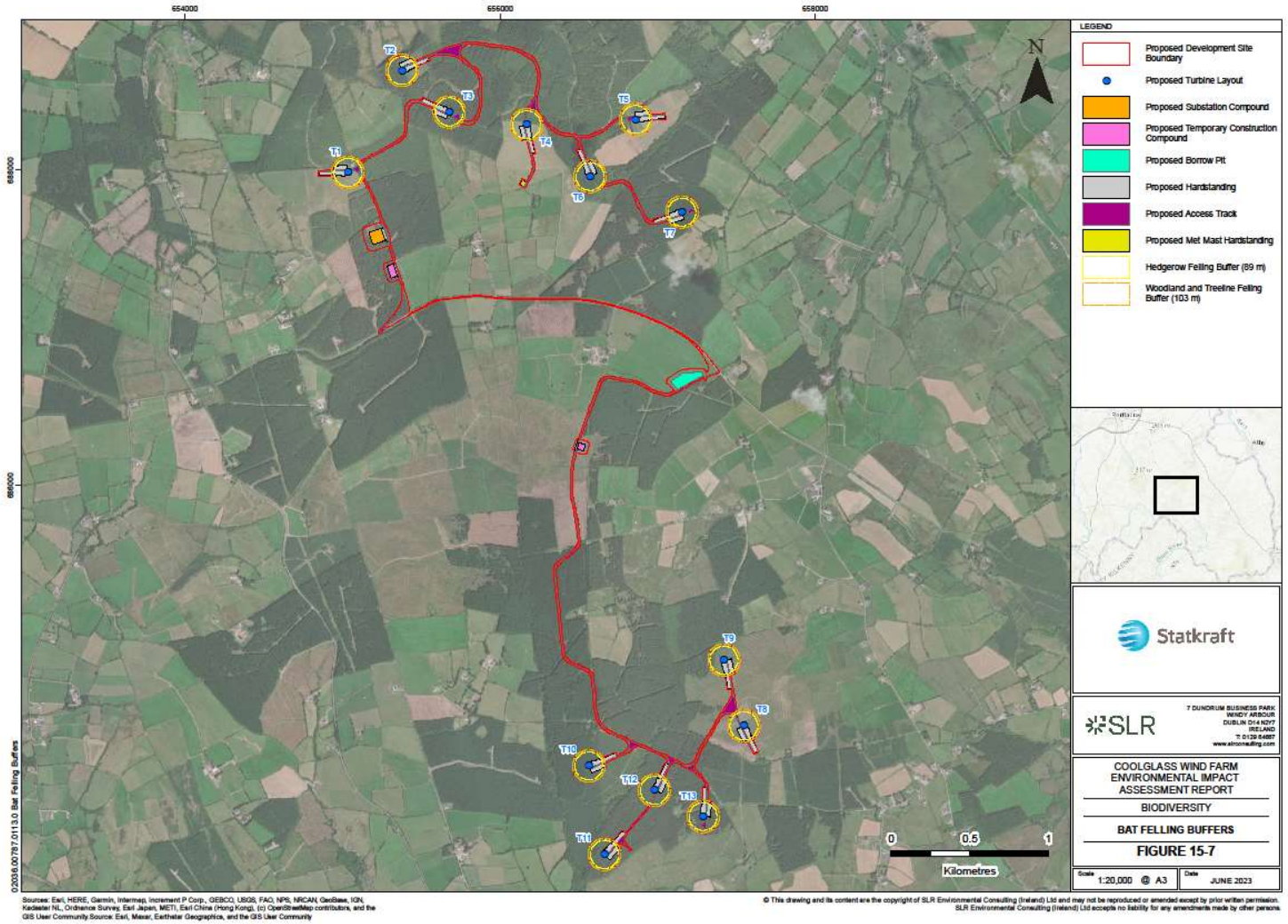

Figure 15-7: Bat Felling Buffers

Turbine curtailment

It is predicted that bat mitigation buffers will limit bat activity near turbines, reducing potential collision risk.

In addition, the following operational mitigation measures for bats may be implemented depending on the results of the proposed monitoring programme (see Section 15.9.4):

- **Feathering of Blades.** There is evidence that bat casualties at wind farms is 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 bat carcasses 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). Curtailment will be implemented via a system of adaptive management. Thus, if bat carcasses are recorded during post-construction monitoring, 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.

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. 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 Site, 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.

15.6.3 Mitigation Measures during Decommissioning

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.

15.7 Compensation Measures

Full details of compensation measures are included in Technical Appendix 15.11 found in Volume III of this EIAR.

15.7.1 Replacement planting

Following DAFM (DAFM, 2017) guidance, 52.78 ha of replacement woodland is expected to be planted ex situ. This will compensate for the loss of woodland habitats permanently felled to accommodate the Proposed Development.

To compensate for the loss of linear treeline and hedgerow habitats, 141 m of treelines will be replaced, and 938 m of hedgerows will be replaced in situ. The placement of these will be designed to ensure connectivity between habitat features at the Proposed Development Site is maintained and enhanced. The replacement of treelines and hedgerows will also ensure that there is no net loss as a result. Full details are shown in Technical Appendix 15.11.

15.8 Biodiversity Enhancement

Enhancement measures are included in Technical Appendix 15.11 found in Volume III of this EIAR. These include:

- Erection of nest boxes for swift (one swift tower);
- Erection of minimum of three insect hotels per 35 ha (i.e. 8 no. in total);
- Maintenance of 5 m rough grassland buffer around borrow pit for pollinators;
- Creation of a minimum of eight log or brash piles for hedgehogs and eight log or brash piles for reptiles and amphibians from hard wood trees and shrubs removed during site clearance; and
- Management of new and existing drainage ditches to benefit amphibians.

A summary table of compensation and enhancement measures shown in the HASMP is shown below in **Table 15-19** and shown in **Figure 15-8**.

Table 15-19 Summary of compensation and enhancement measures

Ecological feature	Summary of measure
Habitats	Hedgerow / treeline creation and enhancement: 938 m of hedgerow and 141 m of treeline
Birds	Maintenance of low vegetation height around turbines to deter kestrels
	Erection of 1 no. swift tower
Hedgehogs	Creation of 8 no. log piles
Amphibians / reptiles	Creation of 8 no. log piles in addition to hedgehog log piles
	Dredging of new and existing drains to benefit amphibians
Insects	Creation of 8 no. insect hotels
	Maintenance of 5 m rough grassland buffer around borrow pit for pollinators
Invasive plants	Prevention, containment, treatment and eradication

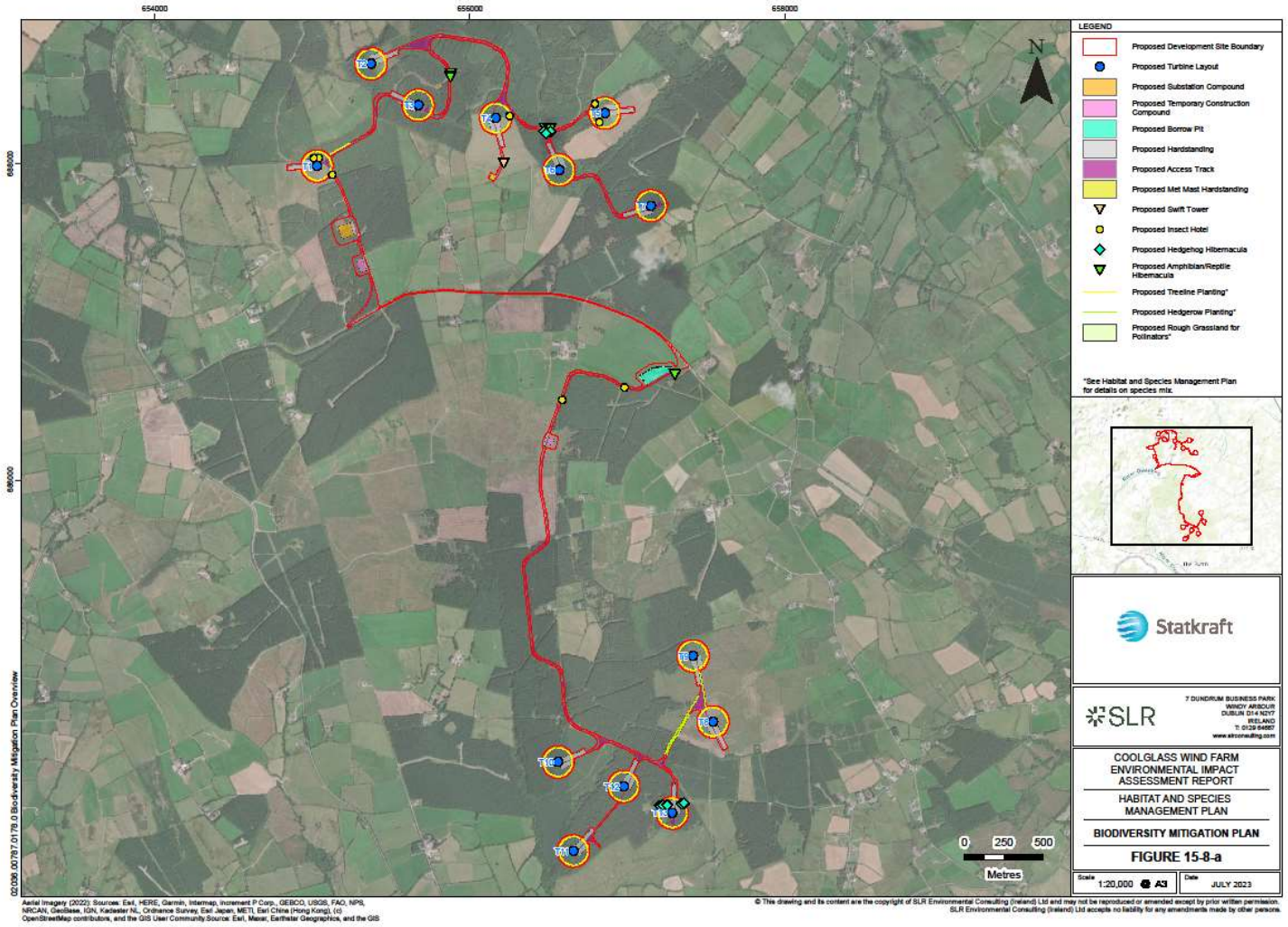

Figure 15-8: Biodiversity Mitigation Plan

P2

P3

P4

P5

P6

P7

15.9 Monitoring

15.9.1 General pre-construction confirmatory surveys

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.

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.

Checks for nesting birds will be required for construction undertaken during the bird breeding season. If nest 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.

15.9.2 Water quality (during and post-construction)

Water quality monitoring will be undertaken as outlined in Chapter 9. This will check the efficacy of mitigation measures.

15.9.3 Birds (post-construction)

Based on current best-practice guidelines (SNH, 2009), 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 unforeseen adverse effects. Thereafter, if the rate of turbine strikes is as low as predicted by the CRM (which is highly precautionary), the monitoring should no longer be required. If monitoring indicates potentially significant levels of collision mortality for IEF birds, potential mitigation measures will be developed and implemented, and further monitoring will also be identified, 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.

15.9.4 Bats (post-construction)

Post-construction monitoring is required in line with commitments made in respect of the permitted wind farm and should be seen as an opportunity to obtain data on bat/turbine interactions and to allow adaptive management of the proposed mitigation measures.

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 wind farm 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 Site, post-construction monitoring will be adapted to pay particular attention to this location.

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.

The post-construction monitoring programme will consist of:

- Static detector surveys. These surveys will allow for a valid comparison of bat activity and Site 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. While not currently recommended, 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.

The results of the post-construction monitoring surveys will be used to determine whether further mitigation measures, such as turbine curtailment, are required.

Bat mitigation buffers will need to 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 wind farm lifespan. The monitoring programme will help ensure there are no significant adverse effects on bats.

15.10 Residual Effects

A summary of the effects, mitigation and residual effects, taking into account cumulative effects, is set out in **Table 15-17**.

Table 15-17 Summary of Effects

Ecological Feature	Phase	Potential Effect	Potential Cumulative Effect	Significance Pre-Mitigation	Proposed Mitigation	Significance of Residual Effect
Riparian Designated Sites and Aquatic Ecology						
River Barrow and River Nore SAC, River Nore SPA and Grand Canal pNHA Annex 1 floating river vegetation habitat, FW1 upland/eroding watercourses, FW2 lowland/depositing watercourses, Atlantic salmon, *Lampetra* sp., European eel, white-clawed crayfish and otter.	Construction	Direct: none. Indirect short-term deterioration in water quality due to pollution or suspended solids.	Risk increased slightly due to proximity of other wind farms, projects and plans.	Significant at the international scale for SAC/SPA, county/regional scale for annex 1 floating river vegetation, lampreys., white-clawed crayfish, European eel and otter, and local scale for Atlantic salmon. Significant at national scale for pNHA.	See Section 15.6.1 based on Chapter 9 and outline CEMP in Technical Appendix 3.2 found in Volume III of this EIAR. including 50 m buffer zones, best practice guidelines and SuDS.	Not significant
	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 runoff and sedimentation.		Significant at the international scale for SAC/SPA, county/regional scale for annex 1 floating river vegetation, *Lampetra* sp., white-clawed crayfish, European eel and otter, and local scale for Atlantic salmon.	See Section 15.6.1 based on Chapter 9 and outline CEMP in Technical Appendix 3.2 found in Volume III of this EIAR.	Not significant

Ecological Feature	Phase	Potential Effect	Potential Cumulative Effect	Significance Pre-Mitigation	Proposed Mitigation	Significance of Residual Effect
				Significant at national scale for pNHA.		
	Decommissioning	As for construction phase but less excavation and no cement/concrete needed.		Significant at the international scale for SAC/SPA, county/regional scale for annex 1 floating river vegetation, *Lampetra* sp., white-clawed crayfish, European eel and otter, and local scale for Atlantic salmon. Significant at national scale for pNHA.	See Section 15.6.1 based on Chapter 9 and outline CEMP in Technical Appendix 3.2 found in Volume III of this EIAR.	Not significant
Non-Riparian Designated Sites						
Clopook Wood pNHA	Construction	Indirect disturbance to foraging animals.	No risk as no other wind farms, projects or plans in the immediate area near Clopook pNHA	Not significant.	None required.	Not significant.
	Operation	None		Not significant	None required	Not significant

Ecological Feature	Phase	Potential Effect	Potential Cumulative Effect	Significance Pre-Mitigation	Proposed Mitigation	Significance of Residual Effect
	Decommissioning	As for construction phase.		Not significant.	None required.	Not significant.
Non-Riparian IEF Habitats						
Drainage ditches FW4, mixed broadleaved woodland WD1, treelines WL1, hedgerows WL2, riparian woodland WN5, immature woodland WS2, scrub WS1	Construction	Direct loss of habitats; indirect spread of invasive species, compaction and excavation of roots,	No risk	Significant at local scale for WD1, WL1, WL2, WS1, FW4, WN5, WS2	Land take minimised through avoidance of most important habitats. As detailed in HASMP (Technical Appendix 15.11 found in Volume III of this EIAR), compensation measures to offset habitat loss will be undertaken. Similarly, the HASMP will outline measures to limit the risk and spread of introducing non-native and invasive species. Root protection areas will be included where soil is to be compacted and excavated next to hedgerow and treeline habitats	Not significant
	Operation	None are likely	No risk	Not significant	None required	Not significant

Ecological Feature	Phase	Potential Effect	Potential Cumulative Effect	Significance Pre-Mitigation	Proposed Mitigation	Significance of Residual Effect
	Decommissioning	As for construction phase	As for construction phase	Significant at local scale for WD1, WL1, WL2, WS1, FW4, WN5, WS2	As for construction phase	Not significant
Riparian IEF Habitats						
Eroding/upland rivers FW1 and depositing/lowland rivers FW2	Construction	Indirect spread of invasive species	Risk increased slightly due to proximity of other wind farms, projects and plans with hydrological connections to Proposed Development.	Significant at regional/county scale for FW1 and international scale for FW2	As detailed in HASMP (Technical Appendix 15.11 found in Volume III of this EIAR), measures are proposed to limit the risk and spread of introducing non-native and invasive species.	Not significant
	Decommissioning	As for construction phase	As for construction phase	Significant at regional/county scale for FW1 and international scale for FW2	As for construction phase	Not significant
IEF Birds Primary Target Species						

Ecological Feature	Phase	Potential Effect	Potential Cumulative Effect	Significance Pre-Mitigation	Proposed Mitigation	Significance of Residual Effect
Avian assemblage	Construction	Direct nest damage or destruction	Risk increased slightly due to proximity of other wind farms, projects and plans in area.	Not significant due to embedded mitigation	As detailed in Section 15.6.1, a series of embedded mitigation measures are included to avoid destruction of active nests.	Not significant
	Construction	Habitat loss leading to indirect disturbance/ displacement. Especially breeding snipe, woodcock and peregrine. Also, open ground species that could be displaced due to in situ compensatory planting.	Risk increased slightly due to proximity of other wind farms, projects and plans in area.	Not significant due to abundant displacement habitat and distance between infrastructure and likely breeding locations	As detailed in HASMP (Technical Appendix 15.11 found in Volume III of this EIAR), measures are proposed to compensate for loss of hedgerows and treelines in situ. Also, other habitats will be managed for biodiversity. Replant lands will provide new habitat for goldcrest. Good practice measures will avoid disturbing species in breeding season including use of appropriate buffers if nests are discovered.	Not significant

Ecological Feature	Phase	Potential Effect	Potential Cumulative Effect	Significance Pre-Mitigation	Proposed Mitigation	Significance of Residual Effect
	Decommissioning	Direct nest damage or destruction	As for construction phase	Not significant	As for construction phase	Not significant
		Habitat loss leading to indirect disturbance/displacement. Especially breeding snipe, woodcock and peregrine.	As for construction phase	Not significant	As for construction phase	Not significant
Woodland bird assemblage, including goldcrest	Construction	Direct and indirect habitat loss	Risk increased slightly due to proximity of other wind farms, Proposed Development and plans in area.	Not significant, neutral	Woodland habitats temporarily lost due to construction will be replaced in situ (partial compensation, as those permanently lost will be replaced ex situ only) and existing agroforestry practices mean habitat loss will happen anyway. Replant lands will provide new habitat for goldcrest.	Not significant, neutral
Common kestrel	Operation	Direct mortality due to collision	Additional mortality could occur to populations due to other wind farms in area	Significant at regional / county scale for resident population; but collision risk model highly	Reduction in suitability of habitats in bat mitigation buffers (Section 15.6.2) to bring collision risk	Not significant

Ecological Feature	Phase	Potential Effect	Potential Cumulative Effect	Significance Pre-Mitigation	Proposed Mitigation	Significance of Residual Effect
				precautionary as based on adult survival rates and only just significant. Not significant when based on juvenile rates, so true level of combined adult/juvenile risk highly likely to be not significant.	down further. Post-construction monitoring is proposed (see Section 15.9.3). If monitoring shows potentially significant levels of collisions with turbines, mitigation measures will be developed in conjunction with the Planning Authority and NPWS.	
Common snipe	Operation	Disturbance/displacement and barrier effects	Risk increased slightly due to proximity of other wind farms, projects and plans in area.	Not significant due to wide availability of more optimal, alternative foraging habitats located outside the Proposed Development site and the lack of breeding and/or communal roosting within or nearby the Proposed Development	None required	Not significant
	Operation	Direct mortality due to collision	Additional mortality could occur to populations due to	Not significant	None. Post-construction monitoring is proposed (see	Not significant

Ecological Feature	Phase	Potential Effect	Potential Cumulative Effect	Significance Pre-Mitigation	Proposed Mitigation	Significance of Residual Effect
			other wind farms in area		Section 15.9.3). If monitoring shows potentially significant levels of collisions with turbines, mitigation measures will be developed in conjunction with the Planning Authority and NPWS.	
Eurasian woodcock	Operation	Disturbance/ displacement and barrier effects	Risk increased slightly due to proximity of other wind farms, projects and plans in area.	Not significant due to wide availability of more optimal, alternative foraging habitats located outside the Proposed Development site and the lack of breeding and/or communal roosting within or nearby the Proposed Development	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	None. Post-construction monitoring is proposed (see Section 15.9.3). If monitoring shows potentially significant levels of	Not significant

Ecological Feature	Phase	Potential Effect	Potential Cumulative Effect	Significance Pre-Mitigation	Proposed Mitigation	Significance of Residual Effect
					collisions with turbines, mitigation measures will be developed in conjunction with the Planning Authority and NPWS.	
Northern lapwing	Operation	Direct mortality due to collision	Additional mortality could occur to populations due to other wind farms in area	Not significant	None. Post-construction monitoring is proposed (see Section 15.9.3). If monitoring shows potentially significant levels of collisions with turbines, mitigation measures will be developed in conjunction with the Planning Authority and NPWS.	Not significant
Peregrine falcon	Operation	Disturbance/ displacement and barrier effects	Risk increased slightly due to proximity of other wind farms, projects and plans in area.	Not significant due to wide availability of more optimal, alternative foraging habitats located outside the Proposed Development site and the lack of breeding and/or communal	None required	Not significant

Ecological Feature	Phase	Potential Effect	Potential Cumulative Effect	Significance Pre-Mitigation	Proposed Mitigation	Significance of Residual Effect
				roosting within or nearby the Proposed Development		
	Operation	Direct mortality due to collision	Additional mortality could occur to populations due to other wind farms in area	Significant at regional / county scale for resident population but collision risk model highly precautionary as based on adult survival rates. Juvenile rates are not significant. As true risk will be in between adult and juvenile risk, likely not to be significant. Also, empirical evidence from NPWS shows no records of turbine strikes in Ireland, so overally, likely to be not significant.	None. Post-construction monitoring is proposed (see Section 15.9.3). If monitoring shows potentially significant levels of collisions with turbines, mitigation measures will be developed in conjunction with the Planning Authority and NPWS.	Not significant
IEF Birds Secondary Target Species						
Swift, black-headed gull, great cormorant, common gull, herring gull, lesser black-backed gull and mallard	Operation	Disturbance/displacement and barrier effects	Risk increased slightly due to proximity of other wind farms, projects and plans in area.	Not significant due to wide availability of more optimal, alternative foraging habitats located outside the Proposed	None required however habitat creation measures for snipe may also benefit these species except cormorant.	Not significant

Ecological Feature	Phase	Potential Effect	Potential Cumulative Effect	Significance Pre-Mitigation	Proposed Mitigation	Significance of Residual Effect
				Development site and the lack of breeding and/or communal roosting within or nearby the Proposed Development		
IEF Birds Red Listed Passerines						
Grey wagtail Meadow pipit	Construction	Displacement/disturbance due to loss of IEF habitats, such as hedgerows, and improved agricultural grasslands.	Risk increased slightly due to proximity of other wind farms, projects and plans.	Not significant	As detailed in HASMP (Technical Appendix 15.11 found in Volume III of this EIAR), measures are proposed to compensate for loss of hedgerows and treelines in situ. Also, other habitats will be managed for biodiversity. Good practice measures will avoid disturbing species in breeding season.	Not significant
	Operation	Disturbance/displacement and barrier effects	Risk increased slightly due to proximity of other wind farms, projects and plans in area.	Not significant due to wide availability of more optimal, alternative foraging habitats located outside the Proposed Development site	None required	Not significant

Ecological Feature	Phase	Potential Effect	Potential Cumulative Effect	Significance Pre-Mitigation	Proposed Mitigation	Significance of Residual Effect
				and the lack of breeding and/or communal roosting within or nearby the Proposed Development		
	Decommissioning	As for construction phase	As for construction phase	Not significant	As for construction phase	Not significant
IEF Mammals (Non Bat)						
Badger	Construction	Direct destruction of setts / mortality of badgers.	No risk	Not significant as no setts located within 100 m of proposed infrastructure.	See Section 15.6.1. Pre-construction walkover of site will be undertaken and if breeding/resting places discovered, exclusion zones will be implemented and construction will timed to avoid sensitive periods.	Not significant
		Indirect loss of foraging, commuting and sheltering habitat	No risk	Not significant as no setts within 100 m of proposed infrastructure and replant lands will provide compensatory foraging, commuting and sheltering habitat.		Not significant
	Operation	Direct loss of breeding/resting sites during maintenance vegetation clearance in bat mitigation buffers	No risk	Not significant as no dwellings within 100 m of buffers.	See Section 15.6.2 and 15.7.1. Connectivity between woodland habitats and linear features will be retained and like-for-like planting will	Not significant

Ecological Feature	Phase	Potential Effect	Potential Cumulative Effect	Significance Pre-Mitigation	Proposed Mitigation	Significance of Residual Effect
					be undertaken in compensation for hedgerows and treelines.	
		Indirect disturbance/displacement	No risk	Not significant as and replant lands will provide compensatory foraging, commuting and sheltering habitat	None required	Not significant
	Decommissioning	As for construction phase	As for construction phase	Not significant	As for construction phase	Not significant
Pine marten	Construction	Direct destruction of dens / mortality of pine marten.	No risk	Not significant as no setts located within 100 m of proposed infrastructure.	See Section 15.6.1 Pre-construction walkover of site will be undertaken and if breeding/resting places discovered, exclusion zones will be implemented and construction will timed to avoid sensitive periods.	Not significant
		Indirect loss of foraging, commuting and sheltering habitat	No risk	Not significant as no dens within 100 m of proposed infrastructure and replant lands will provide compensatory foraging,		Not significant

Ecological Feature	Phase	Potential Effect	Potential Cumulative Effect	Significance Pre-Mitigation	Proposed Mitigation	Significance of Residual Effect
				commuting and sheltering habitat		
	Operation	Direct loss of breeding/resting sites during maintenance vegetation clearance in bat mitigation buffers	No risk	Not significant as no breeding/resting sites within 100 m of buffers.	See Section 15.6.2 and 15.7.1. Connectivity between woodland habitats and linear features will be retained and like-for-like planting will be undertaken in compensation for hedgerows and treelines.	Not significant
		Indirect disturbance/displacement	No risk	Not significant as widely will use the open habitats around the turbines and will not be restricted to trees.	None required	Not significant
	Decommissioning	As for construction phase	As for construction phase	Not significant	As for construction phase	Not significant
Red squirrel	Construction	Direct destruction of dreys / mortality of squirrel.	No risk	Not significant as no dreys located within 100 m of proposed infrastructure	See Section 15.6.1. Pre-construction walkover of site will be undertaken and if breeding/resting places discovered, exclusion zones will be implemented and construction will be timed to	Not significant

Ecological Feature	Phase	Potential Effect	Potential Cumulative Effect	Significance Pre-Mitigation	Proposed Mitigation	Significance of Residual Effect
					avoid sensitive periods.	
		Direct and indirect loss of foraging, commuting and sheltering habitat	No risk	Not significant as no dreys within 100 m of proposed infrastructure and replant lands will provide compensatory foraging, commuting and sheltering habitat.		Not significant
	Operation	Direct loss of breeding/resting sites during maintenance vegetation clearance in bat mitigation buffers	No risk	Not significant as no breeding/resting sites within 100 m of buffers.	See Section 15.6.2 and 15.7.1. Connectivity between woodland habitats and linear features will be retained and like-for-like planting will be undertaken in compensation for hedgerows and treelines.	Not significant
		Indirect disturbance/ displacement	No risk	Not significant as replant lands will provide compensatory foraging, commuting and sheltering habitat	None required	Not significant
	Decommissioning	As for construction phase	As for construction phase	Not significant	As for construction phase	Not significant

Ecological Feature	Phase	Potential Effect	Potential Cumulative Effect	Significance Pre-Mitigation	Proposed Mitigation	Significance of Residual Effect
Irish hare	Construction	Direct destruction of forms / mortality of hares	No risk	Not significant as construction will be undertaken in daylight hours	See Section 15.6.1. Pre-construction walkover of site will be undertaken and if breeding/resting places discovered, exclusion zones will be implemented and construction will timed to avoid sensitive periods.	Not significant
	Operation	Direct loss of breeding/resting sites during maintenance vegetation clearance in bat mitigation buffers	No risk	Not significant as no breeding/resting sites within 100 m of buffers.	See Section 15.6.2 and 15.7.1. Connectivity between woodland habitats and linear features will be retained and like-for-like planting will be undertaken in compensation for hedgerows and treelines.	Not significant
		Indirect disturbance/displacement	No risk	Not significant as replant lands will provide compensatory foraging, commuting and sheltering habitat	None required	Not significant
	Decommissioning	As for construction phase	As for construction phase	Not significant	As for construction phase	Not significant

Ecological Feature	Phase	Potential Effect	Potential Cumulative Effect	Significance Pre-Mitigation	Proposed Mitigation	Significance of Residual Effect
Hedgehog	Construction	Direct impacts via destruction of hibernacula and direct mortality if construction takes place in winter months.	No risk	Significant at local scale	See Section 15.6.1. Pre-construction walkover of site will be undertaken and if breeding/resting places discovered, exclusion zones will be implemented and construction will be timed to avoid sensitive periods.	Not significant
		Indirect disturbance could cause premature emergence from hibernation and starvation.	No risk	Significant at local scale		Not significant
	Operation	Direct loss of breeding/resting sites during maintenance vegetation clearance in bat mitigation buffers	No risk	Significant at local scale	Embedded mitigation and good practice will avoid impacts on hedgehogs (15.7.2)	Not significant
		Indirect disturbance/displacement could cause premature emergence from hibernation and starvation	No risk	Significant at local scale	Embedded mitigation and good practice will avoid impacts on hedgehogs (Section 15.6.2)	Not significant
	Decommissioning	As for construction phase	As for construction phase	Significant at local scale	As for construction phase	Not significant
Fallow deer	Construction	Direct mortality of hidden fawns.	None	Not significant as limited suitable	See Section 15.6.1. Pre-construction	Not significant

Ecological Feature	Phase	Potential Effect	Potential Cumulative Effect	Significance Pre-Mitigation	Proposed Mitigation	Significance of Residual Effect
				breeding habitat present.	walkover of site will be undertaken and if breeding/resting places discovered, exclusion zones will be implemented and construction will timed to avoid sensitive periods.	
		Indirect loss of foraging, commuting and sheltering habitat	No risk	Not significant as abundant displacement habitats available		Not significant
	Operation	Direct loss of breeding/resting sites during maintenance vegetation clearance in bat mitigation buffers	No risk	Not significant as no breeding/resting sites within 100 m of buffers.	See Section 15.7.1. Connectivity between woodland habitats and linear features will be retained and like-for-like planting will be undertaken in compensation for hedgerows and treelines.	Not significant
		Indirect disturbance/displacement	No risk	Not significant as replant lands will provide compensatory foraging, commuting and sheltering habitat	None required	Not significant
	Decommissioning	As for construction phase	As for construction phase	Not significant	As for construction phase	Not significant

Ecological Feature	Phase	Potential Effect	Potential Cumulative Effect	Significance Pre-Mitigation	Proposed Mitigation	Significance of Residual Effect
IEF Bats						
Bat assemblage	Construction	Direct destruction/disturbance of roost sites	No risk	Not significant as no roosts were discovered in works footprint in Site; grid cables will go in roads, so no interference with watercourse crossings	See Section 15.7.1. Replacement of lost hedgerows/treelines with like-for-like species. Inspection of trees/structures in works footprint at Site 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.	Not significant
	Operation	Indirect disturbance/displacement due to lighting		Not significant as most recorded bat species (common and soprano pipistrelle and Leisler's bat) and less sensitive to	Embedded mitigation and good practice will avoid impacts on bats (Section 15.6.2)	Not significant

Ecological Feature	Phase	Potential Effect	Potential Cumulative Effect	Significance Pre-Mitigation	Proposed Mitigation	Significance of Residual Effect
				light disturbance; other species only recorded very infrequently		
		Indirect loss of foraging/commuting features and disturbance by night-time working	No risk	Significant at local scale	No night working is proposed as part of embedded mitigation (section 15.6.2). Design of Proposed Development designed to avoid disrupting connectivity to landscape. Compensatory measures (Section 15.7.1) to offset loss of hedgerows and treelines will ensure like-for-like replanting of linear feature lost.	
	Decommissioning	As for construction phase	As for construction phase	Not significant	As for construction phase	Not significant
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	Bat buffers will be implemented to reduce collision risk.	Not significant

Ecological Feature	Phase	Potential Effect	Potential Cumulative Effect	Significance Pre-Mitigation	Proposed Mitigation	Significance of Residual Effect
Myotis species and brown-long eared bat	Operation	Direct collision with turbines or barotrauma	Additional mortality could occur to populations due to other wind farms in area	Not significant due to low activity and collision risk	Bat buffers will be implemented to reduce collision risk.	Not significant
IEF Other Fauna						
Amphibians (common frog and smooth newt)	Construction	Direct effects via accidental destruction of frog spawn. None predicted to newt as outside Proposed Development footprint.	No risk	Significant at local scale	See Section 15.6.1. Pre-construction checks and translocation of spawn/mating frogs will be undertaken 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 replant lands will provide compensatory foraging, commuting and sheltering habitat	None required	Not significant

Ecological Feature	Phase	Potential Effect	Potential Cumulative Effect	Significance Pre-Mitigation	Proposed Mitigation	Significance of Residual Effect
	Decommissioning	As for construction phase	As for construction phase	Significant at local scale	As for construction phase	Not significant
Gooden's nomad bee	Construction	Direct mortality/loss of habitat	No risk	Not significant as none recorded during surveys	None required	Not significant
		Indirect loss of foraging habitats	No risk	Not significant as replant lands will provide compensatory foraging, commuting and sheltering habitat	None required	Not significant
	Decommissioning	As for construction phase	As for construction phase	Not significant	As for construction phase	Not significant

15.11 Conclusion

This chapter comprehensively assesses all scenarios within the Turbine Range which is described in section 15.2.1. The potential impacts that could arise from the Project during the construction, operational and decommissioning phases are set out in this conclusion.

There are slight changes to the operational effects on IEF habitats, birds and bats associated between hub height 99 m and rotor diameter 155 m compared to hub height 102.5 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.

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.

Assuming that the mitigation measures in this Chapter are adopted in full, there are not likely to be any residual significant effects on important ecological features.

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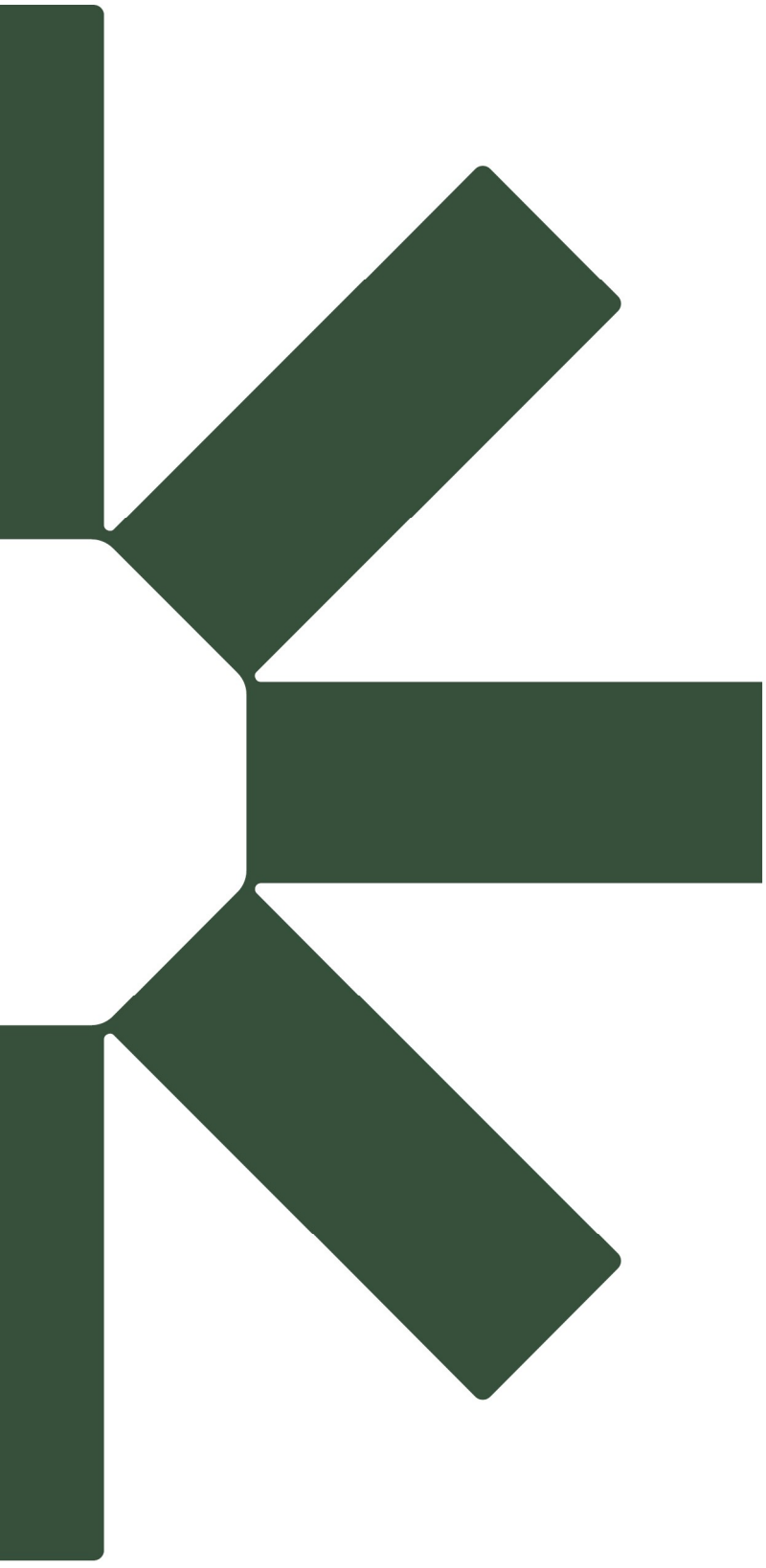

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