BILBOA WIND FARM

VOLUME I:
ENVIRONMENTAL IMPACT ASSESSMENT REPORT

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Prepared By:

Arcus Consultancy Services

7th Floor
144 West George Street
Glasgow
G2 2HG

T +44 (0)141 221 9997 l **E** info@arcusconsulting.co.uk
w www.arcusconsulting.co.uk

Registered in England & Wales No. 5644976

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1 INTRODUCTION

1.1 THE DEVELOPMENT

The Environmental Impact Assessment Report (EIAR) has been prepared by Arcus on behalf of Boolyvannanan Renewable Energy Limited ('the Applicant'), part of Statkraft Group, who are seeking planning permission under Section 34 of the Planning and Development Act 2000, as amended[1] (the Planning Act) to construct and operate the proposed Bilboa Wind Farm (the Development) located at approximately 8 kilometres (km) southwest of the town of Carlow, County Carlow within Carlow County Council (CCC), as shown on Figure 1.1.

The Development will have a total output of 22.5 MW and consist of the following key elements which are subject to the EIA presented herein:

- 5no. wind turbines, each with a height to blade tip of 136.5 m, a hub height of 78 m, and a rotor diameter of 117 m;
- Control building;
- Substation (21 MW capacity);
- Turbine laydown area;
- Temporary crane hardstanding areas (30 m x 62.5 m);
- 1no. borrow pit;
- Upgrading of existing access track;
- Construction of new access tracks
- Temporary construction compound;
- Underground cabling;
- Anemometer mast; and
- Up to 18 ha of forestry felling.

This Chapter of the EIA Report is supported by the following figures provided in Volume II EIA Report Figures:

- Figure 1.1 – Site Location; and
- Figure 1.2 – Site Boundary Plan.

1.2 BACKGROUND OF THE EIA

Section 172(1) (a) of the Planning Act and Article 93 of the Planning and Development Regulations 2001 (S.I. 600 of 2001)[2] (the Planning Regulations), detail the criteria under which a planning application is required to be accompanied by a EIA Report. According to Schedule 5 Part 2 of the Planning Regulations, an EIA is required for:

> "3. *Energy Industry*
>
> ...
>
> *Installations for the harnessing of wind power for energy production (wind farms) with more than 5 turbines or having a total output greater than 5 megawatts."*

As the Development proposes the construction of 5 turbines and has an output greater than 5 MW, therefore an EIA is required under Schedule 5 Part 2 of the Planning Regulations.

[1] Government of Ireland, (2000), Planning and Development Act, 2000 [Online] Available at: https://www.housing.gov.ie/planning/policy/planning-and-development-act-2000-no-30-2000 (Accessed 27/06/2022)

[2] Government of Ireland (2001), Planning and Development Regulations, 2001 [Online] Available at: http://www.irishstatutebook.ie/eli/2001/si/600/made/en/print (Accessed 27/06/2022)

This EIA Report presents information on the likely significant environmental effects of the Development. The EIA Report also informs the reader of the nature of the Development and the measures proposed to protect the environment during site preparation, construction, operation and decommissioning.

1.3 PLANNING & EIA HISTORY

The land within parts of the Development Site is subject to an extensive planning history.

1.3.1 Original Wind Farm Consent

Kilcarrig Renewable Energy previously submitted a planning application to develop and wind farm on the Site to CCC in June 2011[3]. Consent was granted in December 2012[4]. and covered *"the erection of five wind turbines maximum hub height 90m, maximum blade diameter 93m), one permanent meteorological mast, access road and internal site tracks, electricity sub-station, underground cabling and all associate site works."* (CCC Planning Reference 11/154 / ABP Ref: PL 01.240245). The consent has since been acquired by Boolyvannanan Renewable Energy Limited.

In line with the European Union (EU) EIA Directive 2011/92/EU[5] (which has since been amended by the Directive 2014/52/EU[6]) and the Planning Regulations, the planning application submitted in 2011 was accompanied by an Environmental Impact Statement (EIS). This EIS presented the findings of an EIA undertaken on the proposed preparation, construction, operation and decommissioning phases of the proposed development at that time and included assessment of the following technical areas:

- Human Beings;
- Noise;
- Shadow Flicker;
- Landscape and Visual Impact;
- Ecology;
- Air Quality and Climate;
- Soils, Geology and Peat;
- Hydrology and Hydrogeology;
- Material Assets (Road Traffic and Transport);
- Other Considerations (Tourism, Electromagnetic Interference, Air Navigation, Television and Communication Signals); and
- Cultural Heritage.

The EIS did not identify any significant negative impacts on the environment and as a whole, it was determined that the operation of the proposed development would generate a positive impact for air quality, climate and employment.

Additionally, as part of the Appropriate Assessment (AA) process, a Natura Impact Statement (NIS)[7] was prepared as part of the 2011 planning application to assess the potential impacts of the development on the EU Directive 92/43/EEC (the Habitats Directive)[8] Natura 2000 sites.

[3] Carlow County Council Planning Reference: 11/154
[4] An Bord Pleanala Reference: PL01.240245
[5] European Union (2011) Directive 2011/92/EU [Online] Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32011L0092 (Accessed 27/06/2022)
[6] European Union (2014) Directive 2014/52/EU [Online] Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32014L0052 (Accessed 27/06/2022)
[7] Natura Impact Statement, 31st May 2011, prepared by Conservation Services on behalf of Kilcarrig Renewable Energy
[8] European Union (1992) Council Directive 92/43/EEC [Online] Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:31992L0043 (Accessed 27/06/2022)

1.3.2 Consented Modification

On 26th January 2021, a planning application (Ref: 21/15) was submitted by the Applicant to CCC for:

'Permission for development consisting of alterations to a previously permitted wind farm development (Planning Register References: Carlow County Council 11/154: An Bord Pleanala PL 01.240245) The proposed alteration will consist of increasing the maximum turbine blade diameter of the permitted turbines from 93m up to a maximum of 120m, while maintaining the overall tip height of the permitted development; increasing the size of crane hardstanding area at 4 turbines to 30m x 62.5m; felling of up to an additional 6.3 hectares of onsite forestry to accommodate the proposed increased turbine blade diameter in addition to the permitted felling and an extension of the operation lifetime of the permitted wind farm development from 25 years to 30 years. The application is accompanied by a Planning Report, Environment Impact Assessment Report and Natura Impact Statement.'

The Consented Modification was supported by an EIA Report and NIS and was consented in February 2022[9] following a request for Further Information (FI).

1.3.3 The Consented Wind Farm

The Original Wind Farm Consent, as detailed in Section 1.3.1, and the Consented Modification, as detailed in Section 1.3.2, together form what is considered to be the Consented Wind Farm for the purpose of this Report.

1.3.4 The Consented Grid Route

In June 2020, a Grid Application was submitted by Boolyvannan Renewable Energy Ltd to CCC for a development of the following description:

"Permission for the installation of approximately 4.6 kilometres (km) of underground cables within the Carlow County Council (CCC) boundary and approximately 2.0 km within the Laois County Council (LCC) boundary with a voltage of up to 38 kilovolts and associated works, including a new substation within LCC, for the connection of the consented Bilboa Wind Farm (Planning Register References: Carlow County Council 11/154; An Bord Pleanala PL 01.240245) to the national electricity grid; upgrading of an existing forestry track within CCC; construction of two new onsite access tracks within CCC; re-orientation and increasing in size of a crane hardstanding within CCC; and road strengthening and widening along an updated turbine delivery route, within LCC, pursuant to the consented Bilboa Wind Farm (Planning Register References; Carlow County Council 11/154; An Bord Pleanala PL 01.240245). "(CCC Planning Ref: 11/154 / LCC Planning Ref: 20/281).

The Grid Application was supported by an EIA Report and NIS and was consented in July 2021[10] following a request for Further Information (FI).

1.4 SITE CONTEXT

The Development Site red line boundary (the Site Boundary) extends to an area of approximately 25.2 hectares (ha), as detailed in Figure 1.2: Site Boundary Plan.

The Site is within one local authority, Carlow County Council, and is under private land ownership.

[9] Carlow County Council (2021) Planning application details ref: 2115 Carlow County Council (Online) Available at: [ePlan - Online Planning Details]() (Accessed 27/06/2022)

[10] Carlow County Council (2021) Planning application details ref: 20180 Carlow County Council (Online) Available at: https://www.eplanning.ie/CarlowCC/AppFileRefDetails/20180/0 (Accessed 27/06/2022)

The Site extends across a gentle slope of 0 to 4 degrees and an elevation ranging between 290 m Above Ordnance Datum (AOD) to 300 AOD and currently consists of commercial coniferous forestry, predominantly consisting of Sitka Spruce.

No public roads are located within the Site boundary; however, there are stretches of existing forest track. The southern boundary of the Site runs adjacent to the L7130 public road.

The Development Site lies within the upstream surface water catchment of the River Dinin, a major tributary of the River Nore. There are no watercourses or residential properties located within the Site; however, 25 residential properties can be found within approximately 1 km of the Site boundary, primarily to the north and south.

There are no statutory designations within or adjacent to the Site, specifically no Special Areas of Conservation (SAC); Special Protection Areas (SPA); and Natural Heritage Areas (NHA).

The nearest statutory designation is located downstream of the Development is the River Barrow and River Nore SAC, located approximately 2.3 km west of the Site, which are designated for their valuable habitats and populations of plant and animal species listed in Annex I and II of the European Union (EU) Habitat Directive[11], respectively.

There are also no landscape designations within the Site. The Site is located in a CCC Landscape Character Area ("LCA") classified as 'Killeshin Hills" and a landscape type classified as 'Uplands'. The key characteristics of the Killeshin Hills LCA include its rural character with few settlements and open views and vistas with extensive views across the entire County Carlow.

There are no archaeological or cultural heritage designations within the Site; however, the Bilboa Church of Ireland church which is in the National Inventory of Architectural Heritage (NIAH) is located 1.5 km north the Site.

In terms of recreation and public rights of way, the Slieve-Margy Way, a local level walking route promoted in County Carlow[12], passes through the Development Site at the L7129 public road.

1.5 THE APPLICANT

The Development is being proposed by Boolyvannanan Renewable Energy Ltd, part of the Statkraft group. Statkraft operates 11 wind farms in the UK and the Nordics with a combined installed capacity of up to 1,000MW. Ireland is one of the selected growth markets for wind and solar power, given its significant renewable energy resources, particularly in terms of wind energy. Statkraft is already playing a leading role in the transition to a low carbon future and believe that the company's experience and capabilities will be of service to Ireland in this transition over the coming years.

Statkraft believes that renewable energy projects can bring long lasting benefits, not only to our country and our future generations, but also the local communities in which they are located. Through positive engagement with local communities and the public, Statkraft aim to develop renewable energy projects that are socially and environmentally appropriate and beneficial.

[11] Directive 92/43/EEC [Online] Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:01992L0043-20070101 (Accessed 27/06/2022)

[12] Carlow Tourism. (2020). The Slieve-Margy Way [Online]. Available at: https://carlowtourism.com/the-slieve-margy-way-2/ (Accessed 27/06/2022)

1.6 PROJECT TEAM

This EIA Report has been compiled by Arcus Consultancy Services Limited (Arcus) on behalf of the Applicant, supported by sub-consultants on certain specialist assessments. For each topic, the detailed assessment of likely significant effects has been undertaken by subject matter experts with relevant specialist skills, drawing on their qualifications, and experience of working on other development projects, good practice in EIA and on relevant published information. Table 1.1 lists the subject matter experts who have contributed to the EIA Report.

Table 1.1: Project Team

EIA Report Chapter		**Subject Matter Expert**
1	Introduction	**Arcus** Cameron McAllister BSc (Hons) 2 years And Martin Gillespie MSc, 5 years, MRTPI
2	EIA Methodology	**Arcus** Cameron McAllister BSc (Hons) 2 years And Martin Gillespie MSc, 5 years, MRTPI
3	Legislation, Planning and Energy Policy	**Arcus** Martin Gillespie MSc, 5 years, MRTPI And Karl Kent, MSc, 40 years, registered Architect and Town Planner, Member of the Royal Institute of Architects in Ireland and Member of Irish Planning Institute.
4	Site Selection and Alternatives	**Arcus** Cameron McAllister BSc (Hons) 2 years And Martin Gillespie MSc, 5 years, MRTPI
5	Project Description	**Arcus** Cameron McAllister BSc (Hons) 2 years And Martin Gillespie MSc, 5 years, MRTPI
6	Landscape and Visual Impact Assessment (LVIA)	**Arcus** Clare Horner MLA, 20 years, CMLI
7	Biodiversity	**Fehily Timoney Consultancy** Ben O'Dwyer, BSc (Hons) 4.5years. And Jon Kearney, Msc, MCIEEM, over 10 years.
8	Hydrology and Hydrogeology	**Arcus** Liam Nevins, BSc (Hons) 14 years, MCIWEM, C.WEM
9	Land and Soils	**Arcus** David Ballentyne, BSc (Hons), 18 years
10	Cultural Heritage and Archaeology	**Arcus** Amy McCabe BA MA MCIfA (10 years).
11	Noise and Vibration	**Arcus** Alan Moore, BA (Hons) 11 years, MIOA

		And Martin Stevenson, BSc (Hons), 13 years, MIOA
12	Material Assets – Roads and Traffic	**Arcus** Kenneth Laing, BEng (Hons), 6 years And Tomos Ap Tomos, BEng (Hons), 24 years, MIHT
13	Air Quality and Climate	**Arcus** Cameron McAllister BSc (Hons) 2 years And Martin Gillespie MSc, 5 years, MRTPI
14	Population and Human Health	**Arcus** Cameron McAllister BSc (Hons) 2 years And Martin Gillespie MSc, 5 years, MRTPI
15	Other Considerations	**Arcus** Cameron McAllister BSc (Hons) 2 years And Martin Gillespie MSc, 5 years, MRTPI
16	Interactions and Inter-Relationships	**Arcus** Cameron McAllister BSc (Hons) 2 years And Martin Gillespie MSc, 5 years, MRTPI
17	Summary of Mitigation	**Arcus** Cameron McAllister BSc (Hons) 2 years And Martin Gillespie MSc, 5 years, MRTPI

1.7 STRUCTURE OF EIA REPORT

The EIA Report contains the findings of the assessment of likely environment impacts of the Development and comprises of the following volumes:

- **Volume I – EIA Report Text;**
- **Volume II – EIA Report Figures;**
- **Volume III – EIA Report Technical Appendices;**
- **Volume IV – EIA Non-Technical Summary.**

The EIA Report which is split into 17 separate chapters is presented in Table 1.2 below.

Table 1.2: EIA Report Chapters

Chapter	Description
Chapter 1: Introduction	Provides background information about the Applicant and an overview of the Development.
Chapter 2: EIA Methodology	Provides an overview of the EIA process, its regulatory context and an outline of the methodology used to assess environmental effects and ensure a consistent and transparent approach to assessment. It describes the consultation process that assisted in the identification of likely significant environmental effects to be given further consideration.
Chapter 3: Legislation Planning and Energy Policy	Identifies the energy and land use policy and outlines the need for the Development and its benefits within the context of international climate change agreements and European and Irish renewable energy policy.
Chapter 4: Site Selection and Alternatives	Provides details of the site selection exercise and alternative layouts that were considered within the design evolution process.
Chapter 5: Project Description	Provides a detailed description of the Development including details of the construction, operational and decommissioning arrangements.
Chapter 6 -16: Technical EIAR Chapters	Each technical chapter as shown in Table 1.1 will provide a description of the baseline environmental conditions specific to the relevant topic and will assess the potential environmental impacts (positive or negative) due to the Development in line with the EIA methodology. This will include a description of any proposed mitigation or enhancement measures and a statement of predicted residual impacts.
Chapter 17: Summary of Mitigation	Provides a summary of the findings of the EIA, including a tabular summary of all residual effects and proposed mitigation.

2 EIA METHODOLOGY

2.1 INTRODUCTION

Environmental Impact Assessment (EIA) is a process which aims to ensure that planning permission for particular types of development is only granted following assessment of the likely significant environmental effects. In accordance with best practice, the assessment should be carried out following consultation with statutory consultees, other interested bodies and members of the public.

This Chapter of the EIA Report describes the EIA process undertaken for the Development and is supported by the following Technical Appendices provided in Volume III: EIA Report Technical Appendices:

- Technical Appendix A2.1: Consultation Responses.

2.2 REQUIREMENT FOR AN EIA AND RELEVANT LEGISLATION / GUIDANCE

2.2.1 Legislation and the Need for an EIA

EIAs are undertaken in response to the requirements of the European Union (EU) Directive 2014/52/EU[1] (the EIA Directive), which amends Directive 2011/92/EU[2], on the assessment of the effects of certain public and private developments on the environment. The enabling Statutory Instruments (S.I.) which transpose the EIA Directive into Irish law are the European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018 (S.I. 296/2018)[3]; the Planning and Development Act 2000[4], as amended (the Planning Act); and Planning and Development Regulations 2001 (S.I. 600 of 2001)[5], as amended (the Planning Regulations). These regulations, when combined alongside the EPA 'Guidelines on the Information to be Contained in Environmental Impact Assessment Reports' 2022[6], form the EIA Regulations applicable to the Development. The EIA Regulations outline the classes of projects subject to EIA and the statutory format and content of an EIA Report.

Section 172(1) of the Planning Act and Article 93 of the Planning Regulations detail the criteria under which a planning application is required to be supported by an EIA Report.

According to Schedule 5 Part 2 of the Planning Regulations, an EIA is required for:

"3. Energy Industry

...

Installations for the harnessing of wind power for energy production (wind farms) with more than 5 turbines or having a total output greater than 5 megawatts."

[1] European Commission (2014) Directive 2014/52/EU [Online] Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32014L0052&from=EN (Accessed 27/06/2022)
[2] European Commission (2011) Directive 2011/92/EU [Online] Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32011L0092&from=EN (Accessed 27/06/2022)
[3] Government of Ireland (2018) European Union (Planning and Development) (Environmental Impact Assessment) Regulations [Online] Available at: http://www.irishstatutebook.ie/eli/2018/si/296/made/en/print (Accessed 27/06/2022)
[4] Government of Ireland, (2000), Planning and Development Act, 2000 [Online] Available at: https://www.housing.gov.ie/planning/policy/planning-and-development-act-2000-no-30-2000 (Accessed 27/06/2022)
[5] Government of Ireland (2001), Planning and Development Regulations, 2001 [Online] Available at: http://www.irishstatutebook.ie/eli/2001/si/600/made/en/print (Accessed 27/06/2022)
[6] Environmental Protection Agency (2022) Guidelines on the Information to be Contained in Environmental Impact Assessment Reports [Online] Available at: https://www.epa.ie/publications/monitoring--assessment/assessment/EIAR_Guidelines_2022_Web.pdf (Accessed 27/06/2022)

Accordingly, an Environmental Impact Statement (EIS) was prepared for the Consented Wind Farm in accordance with Section 172(1)(a) of the Planning Act and Schedule 5 of the Planning Regulations. Following the submission of the EIS and its supporting documents, CCC responded seeking further detail on a number of aspects. Further Information (FI)[7] was then submitted to CCC prior to the positive determination of the application in February 2012. The permission was then appealed by third party right, and the planning permission was granted by An Bord Pleanála (ABP) in December 2012[8].

As detailed in Section 2.1, the Development will result in an increase to the total output of the Consented Wind Farm to approximately 22.5 MW, dependent on the final turbine selection. As the Development will result in the Consented Wind Farm having an output greater than 5 MW, as per Schedule 5, Part 2 of the Planning Regulations, in the interests of best practice and providing a comprehensive assessment for all relevant environmental considerations, the Application for the Development is supported by this holistic EIA Report.

2.2.2 Case Law and Cumulative Assessment

This EIA Report takes cognisance of relevant case law, particularly the O'Grianna v An Bord Pleanála High Court judgment[9] (the O'Grianna Judgment) which transpired post-consent of the Consented Wind Farm. The O'Grianna Judgement considers the cumulative effect in the context of splitting a wind farm development into on-site infrastructure (i.e. turbines) and grid connection.

The O'Grianna judgement is considered in the Environmental Protection Agency's (EPA) draft EIA guidelines[10]:

> *"In O'Grianna v An Bord Pleanála (IEHC 632, 12/12/2014) the High Court quashed the decision of the Bord granting planning permission for a wind farm in County Cork on 'project splitting' grounds The developer maintained that the EIS could not consider the effects of the connection of the wind farm to the national grid as that design was not available and would be undertaken subsequently by ESB Networks. The Bord accepted this position and clarified that the grid connection was not covered by its permission to develop the wind farm.*
>
> *The Court held that grid connection was an integral part of the development and could not be considered as a separate project.*
>
> *'The wind turbine development on its own serves no function if it cannot be connected to the national grid. In that way, the connection to the national grid is fundamental to the entire project, and in principle at least the cumulative effect of both must be assessed in order to comply with the directive."*

In June 2020, a planning application was submitted to CCC and Laois County Council (LCC) for a development of the following description: *"Permission for the installation of approximately 4.6 kilometres (km) of underground cables within the Carlow County Council (CCC) boundary and approximately 2.0 km within the Laois County Council (LCC) boundary with a voltage of up to 38 kilovolts and associated works, including a new substation within LCC, for the connection of the consented Bilboa Wind Farm (Planning*

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7 Further Information Report, 15th September 2011, prepared by Renewable Power Generation on behalf of Kilcarrig Renewable Energy
8 An Bord Pleanala Reference: PL01.240245
9 Courts Service of Ireland (2014) O Grianna & ors -v- An Bord Pleanála [2014] IEHC 632 (Online) Available at: http://courts.ie/Judgments.nsf/09859e7a3f34669680256ef3004a27de/71409d20df97079280257ddc004f8721?OpenDocument (Accessed 27/06/2022)
10 Environmental Protection Agency (2017) *Guidelines on the Information to be Contained in Environmental Impact Assessment Reports* [Online] Available at: https://www.epa.ie/pubs/advice/ea/EPA%20EIAR%20Guidelines.pdf (Accessed 27/06/2022)

Register References: Carlow County Council 11/154; An Bord Pleanala PL 01.240245) to the national electricity grid; upgrading of an existing forestry track within CCC; construction of two new onsite access tracks within CCC; re-orientation and increasing in size of a crane hardstanding within CCC; and road strengthening and widening along an updated turbine delivery route, within LCC, pursuant to the consented Bilboa Wind Farm (Planning Register References; Carlow County Council 11/154; An Bord Pleanala PL 01.240245). The application is accompanied by a Planning Report, Environmental Impact Assessment Report and Natura Impact Statement ", (the Consented Grid Route) (CCC Planning Ref: 20/180 / LCC Planning Ref: 20/281).

The Grid Application required to connect the Consented Wind Farm to the national grid to allow for the export of renewable electricity generated. Accordingly, an EIA Report was prepared for the Grid Application, as although there are no threshold criteria for the requirement of the Grid Application to be supported by an EIA in of itself, it forms an integral part of the Consented Wind Farm which did require an EIA. The Grid Application was consented in July 2021, following a request for Further Information (FI)[11] [12].

In the interests of best practice and providing a comprehensive assessment for all relevant environmental considerations, the planning application for the Development is supported by this EIA Report which assesses the impacts of the Development and any cumulative impacts of the Development with the Consented Wind Farm, the Grid Application and any other developments as appropriate.

2.2.3 Preparation of this EIA Report

Schedule 6 of the Planning Regulations details what an EIA Report must contain. The results of the EIA are presented in this EIA Report, which, as prescribed in Section 2(c) of Schedule 6 within the Planning Regulations, is required to include a "a description of the likely significant effects" of the Development; the effects which are not considered to be significant do not need to be described.

The scope of the EIA must be appropriately and clearly defined to ensure that any likely significant effects are defined, described and assessed.

The preparation and production of this EIA Report has been conducted in accordance with relevant regulations and good practice guidance. Relevant legislation, policy and guidance are referred to in each of the technical assessments within the EIA Report. Overarching regulation, policy and guidance documents which have been used in preparing this EIA Report are:

- The EIA Directive;
- The EIA Regulations;
- Department of Housing, Planning and Local Government 'Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment" 2018[13];
- European Commission's 'Environmental Impact Assessment of Projects - Guidance on the preparation of the Environmental Impact Assessment Report (Directive 2011/92/EU as amended by 2014/52/EU)', 2017[14]; and

[11] Carlow County Council (2022) Planning application details ref: 20180 Carlow County Council [Online] Available at: https://www.eplanning.ie/CarlowCC/AppFileRefDetails/20180/0 (Accessed 14/07/2022)
[12] Laois County Council (2022) Planning application details ref: 20282 Laois County Council [Online] Available at: https://www.eplanning.ie/LaoisCC/AppFileRefDetails/20281/0 (Accessed 14/07/2022)
[13] Department of Housing, Planning and Local Government (2018) Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment [Online] Available at: https://www.housing.gov.ie/sites/default/files/publications/files/guidelines_for_planning_authorities_and_an_bord_pleanala_on_carrying_out_eia_-_august_2018.pdf (Accessed 27/06/2022)
[14] European Commission (2017) Environmental Impact Assessment of Projects - Guidance on the preparation of the Environmental Impact Assessment Report (Directive 2011/92/EU as amended by 2014/52/EU) [Online]

- IEMA's 'Environmental Impact Assessment Guide to: Delivering Quality Development', 2016[15].

In addition to the legislation, policy and guidance above, the EIA Report will be prepared with cognisance to the "Wind Energy Development Guidelines for Planning Authorities (2006)", the proposed draft revisions to these guidelines (December 2013), and the Preferred Draft Approach to these guidelines as announced by the Government of Ireland in June 2017[16].

Additionally, in December 2019, the Draft Revised Wind Energy Development Guidelines[17] were published. Although these Draft Guidelines are in the preliminary stages and will likely be amended prior to finalisation, the EIA Report will take substantial consideration of them; specifically, when considering effects of the infrastructure changes within the Consented Wind Farm, and any cumulative effects related to the Development and the Consented Wind Farm.

2.3 EIA METHODOLOGY

The EIA Report has been prepared following a systematic approach to EIA and project design. The process of distinguishing environmental effects is iterative and cyclical, running concurrently with the design process, whereby the design of the Development is refined in order to avoid or reduce potential adverse environmental effects using mitigation as necessary.

The EIA process follows a number of stages broadly in line with the following:

- Screening;
- Scoping;
- Consideration of Alternatives;
- Project Description;
- Description of Receiving Environment;
- Identification and Assessment of Impacts;
- Mitigation and Monitoring Proposals;
- Scrutiny and Consent;
- Enforcement and Monitoring.

Section 4 of the 2022 EIA Report Guidelines highlight that an EIA Report should include a range of information including: a description of the development (Chapter 5: Project Description), a description of 'reasonable alternatives' (Chapter 4: Site Selection and Alternatives), baseline information, a description of the likely significant effects of the development, and mitigation measures amongst other factors (Chapters 6 – 16).

This EIA Report has been prepared in accordance with the EIA Regulations and includes the required information.

Available at: https://ec.europa.eu/environment/eia/pdf/EIA_guidance_EIA_report_final.pdf (Accessed 27/06/2022)

[15] IEMA (2016) Environmental Impact Assessment Guide to: Delivering Quality Development [Online] Available at: https://www.iema.net/assets/newbuild/documents/Delivering%20Quality%20Development.pdf (Accessed 27/06/2022)

[16] Department of Communications, Climate Change & Environment (2017) Information Note: Review of the Wind Energy Development Guideline 2006 – "Preferred Draft Approach" [Online] Available at: https://uk-ireland.rwe.com/-/media/RWE/documents/03-unser-portfolio-und-loesungen/innovation-und-technik/projektvorhaben/lyre/preferred-draft-approach-to-wind-energy-guidelines.pdf (Accessed 27/06/2022)

[17] Department of Housing, Planning and Local Government (2019) Draft Revised Wind Energy Development Guidelines [Online] Available at: https://www.gov.ie/en/publication/9d0f66-draft-revised-wind-energy-development-guidelines-december-2019/ (Accessed 27/06/2022)

2.4 CONSULTATION

2.4.1 General Considerations

Consultation has formed an essential part of the EIA. Consultation has principally been based on the following topics:

- Initial consultation – Procuring initial feedback on the Development and Documentation and agreement of EIA scope and methodologies from statutory and non-statutory consultees, including the local authority CCC;
- Technical Assessments - Gathering baseline information from relevant organisations and confirming survey methodologies; and
- Mitigation and Enhancement - Discussing opportunities for mitigation and improvement with statutory and non-statutory consultees.

With the Development comprising entirely of the infrastructure components which have already previously been consented, additional scoping has not been undertaken.

2.4.2 Consultation with Local Community for 2011 EIS and Consideration of Comments

To inform on the scope of the EIS for the original planning application, a Public Information Evening was held by Renewable Power Generation in conjunction with Kilcarrig Renewable Energy at Ballinabranagh GAA Hall on Thursday 31st of March 2011. This meeting allowed the local community to comment upon and to have an input into the planning and design of the proposed Bilboa Wind Farm.

An invitation to the event, along with information on the Development, was delivered to all households within the environs of the proposed wind farm in March 2011. An advertisement for the Information Evening was placed in The Nationalist, published on the 29/03/2011. An advertisement of the information evening was also broadcast on local radio station CKLR FM on the Tuesday (29/03/2011) preceding the event. Members of staff from Renewable Power Generation and Kilcarrig Renewable Energy were present to address any questions and comments on the proposed development from the general public. The key issues raised by the local community were noted and addressed within the original EIS.

These issues were once again considered within the scope of the EIA Report for the Consented Modification, and any impact that the rotor increase could potentially have on local residents was assessed for each item previously raised. The scope of the Original Wind Farm comments in combination with the Consented Modification is inclusive of all components of the Application.

Table 2.1 lists all of the key concerns and how they were originally addressed, as well as the potential impact of the increased rotor diameter and how these subsequent impacts were addressed within the EIS.

Table 2.1: Comments Raised During Community Consultation

Issue Raised	Comment in 2011 EIS	Consideration of Change of Impact from Rotor Modification	Cumulative Consideration
Turbary Rights	A number of attendees expressed concerns that the proposed wind farm would interfere with their turbary rights. The EIS consultant confirmed that the proposed	There is no change to the conclusions, and the commitment that turbary rights will not be interfered with remains in place.	There is no anticipated interference with turbary rights as a result of the Bilboa Wind Farm.

Issue Raised	Comment in 2011 EIS	Consideration of Change of Impact from Rotor Modification	Cumulative Consideration
	construction footprint will not conflict with any of the areas where the claimed turbary rights exist. It was explained that Kilcarrig Renewable Energy would explore any turbary rights on the site and ensure that these are not interfered with.		
Grid Connection	A number of attendees had questions regarding whether the proposed Bilboa project had been offered a grid connection, and how it would be connected to the grid.	The Grid Application was submitted in 2020 (CCC Planning Ref: 20/180 / LCC Planning Ref: 20/281) and consented by CCC and LCC in July 2021.	The consented grid route (CCC Planning Ref: 20/180 / LCC Planing Ref: 20/181) would be used for the Bilboa Wind Farm.
ESB Works	A number of attendees had questions regarding whether the ESB have rights to lay cables across private land. It was explained that the ESB do have these rights, but in any instance of this the ESB would first consult with the landholder, and also offer compensation for works involved. Generally, the laying of cables across private lands is not necessary.	No change as a result of the Rotor Modification.	No change from the 2011 consultation.
Possibility of Extension of Proposed Wind Farm	A number of attendees had questions regarding whether the proposed Bilboa project had the potential of a future extension. No future extension to the proposed Bilboa Wind Farm is planned.	No change; no expansion is proposed by the Applicant.	No change; no expansion is proposed by the Applicant.
Turbine Layout	A number of attendees had questions regarding the layout of the turbines, why they were not arranged in a uniform fashion, and why there were not more turbines on site. The consultant explained that due to the nature of the site and the constraints	No change; there has been no change to the turbine layout.	No change; there has been no change to the turbine layout.

Issue Raised	Comment in 2011 EIS	Consideration of Change of Impact from Rotor Modification	Cumulative Consideration
	involved (such as separation distances from houses and other turbines), the current layout was the optimal layout for the Bilboa site, offering the best balance between wind take and satisfying the environmental considerations outlined in the Wind Energy Development Guidelines (DoEHLG 2006).		
Wind Measurement	A number of attendees had questions regarding wind measurement on site, and why it was not undertaken before the planning permission was lodged. It was explained that a high level study of wind speeds had been undertaken using the Sustainable Energy Authority Ireland Wind Energy Atlas (2003), and as such the consultants were satisfied that wind speeds are more than sufficient on site for the successful operation of a wind farm on the site. It was explained that a wind anemometry mast will be installed on site, subject to planning permission, before the turbines are erected in order to gather detailed information regarding wind speeds on site.	A 2-year wind measurement campaign has been completed utilising a temporary anemometry mast as was originally planned. The temporary mast is to be decommissioned and moved from the site by late 2022.	No change.
Noise Issues	A number of attendees described a mechanical noise occurring from the operation of the nearby Gortahile wind farm, that seemed in particular to be coming from one turbine. The consultant advised the attendees to contact both the Environmental Office of Laois County Council, and also the	Chapter 11 of the Rotor Modification EIA Report and Section 3.6 of the FI Report re-assessed the proposed candidate turbine against the noise levels, and confirm that the Development is compliant with WEDG06 Noise Limits, both individually and cumulatively. No change as a result of the Rotor Modification.	Chapter 11 of the accompanying Wind Farm EIA Report assesses the effects of construction, operation and decommissioning noise, both individually and cumulatively. There is no change to the previous conclusions of acceptable noise levels.

Issue Raised	Comment in 2011 EIS	Consideration of Change of Impact from Rotor Modification	Cumulative Consideration
	developer of the Gortahile wind farm. In relation to the potential for noise from new turbines, it was explained that the Bilboa wind farm is fully compliant with the permitted noise emission levels for wind farms as detailed within the Wind Energy Development Guidelines (DoEHLG 2006). Drawings were on display showing details of all noise contours that will occur from the operation of the proposed Bilboa wind farm, and predicted noise levels at each property within 1km of the development site. It was also demonstrated by means of noise contour drawings that there will be no cumulative impact with the Gortahile wind farm in terms of noise. Chapter 5 of the 2011 EIS deals with the Noise issues associated with the operation of the proposed Bilboa wind farm.		
Visual Impact	A number of attendees had questions regarding what the turbines would look like in the surrounding landscape, and also where would they be visible from. The visual impact of turbines was demonstrated by means of photomontages, and cumulative zones of visual impact were present on the night and these were talked through and explained. Attention was drawn to the fact that the site is in one of only three preferred areas for	Chapter 6 of the Rotor Modification EIA Report and Section 4.1 of the FI Report assessed the proposed candidate turbine against the Turbine Delivery Route, with no significant effects identified. Updated visualisations were provided.	Chapter 6 of the accompanying Wind Farm EIA Report assesses the landscape and visual effects, both individually and cumulatively. There is no change to the previous conclusions of acceptable landscape and visual impact.

Issue Raised	Comment in 2011 EIS	Consideration of Change of Impact from Rotor Modification	Cumulative Consideration
	wind development in the county. Chapter 7 of the 2011 EIS deals with all the visual issues associated with the development of the proposed Bilboa wind farm.		
Transport Route and Access Roads	A number of attendees had questions relating to the transport route for the delivery of the turbines, and also if the local road network would be closed to facilitate the delivery of the turbines. It was explained that a detailed transport route assessment for the turbines has been undertaken, and no road closures would result from the delivery of the turbines. Chapter 12 of the 2011 EIS deals with all the transport issues associated with the development of the proposed Bilboa wind farm.	The Grid Application was submitted in 2020 (CCC Planning Ref: 20/180 / LCC Planning Ref: 20/281) and consented by CCC and LCC in July 2021. This application re-evaluated an alternative turbine route which was subsequently approved. Chapter 12 of the Rotor Modification EIA Report and Section 3.7 of this FI Report assess the proposed candidate turbine against the Turbine Delivery Route, with no significant effects identified. The proposed Traffic Management Plan, which will be in place during construction of the Development, is included as part of the CEMP e.g. Appendix A1 of this FI Report.	No change from the Consented Modification.
Submissions on Planning Permission	A number of attendees had questions regarding how to make a comment or observation on the planning application. It was explained that anyone in Ireland has the right to see a planning application made to a local authority and also have the right to make a written submission or observation on the application providing that the submission or observation is made within 5 weeks of the date of receipt of the planning application by Carlow County Council.	The protocol remained the same for the application for the Rotor Modification. No change.	The protocol remains the same for the application for the Bilboa Wind Farm. No change.

Issue Raised	Comment in 2011 EIS	Consideration of Change of Impact from Rotor Modification	Cumulative Consideration
On Site Quarrying	A number of attendees wanted to know if extraction of rock would take place from the site during development works for the proposed wind farm, or if any quarrying in general would be taking place on site. It was explained that stone for the project will be won on site by means of a borrow pit. This EIS and planning application will state and will welcome a planning condition that states that all construction material won on site will be used on site and no export of construction material will take place. Chapter 10 of the 2011 EIS deals with all the rock extraction issues associated with the development of the proposed Bilboa wind farm.	No change as a result of the Rotor Modification; the borrow pit size and location remains the same.	No change as a result of the Bilboa Wind Farm Application; the borrow pit size and location remains the same.
Impacts on Ecology	A number of attendees had concerns regarding the impact of the wind farm on local wildlife. It was explained that a full ecological survey had been undertaken on site, including potential impacts of the wind farm all flora and fauna, birds, bats and aquatic ecology. Chapter 8 of the 2011 EIS deals with all the Ecology issues associated with the development of the proposed Bilboa Wind Farm.	Chapter 7 of the Rotor Modification EIA Report and Sections 3.3 and 3.12 of the subsequent FI Report updated and re-assessed the effects of the Development, including Grid Connection, on local ecology. No significant effects have been identified, which is consistent with the 2011 EIS. As a result, there is no change from the Rotor Modification.	Ecological impact is assessed in Chapter 7 of the accompanying EIA Report. There is no change to the previously identified conclusion that no significant effects have been identified.
Stability of Peat on Site	A number of attendees had questions relating to the suitability of the site for a wind energy development in terms of peat stability. It was explained that a full	Chapter 9 of the Rotor Modification EIA Report and Section 3.5 of the subsequent FI Report updated and re-assessed the effects of the Development, including Grid Connection,	Impact on land and soils is assessed in Chapter 9 of the accompanying EIA Report. There is no change to the previously identified conclusion that no

Issue Raised	Comment in 2011 EIS	Consideration of Change of Impact from Rotor Modification	Cumulative Consideration
	peat stability study has been undertaken, and the turbines sited accordingly. Chapter 10 of this EIS deals with all the Soils, Peat and Geological issues associated with the development of the proposed Bilbao wind farm.	on peat including peat stability. No significant effects have been identified, which is consistent with the 2011 EIS. As a result, there is no change from the Rotor Modification.	significant effects have been identified.
Existing Planning Application	A number of attendees had questions regarding the planning application (active at the time of the community information evening) for a quarry on the development site. (PP10/329). The consultant confirmed that a quarry and a wind farm development together on site would not be feasible. This planning permission for a quarry on site has since been withdrawn.	No change; the quarry application has not been progressed.	No change; the quarry application has not been progressed.
Existing Rights of Way	A number of attendees had concerns relating to the restriction for access for walking within site along any existing rights of way. It was explained that Kilcarrig Quarries would explore any existing rights of ways on site and ensure that these are not interfered with.	No change as a result of the Rotor Modification.	No change as a result of the proposed Bilboa Wind Farm.
Radio and Television Signals	A number of attendees had concerns relating to the potential for impact of the wind farm on television and radio signals in the locality. It was explained that a protocol document will be signed between Kilcarrig Renewable Energy and RTÉ pledging to fix any problems generated by the wind farm with regard to television signal. The planned implementation of digital television	No change as a result of the Rotor Modification.	No change as a result of the proposed Bilboa Wind Farm.

Issue Raised	Comment in 2011 EIS	Consideration of Change of Impact from Rotor Modification	Cumulative Consideration
	services will remove most issues associated with interference to television signals caused by the operation of wind farms.		
Local Employment	A number of attendees had questions relating to the possibility of local employment being generated from the development. It was explained that local employment at construction stage will be encouraged and will be one of the determining factors in terms of appointing contractors Chapter 4 of the EIS deals with all Socio-Economic issues associated with the development of the proposed Bilboa wind farm.	No change as a result of the Rotor Modification.	No change as a result of the proposed Bilboa Wind Farm.
Community Fund & Benefits to the Local Community	A number of attendees questioned whether a community fund would be established to benefit the community. An annual contribution to St. Vincent de Paul earmarked for the local community will be paid annually from the project. It was also mentioned that the project would generate considerable rates for the county	Statkraft will put a community benefit fund in place. Where developed under RESS, the terms and conditions would be followed, which would include a €2/MWh contribution would be made to the community fund. This equates to approximately €129,000 per annum. This funding would be used to deliver direct benefit to the local communities including local groups and organisations.	Statkraft will put a community benefit fund in place. Where developed under RESS, the terms and conditions would be followed, which would include a €2/MWh contribution would be made to the community fund. This equates to approximately €129,000 per annum. This funding would be used to deliver direct benefit to the local communities including local groups and organisations.

2.4.3 Further Engagement with the Local Community

Since acquiring the Development, the Applicant has maintained a presence in the area to continue to provide updates to the local residents. Rengen Power, in conjunction with Statkraft's in-house Community Liaison team, have endeavoured to make themselves available to any members of the local community to discuss the projects and address any queries and concerns raised.

A brief timeline of the interactions is summarised below:

- Febuary 2020: the Applicant met with local landowners on turbine delivery and grid route;

- July 2020: The Applicant met with Bilboa Community Group on Gortahile. The discussion also included providing detail on the proposed rotor modification and grid route;
- July 2020: The Applicant spoke with local school principal regarding Gortahile. The discussion also included providing detail on the proposed rotor modification and grid route; and
- May 2021- July 2021: The Applicant met with individuals in the local area, including those who had lodged submissions on the previous planning application.

A project website (www.bilboawindfarm.ie) was established for the Development, which went live in April 2019, several months in advance of any of the forthcoming applications. The purpose of the website is to provide the public and all stakeholders with an up-to-date platform where information on the Development is contained. The website provides current details of the Development and, via the engagement listed above, members of the local community were directed by the Applicant and Rengen Power to the website to review the information in their own time.

In addition to providing project updates, the website is used to provide context for the project, an educational section to develop a greater understanding of the issues being faced, how these issues can be addressed and the need for renewable energy development. The website also provides project information and information on the consultation approach. The website will evolve with the Development and continue to provide a source of updated concise information as the project progresses.

2.5 TECHNICAL ASSESSMENTS

Each of the technical assessments contained in Chapters 6 to 16 of this EIA Report follows a systematic approach with the main steps as follows:

- Introduction, assessment methodology and significance criteria;
- Key Conclusions of EIS & FI;
- Description of the Baseline Conditions;
- Assessment of Potential effects;
- Mitigation and Residual Effects;
- Cumulative Effects Assessment;
- Summary of Effects; and
- Statement of Significance.

A summary of each step is highlighted below.

2.5.1 Introduction, Assessment Methodology and Significance Criteria

Each technical assessment sets out the relevant legislation, policy and guidance together with scope and methodology used to carry out the assessment of potential effects, including the criteria that are used to establish which effects are significant. The methodology seeks to ensure transparency in the assessment. Each technical assessment sets out the criteria for assessing significance. The significance criteria follows that which is defined in Table 3.4 and Figure 3.4 within the EPA 'Guidelines on the Information to be Contained in Environmental Impact Assessment Reports' 2022. Where a level of significance is attributed to an effect, this is based on technical guidance and professional judgement informed by consideration of the sensitivity of the receptor and the magnitude of change.

This Section also sets out the pre-application consultation responses that form the framework and scope of the specialist assessment.

2.5.2 Description of Baseline Conditions

In order to evaluate the potential environmental effects, the existing environmental conditions were recorded through field and desktop research. Prior to the fieldwork studies, desktop studies were undertaken to gain a preliminary understanding of the study area. This is detailed in the corresponding chapters of this EIA Report, where relevant. Where appropriate and required, site-specific baseline field surveys were undertaken by experienced professionals to provide an understanding of the current condition of the Development Site and the surrounding area. The results of the desk-based analysis and site surveys, undertaken where appropriate, form the current baseline for individual technical receptors.

In addition, the EIA Regulations require an outline of the projected future baseline i.e. the evolution of the baseline in absence of the project, where this "… *can be assessed with reasonable effort on the basis of the availability of relevant information and scientific knowledge"*[18]*.* As predictions can involve a high number of variables and be subject to large uncertainties, in some cases, the current baseline condition is assumed to remain unchanged throughout the timeframe of the Development.

The baseline has been used to assess the sensitivity of receptors within the study areas. The approach to describing baseline conditions is set out in each relevant technical chapter.

Baseline information is used to inform the layout of the Development. From baseline information, constraints were identified which were considered as part of the design process. Further detail on the design process adopted for the Development is detailed in **Chapter 4: Site Selection and Alternatives** and **Chapter 5: Project Description**.

2.5.3 Assessment of Potential Effects

The prediction of potential significant effects covers the three phases of the Development; construction, operation and decommissioning, as different environmental effects are likely to arise during the different stages. The effects during construction and decommissioning are generally considered to be short term effects, while those arising as a result of the operation of the Development are generally considered to be long term effects. Each technical assessment considers the nature of effects and includes cumulative effects with other developments where appropriate.

Following identification of potential environmental effects, the baseline information is used to predict changes to the existing environmental and biodiversity conditions, and conduct an assessment of these changes along with the design of mitigation measures.

The significance of effects resulting from the Development will be determined through a combination of the sensitivity of the receiving environment (the sensitivity) and the predicted degree of change (the magnitude) from the baseline state.

2.5.3.1 Sensitivity of Receptors

Environmental sensitivity may be categorised by multiple factors, such as the presence of rare or endangered species, transformation of natural landscapes, soil quality and land-use etc. The initial assessment and consultation stages identified these factors along with the implications of the predicted changes.

The sensitivity classification of the receiving environment varies between the different technical areas of assessment e.g. ecology, noise etc. Table 2.2 details a general framework for determining the sensitivity of receptors, however each technical

[18] Government of Ireland (2018) European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018 [Online] Available at: http://www.irishstatutebook.ie/eli/2018/si/296/made/en/pdf (Accessed 01/06/2022)

assessment will specify their own appropriate sensitivity criteria that will be applied during the EIA and details will be provided in each technical chapter.

Table 2.2: Framework for Determining Sensitivity of Receptors

Sensitivity of Receptor	Definition
High	The receptor has little ability to absorb change without fundamentally altering its present character, is of high environmental value, or of national importance.
Medium	The receptor has moderate capacity to absorb change without significantly altering its present character, has some environmental value, or is of regional importance.
Low	The receptor is tolerant of change without detriment to its character, is low environmental value, or local importance.
Negligible	The receptor is resistant to change and is of little environmental value.

2.5.3.2 Magnitude of Change

As detailed in the Environmental Protection Agency's (EPA) '*Guidelines on the information to be contained in Environmental Impact Assessment Reports*' 2022[19], an assessment of the likely impacts of a proposed development is a statutory requirement of the EIA Process.

For the purposes of environmental assessment, the magnitude of a 'change' is generally dependent on the degree to which the change affects the feature or asset, from a fundamental, permanent or irreversible change that changes the character of the feature or asset, to barely perceptible changes that may be reversible. Magnitude should encompass character, extent, duration, probability and consequences, as well as also encompassing the certainty of whether an impact would occur. General criteria for assessing the magnitude of an effect are presented in Table 2.3. Each technical assessment will apply their own appropriate magnitude of change criteria during the EIA, with the details provided in the relevant EIA chapter.

Table 2.3: Framework for Determining Magnitude of Change

Magnitude of Change	Definition
High	A fundamental change to the baseline condition of the asset, leading to a major alteration of character.
Medium	A material, partial loss or alteration of character.
Low	A slight, detectable, alteration of the baseline condition of the asset.
Negligible	A barely distinguishable change from baseline conditions.

If change of zero magnitude (i.e. none / no change) is identified, this will be made clear in the assessment.

2.5.3.3 Significant Effects

The sensitivity of the asset and magnitude of the predicted change will be used as a guide, in addition to professional judgement, to assess the level of effects, and whether

[19] Environmental Protection Agency (2022) Guidelines on the information to be contained in Environmental Impact Assessment Reports [Online] Available at: https://www.epa.ie/publications/monitoring--assessment/assessment/EIAR_Guidelines_2022_Web.pdf (Accessed 27/06/2022)

these can be considered to be 'significant'. Table 2.4 summarises guideline criteria for assessing and identifying whether an effect is significant or not as per the EIA Regulations.

Table 2.4: Framework for Assessment of the Significant Effects

Magnitude of Change	**Sensitivity of Resource or Receptor**			
	High	**Medium**	**Low**	**Negligible**
High	Profound – Very Significant	Significant - Moderate	Moderate - Slight	Slight - Imperceptible
Medium	Significant - Moderate	Moderate	Slight	Imperceptible
Low	Moderate - Slight	Slight	Slight – Not Significant	Imperceptible
Negligible	Slight - Imperceptible	Imperceptible	Imperceptible	Imperceptible

Profound or substantial effects are considered to be 'significant' in the context of the EIA Regulations detailed in Section 2.2, and are shaded in light grey in the above table.

Zero magnitude effects upon a receptor will result in no effect, regardless of sensitivity.

This EIA Report generally follows the above principles in relation to the identification of significant effects; however, some technical assessments may adopt a variation process. The assessment criteria used to determine effects and whether they are significant are made explicit in each technical assessment chapter within this EIA Report.

2.5.4 Mitigation Measures and Residual Effects

The IEMA EIA Guide to Delivering Quality Development Report[20] demonstrates that EIA is an iterative process rather than a unique, post-design, environmental appraisal. In adopting this approach, the findings of the technical environmental studies used to inform the design of the project, and hence achieve a 'best fit' with the environment. This approach has been adopted in respect of the Development; where potentially significant effects have been identified, their avoidance or minimisation has been prioritised at the design stage. This is referred to within this EIA Report as 'embedded design', i.e. mitigation that is embedded within the project design, and includes best practice as well as design features.

In line with the mitigation hierarchy identified in EPA's '*Guidelines on the Information to be contained in Environmental Impact Statements*', the strategy of avoidance, prevention, reduction, and offsetting is a hierarchical one. The guidelines state:

"The efficacy of each is related to the stage in the design process at which environmental considerations are taken into account. Effects avoidance is most applicable at the earliest stages, while prevention may be provided up to a much later stage. Measures such as offsetting should only be considered as a last resort if they may be the only option available, for example where projects cannot avoid, prevent or reduce significant effects due to their need to locate on a particular site."

Appropriate mitigation measures are discussed within each technical chapter as relevant.

[20] IEMA (2016) Environmental Impact Assessment Guide to: Delivering Quality Development [Online] Available at: https://www.iema.net/assets/newbuild/documents/Delivering%20Quality%20Development.pdf (Accessed 27/06/2022)

2.5.5 Cumulative Effects Assessment

In accordance with the EIA Regulations detailed in Section 2.2, the assessment has considered cumulative effects. By definition, these are effects that result from incremental changes caused by past, present or reasonably foreseeable developments together with the Development being assessed. For the cumulative assessment, the combined effects of several developments that may on an individual basis be not significant but cumulatively, have a significant effect, such as landscape and visual effects, have been considered.

Cumulative assessment addresses the combined effects from the addition of the Development to a baseline of identified developments, including grid connection routes, on all technical chapters.

Other developments which may come forward in the future, but which do not currently have sufficient information available in relation to their likely effects to make an informed cumulative assessment, are not considered in detail in this EIA Report.

The extent of any cumulative assessment is defined in each technical assessment chapter and can include the Consented Wind Farm and other forms of development. This will ensure the requirements presented in the O'Grianna Judgement are upheld by ensuring the Development and the Consented Grid Route are considered collectively.

Consideration of cumulative effects has been undertaken for all technical assessments. Where no cumulative effects are likely, this is stated. In relation to some of the technical chapters, specific guidance and policy exists advising that effects associated with existing developments should be considered as cumulative effects. Where relevant, these are noted within each chapter.

2.5.6 Summary of Effects

The residual effects of the Development are those that remain, assuming successful implementation of the identified mitigation and enhancement measures.

Residual effects are identified in each technical assessment alongside an assessment of whether any residual effects are significant or not in terms of the EIA Regulations detailed in Section 2.2.

2.6 ASSUMPTIONS AND LIMITATIONS OF EIA

A number of assumptions have been made during preparation of the EIA Report, as set out below. The assumptions are:

- The principal land uses adjacent to land within the Development Site remain as they are between time of survey to commencement of construction, except in cases where permission has already been granted for Consented Wind Farm; and
- Information provided by third parties, including publicly available information and databases is correct at the time of submission.

Assumptions and limitations specific to certain environmental aspects are discussed in the relevant chapters of this EIA Report.

2.7 STATEMENT OF DIFFICULTIES ENCOUNTERED

No particular difficulties, such as technical deficiencies or lack of knowledge, were encountered in compiling any of the specified information contained in this EIA Report, such that that the prediction of effects has not been possible. Where any specific difficulties were encountered, these are outlined in the relevant chapter of the EIA Report.

2.8 ERRORS

While every effort has been made to ensure that the content of this EIA Report is error free and consistent, there may be instances where typographical errors and/or minor inconsistencies do occur. These typographical errors and/or minor inconsistencies are unlikely to have any material impact on the overall findings and assessment contained in this EIA Report.

3 LEGISLATION, PLANNING AND ENERGY POLICY

3.1 INTRODUCTION

This Chapter of the Environmental Impact Assessment Report (EIA Report) sets out the planning and energy policy framework for the proposed Bilboa Wind Farm. It presents the current and relevant legislation and policy position regarding renewable energy, climate change, decarbonisation, planning and development at a European, national, regional and local level, and relates these policies and legislation to the individual sections set out within the technical chapters of the EIA Report. The reference to specific planning policies and guidance within other Chapters ensures that there is full knowledge and understanding of planning related issues within the EIA Report.

This Chapter does not provide an assessment of whether or not the Development complies with extant policy or how to interpret the Development in the context of the legislative guidance. The Planning Report, which accompanies the Planning Application, provides a detailed assessment of the Development against the policies identified in this Chapter of the EIA Report. Although the two documents are complementary, this Chapter identifies the relevant planning and energy policy framework necessary to inform the technical assessments within this EIA Report, whilst the Planning Report contains assessment of the acceptability of the Development in planning and energy policy terms.

3.2 INTERNATIONAL AND EUROPEAN POLICY CONTEXT

On 12 December 2015, 196 Parties to the UN Framework Convention on Climate Change (UNFCCC) adopted the Paris Agreement, a legally-binding framework for an internationally coordinated effort to tackle climate change. Ireland is legally bound through its commitment to the Paris Agreement.

The Renewable Energy Directive[1] 2009/28/EC establishes an overall policy for the production and promotion of energy from renewable sources in the EU. It required the EU to fulfil at least 20% of its total energy needs with renewables by 2020 – to be achieved through the attainment of individual national targets. All EU countries must also have ensured that at least 10% of their transport fuels come from renewable sources by 2020.

On 30 November 2016, the Commission published a proposal for a revised Renewable Energy Directive to make the EU a global leader in renewable energy and ensure that the target of at least 27% renewables in the final energy consumption in the EU by 2030 is met.

On 14 June 2018 the European Commission, the European Parliament and the European Council reached a political agreement which includes a binding renewable energy target for the EU for 2030 of 32%, with a clause for upwards revision by 2023. This agreement sets the course for a growing demand for renewable energy projects across Europe.

On 11 December 2018, the revised renewable energy directive[2] came into force and sets the course for a growing demand for renewable energy projects across Europe, whilst setting a target of cutting emissions by at least 40% below 1990 levels by 2030.

[1] European Commission (2018) Renewable Energy Directive [Online] Available at: https://ec.europa.eu/energy/en/topics/renewable-energy/renewable-energy-directive (Accessed 27/06/2022)
[2] Official Journal of the European Union (2018) Directive (EU) 2018/2001 of the European Parliament and of the Council [Online] Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2018.328.01.0082.01.ENG&toc=OJ:L:2018:328:TOC (Accessed 27/06/2022)

The 2020 Renewable Energy Progress Report[3] summarises the progress countries within the EU are making towards 2020 targets and the 2030 targets from the revised directive, stating:

"In 2018, twelve Member States already have a renewable energy share above their respective 2020 targets. Eleven Member States met or exceeded their RED I average indicative trajectory for 2017-2018. However, five Member States (France, Ireland, the Netherlands, Poland and Slovenia) failed to do so."

It is a requirement of EU Governance regulations for member countries to produce National Energy & Climate Plans (NECP). The Draft NECP[4] was submitted to the European Commission for approval but as of yet has not been adopted. The purpose of the NECP is to facilitate the EU's analysis and assessment of each member state's ability to achieve the requirements of the Paris Agreement. As per the NECP, "*the total contribution from renewable energy to gross electricity consumption in 2018 was 33.2%*".

The Climate Action Network Europe NECP progress report[5] (CAN Report) states the following about Ireland's progress towards its national targets:

"The European Commission recommended that Ireland puts forward additional measures to reduce the significant projected shortfalls in meeting its 2030 greenhouse gas target for sectors not covered by the ETS. The Irish Government published a Climate Action Plan around the same time that the European Commission published their NECP recommendations. The Climate Action Plan does explicitly state that it builds on the draft NECP, but it did not describe how the final NECP will build on the Climate Action Plan to close Ireland's emissions gap. Therefore, it is not possible to say how the emission projections in the final NECP will be affected by the measures foreseen in the Climate Action Plan. The Plan contains some new measures across sectors and proposes a 2% decline in emissions per annum from 2021 to 2030 to meet the EU targets. However, the 2030 target is not Paris-aligned and this 2% reduction on the short term is insufficient to achieve net zero emissions by mid-century."

The CAN Report demonstrates a context in support of the Development, going beyond national support for the industry and meeting national targets. The CAN Report shows that additional work needs to be done by the industry, and supported by Councils, in order to strengthen the so far 'insufficient' measures.

The 26th UN Climate Change Conference of the Parties (COP26) which took place in Glasgow in November 2021, brought the world leaders of over 200 counties together to address climate change and seek to agree universal objectives and measures that can be enforced to over the next decade to further cut carbon emissions.

3 EUR-Lex (2019) Report from the Commission to the European Parliament, the Council, the European Economic and Social
Committee and the Committee of the Regions: Renewable Energy Progress Report [Online] Available at: https://ec. europa.eu/energy/sites/ener/files/renewable_energy_progress_report_com_2020_952.pdf (Accessed 27/06/2022)

4 Government of Ireland (2018) Draft National Energy & Climate Plan (NCEP) 2021-2030 [Online] Available at: https://www.dccae.gov.ie/en-ie/energy/consultations/Documents/42/consultations/Draft%20NECP%20Ireland.pdf (Accessed 27/06/2022)

5 Climate Action Network Europe (2019) The Clock is Ticking! Insight into progress made by Member States so far in improving their draft National Energy and Climate Plans (NECPs) [Online] Available at: http://www.caneurope.org/docman/energy-union-governance/3570-necps-progress-report-nov19/file (Accessed 27/06/2022)

COP26 outcomes included the Glasgow Climate Pact, an agreement with the aim of keeping the rise in global temperature to within 1.5ºC[6]. All participating countries agreed to revisit and strengthen their 2030 carbon emissions targets.

3.3 IRISH CLIMATE CHANGE AND ENERGY POLICY, GUIDANCE AND LEGISLATION

The following documents set out the Irish Government's commitment to cut carbon emissions through the deployment of renewable energy, and sets out the national energy strategy along with energy planning statistics.

3.3.1 Climate Action Plan 2021

The Climate Action Plan 2021[7] sets out a roadmap of actions to half emissions by 2030 and reach net zero by no later than 2050. The plan identifies the nature and scale of the challenge and outlines the current state of play across all key sectors including electricity, transport, the built environment and agriculture, and projects a route towards meeting the national decarbonisation targets in all sectors. The Climate Action Plan also sets out governance arrangements including carbon-proofing national policy and establishing carbon budgets.

Key targets of the Climate Action Plan are for 70% of electricity generated to be from renewable energy sources by 2030. The Climate Action Plan states that:

"Based on indicative targets for onshore wind energy and grid-scale solar deployment, the Department of the Environment, Climate and Communications (DECC) will set out a target for the total onshore capacity that should be planned for on a national and regional level."

3.3.2 Climate Action and Low Carbon Development Act 2015

The Climate Action and Low Carbon Development Act 2015[8] (the Climate Action Act) is considered to provide the statutory basis for the national transition objective laid out in national policy position; in particular informing requirements for National Mitigation Plans (NMPs) and National Adaptation Frameworks (NAFs).

Within the Climate Action Act, the national transition objective is defined as "the transition to a low carbon, climate resilient and environmentally sustainable economy by the end of the year 2050".

The Climate Action Act creates a long-term framework for the current and successive administrations in Ireland to ensure a successful "transition to a low carbon, climate resilient and environmentally sustainable economy by the end of the year 2050". This is fundamentally a commitment from the Government to expand the renewable energy industry and move away from carbon dependency.

The Climate Action Act provides that the first National Mitigation Plan needed to be submitted to the Irish Government no later than 10 December 2017 (see Section 3.3.4).

[6] UNCCC UK 2021 (2021) *COP26 Keeps 1.5C Alive and Finalises Paris Agreement* [Online] Available at: https://ukcop26.org/cop26-keeps-1-5c-alive-and-finalises-paris-agreement/#:~:text=COP26%20has%20today%20concluded%20in,on%20urgently%20accelerating%20climate%20action. (Accessed 27/06/2022)
[7] Government of Ireland (2021) Climate Action Plan [Online] Available at: gov.ie - Climate Action Plan 2021 (www.gov.ie) (Accessed 27/06/2022)
[8] Government of Ireland (2015) Climate Action and Low Carbon Development Act 2015 [Online] Available at: http://www.irishstatutebook.ie/eli/2015/act/46/enacted/en/pdf (Accessed 27/06/2022)

3.3.3 Climate Action and Low Carbon Development (Amendment) Act 2021

The Climate Action and Low Carbon Development (Amendment) Act was signed into law on 23rd July 2021. It introduces a system of 5-year economy-wide carbon budgets, which will outline a ceiling for total greenhouse gas emissions. The proposed carbon budgets must provide for a reduction of 51% in the total amount of greenhouse gas emissions by 2030, relative to 2018[9].

3.3.4 National Mitigation Plan

Published in July 2017, the first National Mitigation Plan[10] sets out the requisite measures for Ireland to achieve its decarbonisation targets, building on the commitment to decarbonisation in the National Policy Position on Climate Action and Low Carbon Development[11]. This is proposed to be done through CO_2 reductions in electricity generation, the built environment and transport sectors.

The National Mitigation Plan outlines that the targets for Ireland are ambitious and challenging; noting that the target reduction in non-ETS emissions by 2020 was 20%, with likely outcome being a 4-6% reduction. With a 30% reduction target set for 2030, consenting of suitable renewable energy development is a necessity. This is acknowledged in the National Mitigation Plan, which states:

> *"Eirgrid estimates that a total of between 3,900MW and 4,300MW of onshore renewable generation capacity will be requires to allow Ireland to achieve 40% renewable electricity by 2020. This leaves a further requirement of between 780MW and 1,180MW to be installed by 2020 if the 2020 electricity target is to be reached, requiring an increased rate of installation."*

3.3.5 National Adaptation Framework

Published on 19 January 2018, Ireland's National Adaptation Framework[12] (NAF) is intended to negotiate any problems arising from the transition to a low carbon economy and facilitate this transition as smoothly as possible.

The NAF requires local authorities to produce local Climate Change Adaptation Strategies, with Carlow County Council's[13][14] adopted for period 2022-2028.

The NAF considers, under the heading *Sectoral opportunities associated with climate change* that "Ireland's location provides a favourable setting for the generation of renewable energy e.g. wind and wave energy." It is considered that wind farm development is a green, economic opportunity to react to climate change, and mitigate its risks it by reducing reliance on fossil fuels.

[9] Climate Change Advisory Council (2021) *Carbon Budget Technical Report* [Online] Available at: https://www.climatecouncil.ie/media/climatechangeadvisorycouncil/Technical%20report%20on%20carbon%20budgets%2025.10.2021.pdf (Accessed 27/06/2022)
[10] Department of Communications, Climate Change & Environment (2017) National Mitigation Plan [Online] Available at: https://www.dccae.gov.ie/documents/National%20Mitigation%20Plan%202017.pdf (Accessed 27/06/2022)
[11] Department of Communications, Climate Change & Environment (2014) National Policy Position on Climate Action and Low Carbon Development [Online] Available at: https://www.dccae.gov.ie/en-ie/climate-action/publications/Documents/5/National%20Climate%20Policy%20Position.pdf (Accessed 27/06/2022)
[12] Department of Communications, Climate Change & Environment (2018) National Adaptation Framework: Planning for a Climate Resilient Ireland [Online] Available at https://www.dccae.gov.ie/documents/National%20Adaptation%20Framework.pdf (Accessed 27/06/2022)
[13] Carlow County Council (2019) Climate Change Adaptation Strategy 2019-2024 [Online] Available at: http://www.carlow.ie/wp-content/documents/uploads/Climate%20Change%20Adaptation%20Strategy%202019.pdf (Accessed 27/06/2022)
[14] Environment and Climate Change | Carlow County Council's Online Consultation Portal (Accessed 27/06/2022)

The NAF acknowledges the necessity to prepare for uncertainty in the climate and maximising the effectiveness of adaptation options. This is an endorsement of the increased efficiency and resultant reductions in CO_2 emissions that would arise from consenting the Development.

3.3.6 National Renewable Energy Action Plan and Renewable Energy Targets

Submitted under Article 4 of Directive 2009/28/EC, Ireland's National Renewable Energy Action Plan[15] (NREAP) sets out how Ireland will meet the national target set out under the Directive. Given that the NREAP was produced in 2010, the targets within do not reflect the Paris Agreement, however the most recent Progress Report[16] can be read in the context of more recent targets.

Whilst 2020 targets have now passed, it is relevant to assess the need for the Development against the overall determination of whether these targets were met and whether there is a continued need to adapt, adjust and provide immediate development.

Ireland's 2020 renewable energy target is to increase the share of final energy consumption made up of renewable sources (RES) to 16%. The target is broken into three sectors with individual sector targets: 40% of electricity supply (RES-E), 12% of heating (RES-H), and 10% of transport (RES-T).

The NREAP estimated the yearly energy contribution from onshore wind, cumulating in a 2020 estimation of 4,737 MW. It is noted that the estimated contribution in the NREAP for 2016 was 3,182 MW, however the Progress Report lists the actual figure at 2,802 MW, demonstrating that production is currently below estimation, which indicates the requirement for consenting viable renewable energy development.

In 2021, the Central Statistics Office released the updated Greenhouse Gases and Climate Change statistics for Ireland[17], which includes relevant data up until 2019, stating:

> *"In 2019, Ireland's greenhouse gas emissions were 59.8 million tonnes of carbon dioxide equivalent. This was 10% higher than the 1990 figure of 54.4 million tonnes.*
>
> *In 2019, Ireland had the second worst emissions of greenhouse gases per capita in the EU at 12.1 tonnes of carbon dioxide equivalent per capita. Ireland's emissions were 53% higher than the EU28 average of 7.9 tonnes.*
>
> *The energy sector's share of greenhouse gas emissions in 2019 was the third largest sectoral contributor to emissions with 15.8% of the total."*

3.3.7 Energy in Ireland 2021 Report

Published in December 2021, the Energy in Ireland Report[18] details the national energy statistics for 2020, and while it demonstrates a commitment to renewable energy, it shows that there is still a reliance on fossil fuels (which accounted for 86% of Ireland's primary energy use in 2020).

Table 3.2, below, shows the 2020 position in terms of renewable energy usage in electricity generation, transport and heat against 2020 targets (as released in the 2021

[15] Government of Ireland (2010) National Renewable Energy Action Plan [Online] Available at: https://www.ifa.ie/wp-content/uploads/2020/08/2013-National-Renewable-Energy-Action-Plan-2010.pdf (Accessed 27/06/2022)
[16] Government of Ireland (2018) NREAP Fourth Progress Report [Online] Available at: https://www.dccae.gov.ie/documents/NREAP%20Fourth%20Progress%20Report.pdf (Accessed 27/06/2022)
[17] Central Statistics Office (2021) Environmental Indicators Ireland [Online] Available at: https://www.cso.ie/en/releasesandpublications/ep/p-eii/environmentalindicatorsireland2021/greenhousegasesandclimatechange/ (Accessed 27/06/2022)
[18] Sustainable Energy Authority of Ireland (2021) Energy in Ireland 2021 Report [Online] https://www.seai.ie/publications/Energy-in-Ireland-2021_Final.pdf (Accessed 27/06/2022)

Energy in Ireland Report), and reflects the increase from 2019 position, in order to provide context of how the industry was able or unable to meet its targets.

Table 3.2: Progress to 2020 Renewables Target by Sector

Sector	2020 Share of Renewables (%)	Change from 2019 to 2020 (%)	2020 Target (%)
Electricity	39.1	+2.6	40
Transport	10.2	+1.3	10
Heat	6.3	0.0	12
Overall RES Target	13.5	+1.5	16

Considering market fluctuations, an average annual increase over a longer period of time is considered more indicative than simply comparing one year to the previous. It had been evident for several years that the overall targets were not going to be met, and that there remains an immediate need to consent suitable and efficient renewable energy development.

3.3.8 Ireland's Transition to a Low Carbon Energy Future: 2015-2030

The White Paper "Ireland's Transition to a Low Carbon Energy Future 2015-2030"[19] sets out the national energy policy framework and the actions that the Government intends to take in the energy sector until 2030.

At the time of its production the White Paper details that 90% of Ireland's energy comes from non-renewable sources and, thusly, promotes that a "radical transformation of Ireland's energy system is required to meet climate policy objectives" and that a low carbon future involves "radically changing our behaviour as citizens, industry and Government". This position was taken in a pre-Paris Agreement, Tokyo Protocol targets context, and it stands to reason, that in the context of more ambitious targets, that greater investment in renewables is required, even greater than what is purported in the White Paper.

The appropriate reaction to increased ambitious targets is to seek greater production of renewable energy in more efficient ways. Therefore, it is considered that the Development is in line with the ambitions and intentions of the White Paper.

3.3.9 Programme for Government

The Programme for Government: Our Shared Future[20] contains a target of an average 7% per annum reduction in overall greenhouse gas emissions from 2021 to 2030 and to reach net zero emissions by 2050. The Programme for Government aims to achieve a *"revolution in renewables"*, including a government plan setting out how at least 70% renewable electricity by 2030 will be achieved.

[19] Department of Communications, Energy & Natural Resources (2015) Ireland's Transition to a Low Carbon Energy Future: 2015-2030 [Online] Available at: https://www.dccae.gov.ie/documents/Energy%20White%20Paper%20-%20Dec%202015.pdf (Accessed 27/06/2022)

[20] Government of Ireland (2020) Programme for Government: Our Shared Future [Online] Available at: https://www.gov.ie/en/publication/7e05d-programme-for-government-our-shared-future/ (Accessed 27/06/2022)

3.4 LEGISLATIVE PLANNING FRAMEWORK

3.4.1 Planning and Development Act 2000

This Application is made under Section 34 of the Planning and Development Act, 2000, as amended[21] (the Planning Act). As such, it is governed by the relevant provisions of the Act.

Under Section 32 of the Act:

"32 (1) Subject to the other provisions of this Act, permission shall be required under this part –

(a) In respect of any development of land, not being exempted development, and

(b) In the case of development which is unauthorised, for the retention of that unauthorised development."

Section 34, subsections 2 and 3 detail the considerations that the planning authority must take when determining a planning application. In particular these set out the regards that CCC must have to this Application.

"(2) (a) When making its decision in relation to an application under this section, the planning authority shall be restricted to considering the proper planning and sustainable development of the area, regard being had to –

(i) the provisions of the development plan,

(ia) any guidelines issued by the Minister under section 28

(ii) the provisions of any special amenity area order relating to the area

(iii) any European site or other area prescribed for the purposed of section 10(2)(c),

(iv) where relevant, the policy of the Government, the Minister or any other Minister of Government,

(v) the matters referred to in subsection (4),

(va) previous developments by the applicant which have not been

satisfactorily completed,

(vb) previous convictions against the applicant for non-compliance with this

Act, the Building Control Act 2007 or the Fire Services Act 1981, and

(vi) any other relevant provision or requirement of this Act, and any regulation made thereunder.

(aa) When making its decision in relation to an application under this section, the planning authority shall apply, where relevant, specific planning policy requirements of guidelines issued by the Minister under section 28.

(b) In considering its decision in accordance with paragraph (a), a planning authority shall consult with any other planning authority where it considers that a particular decision by it may have a significant effect on the area of that authority, and the authority shall have regard to the views of that other authority and, without prejudice to the foregoing, it shall have regard to the effect a particular decision by it may have on any area outside its area (including areas outside the state).

(ba) Where specific planning policy requirements of guidelines referred to in subsection (2)(aa) differ from the provisions of the development plan of a planning authority, then

[21] Government of Ireland (2015) Planning and Development Act (As Amended) [Online] Available at: gov.ie - Planning legislation (www.gov.ie) (Accessed 27/06/2022)

those requirements shall, to the extent that they so differ, apply instead of the provisions of the development plan.

(c) Subject to section 99F of the Environmental Protection Agency Act 1992, and section 54 (as amended by section 257 of this Act) of the Waste Management Act, 1996, where an application under this section relates to development which comprises or is for the purposes of an activity for which an integrated pollution control licence or a waste licence is required, a planning authority shall take into consideration that the control of emissions arising from the activity is a function of the Environmental Protection Agency.

(d) In this subsection 'specific planning policy requirements' means such policy requirements identified in guidelines issued by the Minister to support the consistent application of Government or national policy and principles by planning authorities, including the Board, in securing overall proper planning and sustainable development.

(3) A planning authority shall, when considering an application for permission under this section, have regard to –

(a) in addition to the application itself, any information relating to the application furnished to it by the applicant in accordance with the permission regulations,

(b) any written submissions or observations concerning the proposed development made to it in accordance with the permission regulations by persons or bodies other than the applicant, and etc. etc."

This Application is submitted in accordance with, and with consideration to, the above legislation. This Report addresses CCC's Development Plan and the policy context in which the determination of this Application will be made; and the accompanying suite of documents, including the EIA Report, addresses the relevant effects required for CCC to make a determination.

3.4.2 Planning and Development Regulations, 2001

The Planning and Development Act is underpinned by the Planning and Development Regulations, 2001, as amended[22] (the Planning Regulations). The Planning Regulations have to be read in concurrence with the Act, in order to understand the requirements placed on both planning authorities and developers.

The Planning Regulations detail the level of information required to be provided by documents which support a planning application, such as this EIA Report.

3.4.3 National Planning Framework (NPF)

Project Ireland 2040: National Planning Framework[23] (NPF) was adopted in February 2018. NPF divides the Ireland into regions with separate strategic planning goals. County Carlow is considered to be part of the Southern Region, which has the following strategic development goal with regards to renewable energy:

"Harnessing the potential of the region in renewable energy terms across the technological spectrum from wind and solar to biomass and wave energy, focusing in particular on the extensive tracts of publicly owned peat extraction areas in order to enable a managed transition of the local economies of such areas in gaining the economic benefits of greener energy."

[22] Government of Ireland (2001), Planning and Development Regulations, 2001 [Online] Available at: http://www.irishstatutebook.ie/eli/2001/si/600/made/en/print (Accessed 27/06/2022)
[23] Government of Ireland (2018) Project Ireland 2040: National Planning Framework [Online] Available at: http://npf.ie/wp-content/uploads/Project-Ireland-2040-NPF.pdf (Accessed 27/06/2022)

National planning policy objective 55 states that the Government will "Promote renewable energy use at appropriate locations within the built and natural environment to meet national objectives towards achieving low carbon economy by 2050".

NPF states:

"In addition to legally binding targets agreed at EU level, it is a national objective for Ireland to transition to be a competitive low carbon, economy by the year 2050. The National Policy Position establishes the fundamental national objective of achieving transition to a competitive, low carbon, climate-resilient and environmentally sustainable economy by 2050, guided by a long-term vision based on:

- *An aggregate reduction in carbon dioxide (CO2) emissions of at least 80% (compared to 1990 levels) by 2050 across the electricity generation, built environment and transport sectors; and*
- *In parallel, an approach to carbon neutrality in the agriculture and land-use sector, including forestry, which does not compromise capacity for sustainable food production"*

Regarding the transition to a low carbon economy from renewable energy NPF states:

"In the energy sector, transition to a low carbon economy from renewable sources of energy is an integral part of Ireland's climate change strategy and renewable energies are a means of reducing our reliance on fossil fuels."

Renewable energy and climate change are themes that run through NPF, in particular National Strategic Objective 8: 'Transition to a Low Carbon & Climate Resilient Society'; and for the system to work as intended, this objective needs to filter into local ambitions.

3.4.4 National Development Plan 2021 – 2030

The National Development Plan[24] (NDP) is intended to be viewed in concurrence with NPF as an investment guide for the implementations of the principles and policies of NPF.

NDP details ten *"National Strategic Outcomes"* including the *"Transition to a Climate-Neutral and Climate-Resilient Society"*, which includes the following Strategic Investment Priorities:

- Renewable Energy;
- Energy Efficiency;
- SOE Investment;
- SOE and Commercial Sector Investment;
- Research;
- Transport; and
- Flood Risk Management.

Under the requirement for decarbonising energy, NDP states:

"The Government will continue to support the deployment of additional electricity generation through the auction-based Renewable Electricity Support Scheme (RESS). It is estimated that the RESS will provide €7.2bn to €12.5bn in supports, financed by the PSO Levy, over the lifetime of the Scheme which will incentivise private capital investment to deliver on the target to generate up to 80 per cent of our electricity from renewable sources by 2030. As an integral part of this investment, the Government will support the community ownership of renewable electricity generation assets through a dedicated 100%-owned community category in each onshore RESS auction."

[24] Government of Ireland (2021) Project Ireland 2040 National Development Plan 2021 – 2030 [Online] Available at: [gov.ie - National Development Plan 2021-2030 (www.gov.ie)](https://www.gov.ie) (Accessed 27/06/2022)

3.4.5 Wind Energy Development Guidelines

Under Section 28 of the Planning and Development Act, 2000, the 2006 Wind Energy Development Guidelines[25] (WEDG) is the current Ministerial Guidance for the determination of wind energy development.

On 12 December 2019, draft revised Wind Energy Development Guidelines were published for public consultation. The consultation closed on 19 February 2020, however, until such time as the revised guidelines are adopted, compliance with the 2006 guidelines remains relevant to the determination of the Development.

The considerations included in the WEDG, for the assessment of the impact of a wind energy development are as follows:

- *Ground conditions, including peat stability;*
- *Site drainage and hydrological effects, such as water supply and quality and watercourse crossings;*
- *Size, scale and layout and the degree to which the wind energy project is visible over certain areas;*
- *Potential impact of the project on natural heritage, to include direct and indirect effects on protected sites, on habitats of ecological sensitivity and biodiversity value and, where necessary, management plans to deal with the satisfactory co-existence of the wind energy development and the particular species/habitat identified;*
- *Potential impact of the project on the built heritage including archaeological heritage;*
- *Landscape issues;*
- *Visual impact of ancillary development, such as access roads;*
- *Local environmental impacts including noise, shadow flicker, electromagnetic interference, etc;*
- *Adequacy of local access road network to facilitate construction of the project and transportation of large machinery and turbine parts to site;*
- *Information on any cumulative effects due to other projects, including effects on natural heritage and visual effects;*
- *Information on the location of quarries to be used or borrow pits proposed during the construction phase and associated remedial works thereafter;*
- *Disposal or elimination of waste/surplus material from construction/site clearance, particularly significant for peatland sites; and*
- *Decommissioning considerations.*

3.4.6 Southern Regional Assembly Regional Spatial and Economic Strategy

On 31st January 2020, the Regional Spatial and Economic Strategy (RSES) for the Southern Region[26] (RSES Southern) came into effect.

[25] Department of Housing, Planning and Local Government (2006) Wind Energy Development Guidelines [Online] Available at: https://www.housing.gov.ie/sites/default/files/migrated-files/en/Publications/DevelopmentandHousing/Planning/FileDownLoad%2C1633%2Cen.pdf (Accessed 27/06/2022)

[26] Southern Regional Assembly (2020) *Regional Spatial & Economic Strategy for the Southern Region* [Online] Available at: https://www.southernassembly.ie/uploads/general-files/Southern%20Regional%20Assembly%20RSES%202020%20FINAL%20High%20Res.pdf (Accessed 27/06/2022)

RPO 95 of RSES Southern states:

"It is an objective to support implementation of the National Renewable Energy Action Plan (NREAP), and the Offshore Renewable Energy Plan and the implementation of mitigation measures outlined in their respective SEA and AA and leverage the Region as a leader and innovator in sustainable renewable energy generation."

RPO 99 of RSES Southern states:

"It is an objective to support the sustainable development of renewable wind energy (on shore and off shore) at appropriate locations and related grid infrastructure in the Region in compliance with national Wind Energy Guidelines."

The emphasis on clean, sustainable renewable energy generation permeates the RSES and is intended to filter down into local determinations.

3.4.7 Carlow County Development Plan 2015-2021

The relevant framework for local development planning, pursuant to the site location of the Development is as follows:

- Carlow County Development Plan 2022-2028

While local development planning in Carlow County does include Local Area Plans and a Joint Spatial Plan, the Site is not within the designated boundary for any of these documents, and therefore the policies and guidance contained within are not of consideration to this planning application.

The Carlow County Development Plan 2022-2028[27] (CCDP) was adopted in July 2022 and covers a statutorily mandated 6-year period for development within the County.

The Development Plan is accompanied by appendices, intended to guide specific development and assessment. The following CCDP Appendices are relevant and the content within has been assessed either as part of this Section or have helped inform the relevant corresponding Chapter of the EIA Report:

- Appendix 6 Renewable Energy Strategy; and
- Appendix 7 Landscape Character Assessment.

Below is a list of the relevant policies within the CCDP for the determination of this Application:

3.4.7.1 Policy CS 05

"It is an objective of the Council to:

Ensure that the future of spatial development of County Carlow is in accordance with the National Planning Framework 2040, including the population targets set out under the Implementation Roadmap, and the Regional, Spatial and the Economic Strategy (RSES) for the Southern Region.

3.4.7.2 Policy CS 08

"It is an objective of the Council to:

Restrict development in areas at risk of flooding in accordance with the Flood Risk Management Guidelines for Planning Authorities (DoECLG/OPW 2009).

[27] Carlow County Council (2021) *Draft Carlow County Development Plan 2022–2028* [Online] Available at: https://consult.carlow.ie/en/consultation/draft-carlow-county-development-plan-2022-2028 (Accessed 27/06/2022)

3.4.7.3 Policy CS O11

"It is an objective of the Council to:

Promote County Carlow in its transition to a low-carbon and climate resilient County through the promotion of sustainable energy, sustainable settlement patterns, and reduced travel demand in accordance with the RSES, NPF and Climate Action Plan 2019.

3.4.7.4 Policy ED P6

"It is the policy of the Council to:

Support the diversification of the construction and manufacturing industries with a focus on expanding and attracting an increasing number of businesses operating in the field of building innovation and in the area of construction and material development and manufacture, particularly in the context of sustainable development and nearly zero energy buildings."

3.4.7.5 Policy PM P4

"It is the policy of the Council to:

Support the development of industries that create and employ green technologies and encourage the uptake of measures to facilitate the transition towards a low carbon economy and circular economy"

3.4.7.6 Policy PM O4

"It is the policy of the Council to:

Encourage energy efficiency and use of renewable energy in new developments and to seek to incorporate energy sustainability into the planning of new and existing employment areas."

3.4.7.7 Policy NR P3

"It is the policy of the Council to:

Ensure that the capacity, efficiency and safety of the national road network within Carlow is protected and to control development that could impact traffic safety and / or hinder the future upgrading of the national road network.

3.4.7.8 Policy RR P1

"It is the policy of the Council to:

Maintain and improve the capacity, safety and function of the regional road network (as finances become available) and to ensure that it is planned for and managed to enable the sustainable economic development of the County and wider area"

3.4.7.9 Policy RR P2

"It is the policy of the Council to:

Exercise control over new developments outside of designated settlements requiring direct access to the regional road network which could compromise the capacity, safety and efficiency of these routes."

3.4.7.10 Policy LR P1

"It is the policy of the Council to:

Ensure that the safety and capacity of the local road network is maintained and improved where funding allows to a suitable standard to accommodate the needs of the County."

3.4.7.11 Policy WS P1

"It is the policy of the Council to:

Work in conjunction with Irish Water to protect existing water and associated drainage infrastructure and to promote investment in the water and drainage network to support environmental protection and facilitate the sustainable growth of the County."

3.4.7.12 Policy WS P5

"It is the policy of the Council to:

Promote best practice water conservation practices in all development including rainwater harvesting and grey water recycling and supporting the implementation of BS8515-2009 Rainwater Harvesting Systems – Code of Practice."

3.4.7.13 Policy WS P6

"It is the policy of the Council to:

Require new development where public water supply and network infrastructure is available to seek connection to existing public water mains where visible."

3.4.7.14 Policy SW P1

"It is the policy of the Council to:

Ensure adequate surface water drainage systems are in place which meet the requirements of the Water Framework Directive and the River Basin Management Plan"

3.4.7.15 Policy SW P2

"It is the policy of the Council to:

Ensure, as an alternative to underground tanks and piped outfalls to watercourses, that all development proposals incorporate Sustainable Drainage Systems and to promote the use of green infrastructure e.g. green roofs, green walls, planting and green spaces for surface water retention purposes, as an integrated part of SuDS and maximise the multi-functional potential of these systems including benefits for biodiversity and amenity value wherever possible."

3.4.7.16 Policy SW P3

"It is the policy of the Council to:

Require appropriate maintenance of the surface water drainage infrastructure to avoid flood risk."

3.4.7.17 Policy SW P4

"It is the policy of the Council to:

To require all new development, to provide for separate drainage systems."

3.4.7.18 Policy EI P1

"It is the policy of the Council to:

Support and facilitate the reinforcement and development of enhanced energy infrastructure, and associated networks, to serve the existing and future needs of the

County and Region. This will include the delivery of the necessary integration of transmission network requirements facilitating linkages of renewable energy proposals to the electricity and gas transmission grid, in a sustainable and timely manner, subject to proper planning and environmental considerations."

3.4.7.19 Policy EI P2

"It is the policy of the Council to:

Ensure that development proposals for energy transmission and distribution infrastructure follow best practice with regard to siting and design. Proposed high voltage overhead lines shall as far as possible seek to avoid areas of sensitivity.

Where avoidance is not possible, full consideration shall be given to undergrounding the lines where technically feasible, economically viable and environmentally appropriate."

3.4.7.20 Policy EI P3

"It is the policy of the Council to:

Require the under-grounding of electrical cables within new residential, commercial or civic developments. Where existing, and proposed high voltage lines traverse new residential, commercial or civic developments, these should be re-located under-ground where technically feasible."

3.4.7.21 Policy FR P1

"It is the policy of the Council to:

Support, in co-operation with the OPW the implementation of the EU Flood Risk Directive (2007/60/EC) on the assessment and management of flood risks, the Flood Risk Regulations (SI No. 122 of 2010) and relevant outputs of the South Eastern Catchment and Flood Risk Assessment and Management Study."

3.4.7.22 Policy FR P2

"It is the policy of the Council to:

Carry out flood risk assessment for the purpose of regulating, restricting and controlling development in areas at risk of flooding and to minimise the level of flood risk to people, business, infrastructure and the environment through the identification and management of existing and potential future flood risk."

3.4.7.23 Policy FR P3

"It is the policy of the Council to:

Ensure that all development proposals comply with the requirements of the Planning Systems and Flood Risk Management – Guidelines for Planning Authorities (DEHLG and OPW, 2009) and Circular PL2/2014 (or any amendments thereto), in particular through the application of the sequential approach and the Development Management Justification Test."

3.4.7.24 Policy FR P4

"It is the policy of the Council to:

Require the submission of a Site-Specific Flood Risk Assessment (FRA) in areas at risk of flooding. The assessment shall be carried out by a suitably qualified and indemnified professional, shall be appropriate to the scale and nature of the risk to the proposed development and shall consider all sources of flooding. The FRA shall be prepared in accordance with the Planning System and Flood Risk Management - Guidelines for

Planning Authorities and shall address climate change, residual risk, avoidance of contamination of water sources and any proposed site-specific flood management measures."

3.4.7.25 *Policy FR P5*

"It is the policy of the Council to:

To protect and enhance the county's floodplains and wetlands as "green infrastructure" which provides space for storage and conveyance of floodwater, enabling flood risk to be more effectively managed. Riparian buffer zones shall have regard to Policies contained in Section 10.8 of this Plan."

3.4.7.26 *Policy FR P6*

"It is the policy of the Council to:

To ensure each flood risk management activity is examined to determine actions required to embed and provide for effective climate change adaptation as set out in the OPW Climate Change Sectoral Adaptation Plan Flood Risk Management"

3.4.7.27 *Policy NP P4*

"It is the policy of the Council to:

Ensure new development does not cause an unacceptable increase in noise levels affecting noise sensitive properties. Proposals for new development with the potential to create excessive noise will be required to submit a construction and/or operation management plan to control such emissions."

3.4.7.28 *Policy CA P1*

"It is the policy of the Council to:

"Promote and support the implementation of European, national, regional, and local objectives for climate change adaptation and mitigation as detailed in the following documents and taking into account all other provisions of the Plan (including those relating to land-use planning, sustainable travel and transport, and flood risk management and drainage);

- *Climate Action Plan 2019 – To Tackle Climate Breakdown;*
- *National Adaptation Framework (NAF) – Planning for a Climate Resilient Ireland 2018;*
- *Any new National Mitigation Plan adopted during the lifetime of this Development Plan;*
- *Relevant provisions of any Sectoral Adaptation Plans prepared to comply with the requirements of the Climate Action and Low Carbon Development Act 2015, including those seeking to contribute towards the National Transition Objective, to pursue, and achieve, the transition to a low carbon, climate resilient and environmentally sustainable economy by the end of the year 2050;*
- *Any Regional Decarbonisation Plan prepared on foot of commitments included in RPO 90 of the Regional Spatial and Economic Strategy (RSES) for the Southern Region;*
- *Carlow County Council Climate Change Adaptation Strategy 2019-2024; and,*
- *Carlow County Renewable Energy Strategy (Appendix VI)."*

3.4.7.29 *Policy CA P2*

"It is the policy of the Council to:

Support the transition of the County to a competitive, low carbon, climate-resilient and environmentally sustainable economy by 2050, by way of reducing greenhouse gases, increasing renewable energy, and improving energy efficiency."

3.4.7.30 Policy RE P1

"It is the policy of the Council to:

Encourage and facilitate the production of energy from renewable sources, such as from wind, solar, bioenergy, hydroelectricity, and geothermal, subject to compliance with proper planning and environmental considerations."

3.4.7.31 Policy WE P1

"It is the Policy of the Council to:

Have regard to the Department of the Environment, Heritage and Local Government's Guidelines for Planning Authorities on Wind Energy Development (or any update to this document)."

3.4.7.32 Policy WE P4

"Wind farm development will not normally be permissible in the Uplands Landscape Type as shown in Figure 6 of the Carlow County Character Assessment included as Appendix VII to this Plan. This provision shall not apply to micro energy generation and community energy projects as provided for in Section 7.10.3.5, where deemed appropriate and subject to compliance with proper planning and environmental considerations."

3.4.7.33 Policy LA P1

"It is the policy of the Council to:

Protect and maintain the overall integrity of the County's landscape, by recognising its capacity to sustainably integrate and absorb development, and by ensuring that development protects, retains and, where necessary, enhances the appearance and character of the landscape, and does not unduly damage or detract from those features which contribute to its value, character, distinctiveness and sensitivity e.g. landform, habitats, scenic quality, settlement pattern, historic heritage, amenity, land use and tranquillity."

3.4.7.34 Policy LA P2

"It is the policy of the Council to:

Ensure that development will not have a disproportionate landscape or visual impact in sensitive upland areas of the County (due to siting, layout, design or excessive scale and bulk) and will not significantly interfere with or detract from scenic upland vistas, when viewed from the surrounding environment, including nearby areas, scenic views and routes, and from settlements."

3.4.7.35 Policy LA P3

"It is the policy of the Council to:

Adopt a presumption against developments which are located on elevated or visually exposed sites or areas with open exposed vistas, and where the landscape cannot accommodate such development with appropriate mitigation."

3.4.7.36 Policy LA P4

"It is the policy of the Council to:

Ensure that developments on steep slopes or ridges will not be conspicuous or have disproportionate landscape or visual impacts when viewed from the surrounding environment, including from nearby areas, scenic views and routes, and from settlements."

3.4.7.37 Policy LA P6

"It is the policy of the Council to:

Require all developments, having regard to their landscape setting, to be appropriate in siting, layout, design and scale, in order to ensure any potential adverse or landscape and visual impacts are minimised and/or removed where necessary, and that natural site features and characteristics are retained and maintained."

3.4.7.38 Policy LA P7

"It is the policy of the Council to:

Facilitate, where appropriate, developments that have a functional and locational requirement to be situated on steep or elevated sites (e.g. reservoir, telecommunication masts or wind energy structures) where residual adverse visual impacts are minimised or mitigated."

3.4.7.39 Policy LA P8

"It is the policy of the Council to:

Require, where appropriate, Landscape/Visual Impact Assessments to be prepared by suitably qualified professionals, for development proposals which may have significant landscape or visual impacts, and/or which are located within or adjacent to sensitive landscapes."

3.4.7.40 Policy LA P10

"It is the policy of the Council to:

Ensure that features which contribute to local landscape character, including historic features and buildings, trees, hedgerows, shelter belts and stone walls, are retained, protected, and enhanced where appropriate, so as to preserve the appearance and local landscape character of an area, whilst supporting sustainable landscape change and development. Development proposals necessitating the removal of such features will be discouraged."

3.4.7.41 Policy LA P11

"It is the policy of the Council to:

Protect and preserve the established appearance and aesthetic attributes of views and prospects that contribute to the inherent quality of the County's landscape, including views, prospects and scenic routes listed in Tables 9.3 and 9.4, and particularly views to and from mountains, hills, river valleys and river corridors, and views of historical or cultural value (including buildings and townscapes) and views of natural beauty."

3.4.7.42 Policy NH P1

"It is the policy of the Council to:

Protect, manage and enhance the natural heritage, biodiversity, landscape and environment of County Carlow in recognition of its importance as a non-renewable resource, a unique identifier, and as a natural resource asset."

3.4.7.43 Policy NH P2

"It is the policy of the Council to:

Ensure, as far as is practicable, that development does not adversely impact on wildlife habitats and species, and that biodiversity is conserved for the benefit of future generations in the interest of sustainability."

3.4.7.44 Policy NH P9

"It is the policy of the Council to:

… promote the carrying out of ecological/habitat assessments to inform the layout and design of development proposals and ensure they integrate the protection and enhancement of biodiversity and landscape features wherever possible, by minimising adverse impacts on existing habitats (whether designated or not) and by including mitigation and/or compensation measures, as appropriate."

3.4.7.45 Policy NS P1

"It is the policy of the Council to:

To support the conservation and enhancement of Natura 2000 Sites, and to protect the Natura 2000 network from any plans and projects that are likely to have a significant effect on the coherence or integrity of a Natura 2000 Site, in accordance with relevant EU Environmental Directives and applicable National Legislation, Policies, Plans and Guidelines."

3.4.7.46 Policy NS P2

"It is the policy of the Council to:

Screening for Appropriate Assessment and if required Appropriate Assessment is undertaken for all plans to be adopted and projects to be granted permission/authorised by the Council. Where likely significant effects have been identified in respect of any plan or project not directly connected with or necessary to the management of a Natura 2000 site, wither individually or in combination with other plans or projects, ensure appropriate assessment, in accordance with Article 6(3) of the Habitats Directive. The Council shall only agree to the plan or project having ascertained that it will not adversely affect the integrity of the site concerned, unless the plan or project is subject to the provisions of Article 6(4) of the Habitats Directive."

3.4.7.47 Policy NS P3

"It is the policy of the Council to:

Consider impacts within a plan or project's zone of influence, which may include Natura 2000 sites outside the County, when assessing whether a plan or project is likely to have significant effects on Natura 2000 sites."

3.4.7.48 Policy NS P4

"It is the policy of the Council to:

Maintain or restore the favourable conservation status of County's Natura 2000 sites qualifying interest habitats and species."

3.4.7.49 Policy ND P1

"It is the policy of the Council to:

Conserve the existing flora, fauna and wildlife habitats in the County, including rare and threatened plant, animal and bird species, through the preservation of ecological corridors and ecological networks."

3.4.7.50 Policy ND P2

"It is the policy of the Council to:

Ensure that development does not have a significant impact on rare and threatened species, their breeding places, resting places, habitat or environment, as applicable, including those protected under the Wildlife Acts 1976 or 2021, the Birds Directive (2009/147/EC), the Habitats Directive (92/43/EEC) and including plant species listed on the Flora (Protection) Order 2015 (S.I. No. 356 of 2015)."

3.4.7.51 Policy ND P3

"It is the policy of the Council to:

Require the submission of an Ecological Impact Assessment, where deemed necessary, for any development proposal likely to have a significant impact on existing flora, fauna and wildlife habitats, including rare and threatened plant, animal and bird species."

3.4.7.52 Policy ND P4

"It is the policy of the Council to:

Ensure that, where evidence exists of species that are protected under the Wildlife Act 1976 (as amended), the Bird Directive 1979, and the Habitats Directive 1992, appropriate avoidance and mitigation measures are incorporated into development proposals as part of any ecological impact assessment. In the event of a proposed development impact on a site known to be a breeding or resting site of species listed in the Habitats Regulations or the Wildlife Act 1976 (as amended) a derogation licence, issued by the Department of Housing, Local Government and Heritage, may be required."

3.4.7.53 Policy WT P1

"It is the policy of the Council to:

Protect and manage existing woodland trees and hedgerow which are of amenity or biodiversity value and/or contribute to landscape character and ensure that proper provision is made for their consideration, protection and management when undertaking, approving or authorising development."

3.4.7.54 Policy WT P2

"It is the policy of the Council to:

Ensure that hedgerow removal to facilitate development is kept to an absolute minimum and, where unavoidable, a requirement for mitigation planting will be required comprising a hedge of similar length and species composition to the original, established as close as is practicable to the original and where possible linking in to existing adjacent hedges. Native plants of a local provenance should be used for any such planting"

3.4.7.55 Policy WT P4

"It is the policy of the Council to:

Encourage the protection of historic hedgerows or significant hedgerows which serve to link habitat areas to each other and the surrounding countryside."

3.4.7.56 Policy WT P6

"It is the policy of the Council to:

Protect individual or groups of trees which are important for environmental, recreational, historical, biodiversity and/or aesthetic reasons or by reason of contribution to sense of place, and to discourage the felling of mature trees to facilitate development."

3.4.7.57 Policy WT P8

"It is the policy of the Council to:

Ensure a Tree Management Plan is provided so as existing tree planting is adequately protected during development and incorporated into the layout and design of new developments."

3.4.7.58 Policy IW P1

"It is the policy of the Council to:

Protect the biodiversity of rivers, streams and other watercourses, to maintain them in an open state, to discourage culverting or realignment, and where possible, uncover existing culverts and restore the watercourses to acceptable ecological standards and for the passage of fish."

3.4.7.59 Policy IW P2

"It is the policy of the Council to:

Ensure that the County's watercourses are retained for their biodiversity and flood protection values and to conserve and enhance where possible, the wildlife habitats of the County's rivers, streams and riparian zones, including those which occur outside of designated areas, in order to provide a network of habitats and biodiversity corridors throughout the County."

3.4.7.60 Policy IW P3

"It is the policy of the Council to:

Control the encroachment of development on watercourses and riparian zones and provide for protection measures to watercourses and their banks, including but not limited to: the prevention of pollution of the watercourse, the protection of the river bank from erosion, the retention and/or provision of wildlife corridors and the protection from light spill in sensitive locations, including during construction of permitted development."

3.4.7.61 Policy IW P4

"It is the policy of the Council to:

Require the submission of an Ecological Impact Assessment, where deemed necessary (and where necessary an Appropriate Assessment where in relation to Natura 2000 sites), including bat and otter surveys, for development proposals along rivers, streams and canal corridors and areas of ecological importance."

3.4.7.62 Policy IW P5

"It is the policy of the Council to:

Maintain a biodiversity protection (buffer) zone of not less than 10 metres from the top bank of all watercourses in the County, with the full extent of the protection zone to be determined on a case by case basis by the Planning Authority, based on site specific characteristics and sensitivities and consultation with Inland Fisheries Ireland."

3.4.7.63 Policy IW P7

"It is the policy of the Council to:

Require that runoff from a development area will not result in deterioration of downstream watercourses or habitats, and that pollution generated by a development is treated within the developed area prior to discharge to local watercourses."

3.4.7.64 Policy IW P9

"It is the policy of the Council to:

Ensure that development proposals do not adversely affect groundwater resources and groundwater dependent habitats and species."

3.4.7.65 Policy IW P12

"It is the policy of the Council to:

Promote the natural, historical and amenity value of the County's watercourses, including public access where feasible and appropriate, in partnership with the National Parks and Wildlife Services, Waterways Ireland, Inland Fisheries Ireland, and other relevant stakeholders, while maintaining the watercourses free from inappropriate development."

3.4.7.66 Policy WT P1

"It is the policy of the Council to:

Protect, manage, and enhance wetlands in the County, and resist development that would remove, fragment, or degrade wetlands."

3.4.7.67 Policy WT P2

"It is the policy of the Council to:

Protect the biodiversity and flood protection value of wetlands and floodplains in the County."

3.4.7.68 Policy IS P1

"It is the policy of the Council to:

Prevent the spread of invasive alien species in the County, and to require landowners and developers to adhere to best practice guidance in relation to the containment and control of invasive alien species, including:

- *Invasive Species Ireland guidelines (see www.invasivespeciesireland.com).*
- *TII (2020) The Management of Invasive Alien Plant Species on National Roads – Standard GE-ENV-01104 https://www.tiipublications.ie/library/GE-ENV-01104-01.pdf*
- *TII (2020) The Management of Invasive Alien Plant Species on National Roads – Technical Guidance https://www.tiipublications.ie/library/GE-ENV-01105-01.pdf"*

3.4.7.69 Policy IS P2

"It is the policy of the Council to:

To require, as appropriate, development proposals to address the presence or absence of invasive alien species, and to require the preparation of an Invasive Species Management Plan for their eradication and/or containment and control where identified *on a site or in the vicinity of a site, in accordance with the requirements of the European Communities (Birds and Natural Habitats) Regulations 2011-2015."*

3.4.7.70 Policy AH P1

"It is the policy of the Council to:

Secure the preservation (either in situ or by record) of all archaeological monuments included in the Record of Monuments and Places (RMP) and their settings, and of all sites and features of significant archaeological or historical interest, including potential and previously unknown sites or features, in consultation with the National Monuments Service in the Department of Housing, Local Government and Heritage."

3.4.7.71 Policy AH P2

"It is the policy of the Council to:

Protect and conserve underwater archaeological heritage in the inland waters of the County, including potential and previously unknown sites or features, in consultation with the National Monuments Service in the Department of Housing, Local Government and Heritage."

3.4.7.72 Policy AH P3

"It is the policy of the Council to:

Protect, conserve and enhance the archaeological heritage of the County, and to manage development in a manner that avoids adverse impacts on sites, monuments, features or objects of significant archaeological or historical interest, including areas and sites of archaeological potential. There will be a presumption in favour of the 'preservation in situ' of archaeological heritage in accordance with the 'Framework and Principles for the Protection of Archaeological Heritage (DAGHI 1999) or any superseding national policy document."

3.4.7.73 Policy AH P4

"It is the policy of the Council to:

Ensure that any development proposal that may, by reason of location, scale, nature, layout or design, have potential implications for archaeological heritage (including areas and sites of archaeological potential), shall be subject to an archaeological assessment. The archaeological assessment will seek to ensure that the development proposal can be sited and designed to avoid impacting on archaeological heritage. Any archaeological excavation shall be carried out in accordance with best practice outlined by the NMS, the National Museum of Ireland and the Institute of Archaeologists of Ireland. In all such cases the Planning Authority shall consult with the National Monuments Service in the Department of Housing, Local Government and Heritage."

3.4.7.74 Policy AH P6

"It is the policy of the Council to:

Protect the Zones of Archaeological Potential (Zones of Archaeological Notification) located within both urban and rural areas as identified in the Record of Monuments and Places (RMP)."

3.4.7.75 Policy AH P7

"It is the policy of the Council to:

Protect and conserve historic burial grounds within the County, including through the avoidance of extensions to them that would have an inappropriate level of impact on sub-surface archaeological remains or on their setting and amenity, and encourage their maintenance in accordance with best practice conservation principles, including 'Guidance for the Care, Conservation and Recording of Historic Graveyards' (The Heritage Council 2011) and 'Ireland's Historic Churches and Graveyards' (The Heritage Council), and in consultation with the National Monuments Service in the Department of Housing, Local Government and Heritage."

3.4.7.76 Policy HT P2

"It is the policy of the Council to:

Protect and conserve the natural and built heritage of the County upon which the tourism industry is based, including landscapes, designated sites, habitats and species, water quality, archaeology and historic buildings and structures."

3.4.7.77 Policy R P1

"It is the policy of the Council to:

Promote the value of the County's outdoor recreational and amenity resources as key assets for the local economy and for the health and well-being of communities and continue to support the expansion of existing amenities."

3.4.7.78 Policy RI P1

"It is the policy of the Council to:

Support investment in infrastructure and to facilitate innovation in rural economic development and enterprise through the diversification of the rural economy into new sectors and services, including ICT based industries and those addressing climate change, carbon reduction and sustainability."

3.4.7.79 Policy RE P1

"It is the policy of the Council to:

Facilitate agriculture, horticulture, forestry, tourism, energy production, small scale home-based enterprises and rural resource-based enterprises, subject to proper planning and environmental considerations."

3.4.7.80 Appendix 6 Carlow County Renewable Energy Strategy 2021

Under the CCDP Policy CA P1, regard is to be had for the Carlow County Renewable Energy Strategy 2021 ('the CCRES') (Appendix 6 of the CCDP[28]).

The CCRES acknowledges that County Carlow has less than 0.1% of the installed national capacity of onshore wind energy, and that several planning applications for new onshore wind development have been unsuccessful due to their interference with landscape and visual amenities.

The CCRES Figure 6.3 highlights the Site and notes that it is outside of settlement envelopes and key constraints, as well as being in an area of *"viable wind speed"*.

[28] Carlow County Council (2021) *Draft Carlow County Renewable Energy Strategy* [Online] Available at: VI. Renewable Energy Strategy | Carlow County Council's Online Consultation Portal (Accessed 27/06/2022)

3.4.7.81 Appendix 7 Landscape Character Assessment[29]

The Site is located in a Landscape Character Area (LCA) classified as 'Killeshin Hills, and a Landscape Type classified as 'Uplands'.

The key characteristics of the Killeshin Hills LCA are as follows:

- *Rural character with few settlements.*
- *Distinct prominence of Castlecomer Plateau forms a backdrop to the area and separates the County from Kilkenny*
- *Mixture of grassland, rough grazing, and forestry plantations at higher elevations.*
- *River Barrow forms eastern edge of area.*
- *Isolated stone quarries and lime working have left a mark on the landscape.*
- *Open views and vistas with extensive views across the entire County from ridges and from the Castlecomer Plateau.*

The Killeshin Hills LCA is deemed to have moderate sensitivity to development; and with particular regard to wind energy it is considered that "subject to appropriate mitigation measures there may also be moderate scope to absorb extractive industry and wind farming".

In the capacity table on page 38 of the Landscape Character Assessment, the assessment of wind capacity in the Killeshin Hills LCA is 'moderate'. This is still tied for the highest capacity ascribed to any LCA within the County, however in light of the above quotation, it is considered that this may be the most suitable of the four LCAs within the County.

3.5 MATERIAL CONSIDERATIONS

3.5.1 Carlow Climate Change Adaptation Strategy 2019-2024

CCC has adopted a Local Authority Climate Change Adaptation Strategy[30] in accordance with the provisions of The Climate Action and Low Carbon Development Act 2015 and the National Adaptation Framework. The Climate Change Adaptation Strategy is based around the following thematic areas with high level goals[31]:

- Theme 1 - Local Adaptation Governance and Business Operations;
- Theme 2 - Infrastructure and Built Environment;
- Theme 3 - Land Use and Development;
- Theme 4 - Drainage and Flood Management;
- Theme 5 - Natural Recourses and Cultural Infrastructure;
- Theme 6 - Community Health and Wellbeing;
- Theme 7 - Mobility;
- Theme 8 - Economic Development; and
- Theme 9 - Resource Management.

[29] Carlow County Council (2015) Carlow County Landscape Character Assessment and Schedule of Protected Views [Online] http://www.carlow.ie/wp-content/documents/uploads/carlow-county-development-plan-appendix-6-landscape-character-assessment.pdf (Accessed 27/06/2022)
[30] Carlow County Council (2019) *Climate Change Adaptation Strategy 2019-2024* [Online] Available at: https://www.carlow.ie/wp-content/documents/uploads/Climate%20Change%20Adaptation%20Strategy%202019.pdf (Accessed 27/06/2022)
[31] https://consult.carlow.ie/en/consultation/carlow-draft-county-development-plan-issues-paper (Accessed 27/06/2022)

4 SITE SELECTION AND ALTERNATIVES

4.1 INTRODUCTION

This Chapter of the Environmental Impact Assessment Report (EIA Report) presents a consideration of alternatives investigated by Boolyvannanan Renewable Energy Limited (the Applicant) for the proposed Bilboa Wind Farm (the Development).

The European Union (EU) Directive 2014/52/EU details that an Environmental Impact Assessment (EIA) is required to include:

"A description of the reasonable alternatives (for example in terms of project design, technology, location, size and scale) studied by the developer, which are relevant to the proposed project and its specific characteristics, and an indication of the main reasons for selecting the chosen option, including a comparison of the environmental effects."

As detailed in Section 2.2 of **Chapter 2: EIA Methodology**, the Directive is transposed into Irish law through the Planning and Development Regulations 2001 (S.I. 600 of 2001)[1] (the Planning Regulations) which state in Schedule 6 Part 1(d) that an EIA Report must contain:

"An outline of the main alternatives studied by the developer and an indication of the main reasons for his or her choice, taking into account the effects on the environment."

This Chapter details why the Site has been selected and summarises the design options that were considered by the Applicant during the evolution of the Development, taking into account environmental, engineering and technical parameters.

4.2 NEED FOR THE DEVELOPMENT

As detailed in **Chapter 3: Planning and Energy Policy**, in 2018, the Irish Government adopted the Project Ireland 2040: National Planning Framework[2] (NPF) was adopted in February 2018. NPF divides the Ireland into regions with separate strategic planning goals. County Carlow is considered to be part of the Southern Region, which has the following strategic development goal with regards to renewable energy:

"Harnessing the potential of the region in renewable energy terms across the technological spectrum from wind and solar to biomass and wave energy, focusing in particular on the extensive tracts of publicly owned peat extraction areas in order to enable a managed transition of the local economies of such areas in gaining the economic benefits of greener energy."

NPF states:

"In addition to legally binding targets agreed at EU level, it is a national objective for Ireland to transition to be a competitive low carbon, economy by the year 2050. The National Policy Position establishes the fundamental national objective of achieving transition to a competitive, low carbon, climate-resilient and environmentally sustainable economy by 2050, guided by a long-term vision based on:

- *An aggregate reduction in carbon dioxide (CO2) emissions of at least 80% (compared to 1990 levels) by 2050 across the electricity generation, built environment and transport sectors; and*

[1] Government of Ireland (2001), Planning and Development Regulations, 2001 [Online] Available at: http://www.irishstatutebook.ie/eli/2001/si/600/made/en/print (Accessed 27/06/2022)
[2] Government of Ireland (2018) Project Ireland 2040: National Planning Framework [Online] Available at: http://npf.ie/wp-content/uploads/Project-Ireland-2040-NPF.pdf (Accessed 27/06/2022)

- *In parallel, an approach to carbon neutrality in the agriculture and land-use sector, including forestry, which does not compromise capacity for sustainable food production."*

Additionally, published by the Irish Government in August 2019, the Climate Action Plan[3] contains the up-to-date energy data and incremental targets to help achieve overall climate action requirements. The Climate Action Plan details that it is the ambition of the Irish Government to ensure that "70% of our electricity needs will come from renewable sources by 2030" and to "increase reliance on renewables from 30% to 70% adding 12GW of renewable energy capacity" with 8.2 gigawatt (GW) of that being increased onshore wind capacity. Using a new pipeline analysis tool, the Irish Wind Energy Association (IWEA) have estimated that unless action is taken urgently to deliver these targets, it is unlikely that the targets will be met. IWEA have estimated an outlook of only 5.5 GW of onshore wind estimated to be installed by 2030[4]. Therefore, increased renewable energy developments, such as the Consented Wind Farm, are essential if Ireland is to meet these targets. The project is therefore aligned with the Climate Action Plan.

In order to meet the new targets enshrined in law, there is a need to increase wind energy production and utilise ever-improving wind energy technology. With substantial advances in global turbine technology, it is necessary for onshore wind sites to be designed to maximise site yield and efficiency whilst minimising environmental impacts. Maximising site yield is often achieved through utilisation of the most modern wind turbine technology, including larger wind turbines.

Every unit of electricity produced by a wind farm development displaces a unit of electricity which would otherwise have been produced by a conventional (coal or gas) power station, and therefore presents carbon savings.

The Applicant would reiterate that the Application is for infrastructure that is already consented. However, given the timescales since the Consented Wind Farm was determined, the Applicant requires to submit a new planning application. This is to provide security in the programme for construction of the Bilboa Wind Farm.

4.3 SITE SELECTION

As detailed in **Chapter 1: Introduction**, the Applicant is committed to contributing to Ireland's binding renewable targets, and has undertaken an exercise to assess and identify potential onshore wind farms throughout Ireland. The overarching criteria which informed the Applicant's site search consisted of identifying potential wind farm locations which could:

- Be developed whilst minimising environmental impacts;
- Positively affect climate change via maximising the energy yield; and
- Contribute a positive economic benefit.

As the client acquired the site with an existing consent to develop, no alternative locations have been assessed. The existing consent dates back to 2011.

As detailed in Section 4.2, Ireland has set ambitious carbon reduction and onshore wind capacity targets. The Applicant initially reviewed potential onshore wind development sites across Ireland to objectively contribute to meeting these targets.

[3] Government of Ireland (2019) Climate Action Plan 2019: To Tackle Climate Breakdown [Online] Available at: https://www.dccae.gov.ie/en-ie/climate-action/publications/Documents/16/Climate_Action_Plan_2019.pdf (Accessed 16/05/2022)
[4] Irish Wind Energy Association (2020) Building Onshore Wind [Online] Available at: https://www.iwea.com/images/files/iwea-building-onshore-wind-report-lr.pdf (Accessed 27/06/2022)

The Consented Wind Farm was identified by the Applicant as a wind farm that could be developed given that the principle of a wind development is already established on site and that the environmental effects have already been assessed by CCC and consultees through the previous EIS, and considered to be acceptable. The Consented Wind Farm had not had the opportunity to be constructed by the previous applicants, considered likely due an increasingly competitive national policy for financially supporting onshore wind and the absence of a suitable grid connection. As detailed in **Chapter 1: Introduction**, the Applicant submitted an application for the installation of a grid connection pursuant to the Consented Wind Farm in June 2020 (CCC Ref: 20/180). This proposed grid connection only became recently available and therefore, the previous applicants were not able to construct the Consented Wind Farm under the previous Renewable Energy Feed-in Tariff support scheme (REFIT) without this grid connection.

4.4 CONSIDERATION OF ALTERNATIVES

4.4.1 Alternatives Methodology

As detailed in the Environmental Protection Agency's (EPA) *'Guidelines on the information to be contained in Environmental Impact Assessment Reports'* 2022[5] (the EPA Guidelines), the consideration of alternatives investigated is an essential part of the overall EIA process. The EPA Guidelines suggest that alternatives can be considered under the following headings:

- Alternative Locations;
- Alternative Layouts;
- Alternative Design;
- Alternative Processes;
- Alternative Mitigation;
- Consultation about the consideration of alternatives; and
- 'Do Nothing' Alternative.

However, the EPA Guidelines recognise that some of the alternatives noted above, may not be applicable to all proposed developments – *"… e.g. there may be no relevant 'alternative location' for the upgrading of an existing road".*

An examination of the alternatives for the Layout and Design, and Rotor Type and Diameter Design in relation to the EPA Guidelines headings is provided below.

4.4.2 Alternative Locations

As the Consented Wind Farm demonstrated a proven capability to accommodate a large-scale wind development and a suitable grid connection has been established and consented, the Applicant assessed the Consented Wind Farm site as the optimal location for the Development.

The alternative would have been to identify and assess a new wind farm site which could have resulted in significant environmental effects.

4.4.3 Alternative Layout and Design

As all component infrastructure has been assessed as part of the Consented Wind Farm and deemed acceptable in its current layout and design, it was not deemed necessary to explore an alternative design.

[5] Environmental Protection Agency (2022) Guidelines on the information to be contained in Environmental Impact Assessment Reports [Online] Available at: https://www.epa.ie/publications/monitoring--assessment/assessment/EIAR_Guidelines_2022_Web.pdf (Accessed 27/06/2022)

The current layout and design, as applied for in this Application, forms the Consented Wind Farm. The purpose of this submission is not to redesign the Consented Wind Farm, which has already been considered acceptable, but rather to ensure that the construction and operation programme can be sufficiently carried out.

4.4.4 Alternative Rotor Type and Diameter Designs

As previously mentioned, in order to contribute to Ireland's renewable targets, there is a need to increase wind energy production and utilities ever-improving wind energy technology. With substantial advances in global turbine technology, it is critical for onshore wind developments to be designed to maximise site yield and efficiency whilst minimising environmental impacts. Maximising site yield if often achieved through utilisation of the most modern wind turbine technology.

The Original Wind Farm consent was for smaller rotor blades. However, the Consented Modification, which has been carried over into this Application, optimises the mind yield with larger rotor blades whilst maintaining acceptable environmental effects.

Any alternative turbines would either need to be larger or smaller, and/or the number of turbines on Site would change. The use of smaller turbines would not make efficient use of the wind resource available having regard to the nature of the Site and a larger number of smaller turbines would result in the Development occupying a greater footprint within the Site due to the requirement for an increased amount of supporting infrastructure (access tracks, crane hardstands etc.) which increases the potential for significant, adverse environmental impacts to occur.

Turbines of a similar height with a reduced rotor would be similar to that of the Original Wind Farm, which would mean an installed capacity of approximately 2 MW per turbine, which is ~45% less generation than the 117 m rotor diameter proposed.

The Applicant therefore opted to minimise the potential for increasing environmental effects by maintaining the same turbine layout as the Consented Wind Farm.

4.4.5 'Do Nothing' Alternative

Under the 'Do-Nothing' alternative, the construction of Consented Wind Farm could be undertaken, however the long-term security of the programme would not be present.

In order to meet the new targets enshrined in law, there is a need to develop suitable sites for onshore wind energy production. Under the 'Do-Nothing' approach, CCC would risk losing the development of an identified and consented site for wind energy production and fail to contribute to national energy targets, as well as the EU's renewable energy targets and reduction of greenhouse gas emissions, as detailed in **Chapter 3: Planning and Energy Policy** of this EIA Report.

As detailed within **Chapter 13: Air Quality and Climate** of this EIA Report, the Development will result in the displacement of 525,660 tonnes of carbon dioxide (CO_2) during its lifetime which would otherwise be released into the atmosphere through alternative, fossil fuel based energy sources in the 'Do-Nothing' alternative.

Additionally, under the 'Do-Nothing' alternatives, the socio-economic benefits associated with the Development in combination with the Consented Wind Farm would be lost. These benefits include jobs during the construction and operational phase of the Development as well as the wider, economic, supply-chain benefits that occur during the construction phase.

Therefore, on the basis of the positive environmental effects arising as a result of the Development, the 'Do Nothing' scenario was not selected.

4.5 ALTERNATIVE PROCESSES FOR THE DEVELOPMENT

The management of processes that affect the volumes and characteristics of aspects such as emissions, traffic and the use of natural resources has formed a key part of the alternatives considerations.

During the operational phase the processes required for the Development are anticipated to be relatively minimal i.e. there is no requirement for the use of natural resources, significant traffic volumes or the generation of waste. For that reason, alternative processes designed to reduce waste, environmental effects such as emissions and use of natural resources etc. during the operational phase of the Development is not required.

The construction phase of the Development will require the use of natural resources in the form of standard construction materials such as stone and concrete. The use of these resources will be managed by the employment of standard, good practice construction methods and construction management plans including a combined Construction Environmental Management Plan (CEMP) which will cover all elements of both the Development and the Consented Wind Farm and will include waste management practices. Therefore, no alternatives processes for the construction of the Development have been assessed.

A CEMP has been provided as part of the EIA Report in Volume III: Technical Appendix A4.1: CEMP.

4.6 ALTERNATIVE MITIGATION FOR THE DEVELOPMENT

Mitigation by avoidance, or 'embedded mitigation' has been a key aspect throughout the evolution of the selection and design process for the Development. The Development selection process has included considerable embedded mitigation in the form of design refinement with the over-riding key criteria being the desire to minimise environmental impacts.

Due to the nature of the Development, the potential for environmental impacts is more likely to occur during the construction phase. Throughout the operational phase, there are no significant environmental impacts relative to the Development, individually or cumulatively with the Consented Wind Farm. Thus, no further consideration of operational mitigation alternatives where developed.

During construction, the implementation of embedded design measures and the utilisation of mitigation and construction good practice measures, will ensure the Development does not adversely affect the environment individually or cumulatively with the Consented Wind Farm and any other developments in the area. The alternative would be to not employ good practice construction measures which is deemed not suitable.

Throughout the operational phase, no significant environmental impacts relative to the Development are considered likely, individually or cumulatively with the Consented Wind Farm. The Operational Extension will not result in any additional mitigation requirements. All mitigation proposed for the Consented Wind Farm and the Development remains applicable with the 30-year lifetime. Thus, no further consideration of the 30-year operational mitigation alternatives is required. Thus, no further consideration of operational mitigation alternatives is required.

5 PROJECT DESCRIPTION

5.1 INTRODUCTION

This Chapter of the Environmental Impact Assessment Report (EIA Report) provides a description of the proposed Bilboa Wind Farm (the Development) pursuant to the consented development of wind turbines at the Bilboa Wind Farm (the Consented Wind Farm) which form the basis of the assessments presented within Chapter 6 to 16.

The Development consists of the following:

- 5no. wind turbines, each with a height to blade tip of 136.5 m, a hub height of 78 m, and a rotor diameter of 117 m;
- Control building;
- Substation (21 MW capacity);
- Turbine laydown area;
- Temporary crane hardstanding areas (30 m x 62.5 m);
- 1no. borrow pit;
- Upgrading of existing access track;
- Construction of new access tracks
- Temporary construction compound;
- Underground cabling;
- Anemometer mast; and
- Up to 18 ha of forestry felling.

This Chapter includes an overview of the Development followed by a detailed description of the method of construction. Measures that have been built into the design of the Development to reduce effects, also known as 'embedded' mitigation measures, are set out in the previous chapter (**Chapter 4: Site Selection and Alternatives**), and in this Chapter. In addition to these embedded mitigation measures, Chapters 6 to 16 present mitigation and enhancement measures where specifically relevant to their assessment topic.

This Chapter of the EIA Report is supported by the following figures provided in Volume II: EIA Report Figures:

- Figure 5.1: Site Layout Plan;
- Figure 5.2a-d: Detailed Site Layout Plan;
- Figure 5.3: Turbine Elevation;
- Figure 5.4: Proposed Crane Hardstanding;
- Figure 5.5: Met Mast General Arrangement;
- Figure 5.6: 20kV Substation Compound Plan;
- Figure 5.7: 20kV Substation Compound Southwest and Northeast Elevations;
- Figure 5.8: 20kV Substation Compound Northwest and Southeast Elevations;
- Figure 5.9: 20kV Substation Control Building Plan and Elevations;
- Figure 5.10: Temporary Construction Compound Plan

5.2 SITE CONTEXT

As detailed within **Chapter 1: Introduction,** the Site red line boundary (the Site Boundary) extends to an area of approximately 25.2 hectares (ha), as detailed in Figure 1.2: Site Boundary Plan.

The Site is located entirely within one local authority, Carlow County Council (CCC). The Site extends across a gentle slope of 0 to 4 degrees and an elevation ranging between 290 m Above Ordnance Datum (AOD) to 300 m AOD. The Development is located on land under private landownership and the land within the Site comprises commercial coniferous forestry, predominantly consisting of Sitka Spruce.

No public roads are located within the Site; however, there are stretches of existing forest track. The southern boundary of the Site runs adjacent to the L7130 public road. The Development lies within the upstream surface water catchment of the River Dinin, a major tributary of the River Nore. There are no watercourses or residential properties located within the Site; however, 25 residential properties are within approximately 1 km of the Site boundary, primarily to the north and south. The nearest settlement is the village of Bilboa, located approximately 1.1 km north of the Site.

There are no statutory designations within or adjacent to the Site, specifically no Special Areas of Conservation (SAC); Special Protection Areas (SPA); and Natural Heritage Areas (NHA).

The nearest statutory designation is located downstream of the Development is the River Barrow and River Nore SAC, located approximately 2.3 km west of the Site, which is designated for its valuable habitats and populations of plant and animal species listed in Annex I and II of the European Union (EU) Habitat Directive[1], respectively.

There are also no landscape designations within the Site. The Site, is located in a CCC Landscape Character Area ("LCA") classified as 'Killeshin Hills" and a landscape type classified as 'Uplands'. The key characteristics of the Killeshin Hills LCA include its rural character with few settlements and open views and vistas with extensive views across the entire CCC. There are no archaeological or cultural heritage designations within the Site; however, the Bilboa Church of Ireland church which is in the National Inventory of Architectural Heritage (NIAH) is located 1.5 km north the Site.

The associated dimensions of the Development are illustrated on Figures 5.1-5.10.

5.3 THE PREVIOUSLY CONSENTED WIND FARM

For the purposes of this assessment, the Consented Wind Farm consist of a combination of the Original Wind Farm consent and Consented Modification. As such, the Consented Wind Farm consists of the following elements:

- 5 x wind turbines, each with a height to blade tip of up to 136.5 m and a rotor diameter of up to 120 m (assessed at 117 m);
- Erection of associated infrastructure including control building/substation, turbine laydown areas and temporary crane hardstandings;
- One borrow pit;
- Upgrading of existing access tracks;
- Construction of new access tracks;
- Construction of a temporary construction compound;
- Lying of underground cabling between turbines;
- Erection of on permanent anemometer mast; and
- Up to 18 ha of coniferous forestry felling.

The Original Wind Farm proposed the main access to Site from the existing forestry entrance to the south of the Site along the L7130; however, as detailed in Chapter 1: Introduction, in June 2020, a planning application was submitted for a grid connection route, re-orientated crane hardstanding, new onsite access tracks, an upgraded access track into the Site and an updated turbine delivery route which proposed access from the L7129 access junction to the north of the Site (the Consented Grid Route). Further detail on the Consented Grid Route can be found in Section 5.4.

[1] 92/43/EEC [Online] Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:01992L0043-20070101 (Accessed 27/06/2022)

The location and number of turbines for the Development has not changed from that of the Consented Wind Farm as documented in the Original Wind Farm 2011 Environmental Impact Statement (EIS) and the Consented Modification 2021 EIA. All infrastructure proposed for this Development remains as it was in the Consented Wind Farm. This Application is not for any change to consented infrastructure; and primarily serves to provide flexibility in the construction period.

5.4 THE CONSENTED GRID ROUTE

The Consented Grid Route consists of the following elements:

- The installation of 6.6 km of underground cables required to connect the Consented Wind Farm to the national electricity grid;
- A new offsite substation located approximately 3 km from the Site;
- An updated offsite transport delivery route commencing from the turbine delivery point at Waterford Port (also known as Bellview Port) to the Consented Wind Farm site;
- The upgrading of an existing forestry access track between the Consented Wind Farm boundary and the L7129 public road; and
- Construction of two additional sections of onsite access tracks and the re-orientation and increase in size of turbine one's crane hardstanding pursuant to the consented development of wind turbines at the Consented Wind Farm.

An upgrade of an existing forestry access track was proposed to enable the components, construction materials and construction staff to be transported to the Consented Wind Farm. The new site access is located north of the Consented Wind Farm and runs from the existing junction off the L7129 public road along an approximately 3 km forestry track onto the Consented Wind Farm.

The Application was consented in July 2021 following a request for Further Information (FI), and is considered within the EIA Report where appropriate.

5.5 THE DEVELOPMENT

In the following sections, a detail explanation of the windfarm components is provided.

5.5.1 Development Components

5.5.1.1 Wind Turbines

The Development proposal is for 5 three-bladed horizontal axis wind turbines with an overall height to tip of 136.5 m, a hub height of 78 m and a rotor blade diameter of 117 m, as detailed in Figure 5.3 located in Volume II of the EIA Report.

5.5.1.2 Substation and Temporary Compound

A substation (Figures 5.6 – 5.9) and temporary construction compound (Figure 5.10) are proposed towards the northwest of the Site, between Turbines 4 and 5. This compound will likely be on an area of crushed stone hardstanding.

The principal element of the substation compound will contain the electrical infrastructure and control elements of the Development. This will be in a free standing unit approximately 50 m by 25 m with a capacity of 21 MW.

The underground cables from the wind turbines would be brought into the substation building in ducts. The ducts would guide the cables to the appropriate switchgear inside the building. Communications cables would enter in a similar manner.

Lighting will be kept to a minimum and will be limited to working areas only and will comply with health and safety requirements.

5.5.1.3 Crane Hardstanding

Each turbine requires an area of hardstanding adjacent to the turbine foundation to provide a stable base on which to site the turbine components and cranes for the erection of the turbine.

The proposed crane hardstanding area is approximately 30 m x 62.5 m at each turbine, as detailed in Figure 5.4.

The final crane hardstanding will be confirmed when the specific turbine type has been selected. For the purpose of the EIA Report the hardstanding assessed represents the maximum size that will be used, meaning all assessed impacts represent the greatest potential impacts and any modification to the hardstanding size will result in less significant impacts. The construction contractors would determine the actual cranes used. The final crane hardstanding design will be confirmed with CCC prior to construction. Further detail on the result of the intrusive ground investigations can be found in **Chapter 9: Land and Soils.**

The hardstanding areas will be retained through the life of the Development and can be used for access to the turbines for maintenance and repair works.

5.5.1.4 Borrow Pit

The Development includes access tracks, which, in practice, require earthworks and cut materials. One potential borrow pit has been identified and illustrated on Figure 5.2d.

5.5.1.5 Access Tracks

Figure 5.1 details the route of internal access tracks. Existing tracks within the Site will be reused as far as possible, although these may need to be upgraded during construction. There are approximately 2.8 km of existing internal tracks that may be required to be upgraded. There are also approximately 0.4 km of proposed tracks that will have a maximum width of 8 m.

5.5.1.6 Anemometer Mast

Figure 5.5 details the meteorological mast general arrangement as proposed for the Site. One meteorological mast option will be for an up to 81 m high lattice mast with intermittent weather monitoring equipment, secured to ground foundations and surrounded at the base by security palisade fence.

This model has been suggested in order to keep the height of the meteorological mast approximately equivalent to the hub height of the turbine.

An alternative smaller mast, approximately 31m, is also shown on Figure 5.5. The final meteorological mast will be selected based on the requirements of the system operator

5.5.1.7 Tree Felling

As part of the project construction process, a small amount of tree felling will have to be undertaken. Sitka Spruce is the predominant tree species on the site. Approximately 18 hectares of forestry will be felled as part of the Development.

All felling measures will be conducted in line with best practice guidelines.

5.5.1.8 The Operational Lifetime

The Applicant is applying for a 30 year operational lifetime.

5.6 CONSTRUCTION OF THE DEVELOPMENT

5.6.1 General Construction Methodology

The following sections describe the outline construction methodologies proposed and serve as a basis for completion of the technical assessments.

The Development would be constructed in accordance with documented ISO 14001 (2015)[2] environmental management procedures which ensure compliance with applicable environmental legislation and best practice. Effective communication underpins the whole system of environmental management, ensuring appropriate information passes between the Applicant and the consultants / contractors engaged. This ensures that environmental considerations are fully integrated into the management of the Development throughout construction, the operation, and maintenance of the completed project and ultimately to decommissioning.

5.6.2 Construction Environment Management Plan

A Construction Environmental Management Plan (CEMP) has been produced and provided at Appendix A4.1. The CEMP will be implemented in full during the construction of the Wind Farm.

It is fully anticipated that should the Application be consented, a planning condition such as the following that was applied to the Consented Wind Farm would again be enforced:

"8) The construction of the development shall be managed, and construction control measures implemented at the site, in accordance with the Construction Environmental Plan (CEMP) submitted with the further information response on 19th November 2021."

As detailed in the documents supporting the Consented Wind Farm application, selection of the construction contractor would be based partly upon the contractor's record in dealing with environmental issues and on its provision of evidence that it has incorporated all environmental requirements into its method statements as well as its staffing and budgetary provisions. The Applicant would retain the services of specialist advisers, for example on archaeology, ecology, and peat restoration, to be called on, as required, to advise on specific issues. More detailed information on the role of such specialist advisors during construction is provided in the relevant technical sections, where appropriate.

The contract between the Applicant and the contractor would specify the measures to be taken to reduce or mitigate the environmental impact of the construction process (as detailed in the technical chapters of this EIA Report, and the CEMP). A copy of the conditions associated with the deemed planning permission would be incorporated into the contract with the contractor and any subcontractors responsible for constructing the Development. All contractors will be contractually obliged to adhere to the planning conditions.

The CEMP sets out how the Development would be constructed and the mitigation commitments. These commitments include both specific mitigation measures as well as proposals for monitoring and emergency procedures. Such emergency procedures include a site-specific Pollution Incident Response Plan in order to prevent and mitigate damage to the environment caused by accidents such as spillages and fires.

The CEMP has been produced to capture a diverse range of environmental management controls. Key measures incorporated into the CEMP include:

- Site induction and training;
- Working hours;

[2] ISO (2015) ISO 14001:2015 [Online] Available at: https://www.iso.org/standard/60857.html (Accessed 27/06/2022)

- Enabling works;
- Surface water and drainage management;
- Waste management;
- Wastewater and water supply monitoring and control;
- Oil and chemical delivery and storage;
- Water quality monitoring;
- Ecological protection measures;
- Construction noise management;
- Cultural heritage protection measures;
- Handling of excavated materials;
- Reinstatement and restoration;
- Traffic management;
- Environment incident response and reporting;
- Use and extent of borrow pits;
- Method statements and risk assessments; and
- Final drawings and details of access tracks.

The CEMP will require to be agreed with the appropriate planning authorities and bodies, such as Environmental Protection Agency, prior to construction. In order to ensure that the CEMP is being suitably adhered to by the appointed contractors, a qualified Engineer would be employed during the construction phase of the project to monitor implementation and provide specialist advice. The Engineer would liaise with the various environmental, archaeological and other advisers who would have input into the project to ensure compliance is met in relation to any imposed planning conditions as well as the approved CEMP.

Standard construction working practices would be implemented during construction and any maintenance works, in order to ensure adherence to relevant guidance and other current best practice. The CEMP is a combined document for the construction of the Development and the Consented Grid Route. Additionally, as required and secured via planning condition, prior to the commencement of construction works, the Applicant will submit to the planning authority a Traffic Management Plan (TMP). This TMP will detail the finalised route to Site for abnormal loads and general traffic, details of the maximum size of components to be delivered and details of any land take requirements in order to facilitate delivery. A Framework TMP has been provided in the CEMP.

5.6.3 Construction Programme

It is anticipated that the construction of the Development will require approximately 19 months to complete, subject to the requirements of final planning conditions.

The site working hours are expected to be 07:00 to 19:00 Monday to Friday, and 07:00 to 13:00 on Saturdays with no site work generally on Sundays and bank holidays, except in circumstances where contractors see suitable weather windows outside of these times for the construction of the wind turbines. Material deliveries may be taken outside these times on certain occasions.

Work outside these hours is not usual, though if it was required to meet specific short-term demands, the planning authority would be informed, as required. Appendix A12.1 indicates the anticipated programme of construction.

5.6.4 Construction and Operational Waste

The Development will not alter the waste management procedures specified in the EIS for the Original Wind Farm and the EIA Report for the Consented Modification. As such, all mitigation proposed for the Consented Wind Farm remains valid.

All such materials would be disposed of by the maintenance contractors in line with normal waste disposal practices.

5.7 OPERATION

5.7.1 Turbine Maintenance

Each turbine manufacturer has specific maintenance requirements, but typically, routine maintenance or servicing of turbines is carried out twice a year, with a main service at twelve monthly intervals and a minor service at six months. In the first year, there is also an initial three-month service after commissioning. The turbine being serviced is switched off for the duration of its service.

Teams of two people with a 4x4 vehicle would carry out the servicing. It takes two people (on average) one day to service each turbine.

At regular periods through the project life, oils and components would require changing, which would increase the service time on-site per machine. Gearbox oil changes are required approximately every 18 months.

Blade inspections would occur as required (somewhere between every two and five years) using a Cherry Picker or similar, but may also be performed with a 50T crane and a man-basket. It could take approximately two weeks to inspect the turbines at the Development. Repairs to blades would utilise the same equipment.

Blade inspection and repair work is especially weather-dependent. Light winds and warm, dry conditions are required for blade repairs. Hence summer (June, July and August) is the most appropriate period for this work.

The following factors could affect the duration of repair operations:

- Working with cranes is highly weather-dependent;
- The availability of spares; and
- The stage in the component's life cycle.

5.7.2 Crane Hardstanding and Access Tracks Maintenance

The maintenance of the Crane Hardstanding will occur concurrently with the access tracks. The frequency of crane hardstanding maintenance depends largely on the volume and nature of the traffic using the crane hardstanding, with weathering of the crane hardstanding surface also having an effect. Since the volume of traffic using the crane hardstanding during operation would be low (although heavy plant is particularly wearing), the need for maintenance is anticipated to be low and infrequent. Any maintenance that is required would generally be undertaken in the summer months when the tracks are dry. However, maintenance will be carried out when required.

5.8 DECOMMISSIONING

As defined by condition for the existing consent, the Consented Wind Farm currently has a permitted operational lifespan of up to 30 years from full and final commissioning of the all of the proposed turbines. At the end of the 30 year operational period, the Development would be decommissioned and the turbines dismantled and removed. Any alternative to this action would require consent from CCC and is not considered in this EIA Report.

During decommissioning, the turbines and foundations would likely be dismantled to below ground level. The crane hardstandings will be left in situ, along with the Wind Farm tracks, for use by the landowner. This approach is considered to be less environmentally damaging than seeking to remove foundations, cables and roads entirely. The approach to decommissioning will be confirmed based on best practice at the time.

6 LANDSCAPE & VISUAL IMPACT ASSESSMENT

6.1 INTRODUCTION

This Chapter of the Environmental Impact Assessment Report (EIA Report) presents the findings of a Landscape and Visual Impact Assessment (LVIA) undertaken to evaluate the effects the Bilboa Wind Farm (the Development) may have on landscape and visual receptors. This assessment was undertaken by Arcus Consultancy Services Limited (Arcus).

The land within Development boundary (the Site) which contains the Development is located approximately 8 kilometres (km) southwest of the town of Carlow, County Carlow within Carlow County Council (CCC), as shown on Figure 6.1.

This Landscape and Visual Assessment (LVIA) incorporates the following:

- An assessment of landscape character effects within the host landscape character area and landscape character type resulting from the Development;
- Visual assessment of the Wind Farm;
- A cumulative assessment of the Development including an assessment of the Gortahile Wind Farm, and the Consented Grid Route;
- The production of eight wireframes and photomontages from the viewpoints selected within the Landscape and Visual Impact Assessment (LVIA) of the Original Wind Farm 2011 Environmental Impact Statement (the 2011 EIS) which have been replicated to illustrate the Consented Rotor Modification within the Development LVIA, which together for the Development; and
- A review of the current cumulative baseline to review and update the cumulative wirelines from viewpoints selected within the original LVIA.

The LVIA Chapter is also supported by a suite of figures presented in Volume II of the EIA Report, and technical appendix documents provided in Volume III.

This Chapter includes the following elements:

- Project Description;
- Landscape Legislation and Policies;
- LVIA Methodology and Guidelines;
- Scope of Assessment;
- Landscape Planning Context;
- Baseline Conditions;
- The Development;
- Embedded Mitigation;
- Assessment of Construction Effects;
- Assessment of Residual Landscape Effects;
- Assessment of Residual Visual Effects;
- Cumulative Effects;
- Statement of Significance;
- Summary & Conclusion; and
- Conclusion.

6.2 PROJECT DESCRIPTION

The Development will consist of physical elements previously assessed and consented under the LVIA for the Original Wind Farm and Consented Modification, together comprising the Consented Wind Farm

No changes to the Consented Wind Farm are proposed, therefore the LVIA is to be viewed in the context of the assessment for the Consented Wind Farm and the determination of acceptability from a landscape and visual perspective. This LVIA also assesses the cumulative effects from the addition of the Development to the baseline identified for the Consented Grid Route and the operational Gortahile Wind Farm.

Please refer to **Chapter 5: Project Description** for further detail on the Development.

6.3 LANDSCAPE LEGISLATION AND POLICIES

Policies which are relevant to the Development are detailed in **Chapter 3: Planning and Energy Policy** of this EIA Report.

6.3.1 Environmental Impact Assessment

Legislation, policy and guidance has evolved considerably since the 2011 EIS for the Original Wind Farm was drafted, however much of what was considered as part of the 2020 EIA for the Consented Modification remains relevant.

EIAs are undertaken in response to the requirements of the European Union (EU) Directive 2014/52/EU[1] (the EIA Directive). **Chapter 2: EIA Methodology** outlines the relevant Environmental Impact Assessment (EIA) legislation.

The Consultation Draft Revised Wind Energy Guidelines were published in December 2019[2]. The Draft Guidelines provide guidance on the approach and methodology for the siting and design of wind energy development, and the landscape and visual assessment of wind energy development, including cumulative effects.

The EPA 'Guidelines on the Information to be Contained in Environmental Impact Assessment Reports' 2022[3] detail the framework for assessment for EIA, that is followed in this EIA Report.

Relevant overarching planning polices for the Development are detailed in **Chapter 3: Planning and Energy Policy** and within the Planning Report that accompanies the planning application (the Application) for the Development.

6.3.2 European Landscape Convention

The European Landscape Convention (ELC) which was ratified in Ireland and came into effect on 1 March 2004, promotes the protection, management and planning of the landscapes and organises international co-operation on landscape issues.

The ELC defines landscapes as: "*An area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors.*"

The ELC applies to natural, rural, urban and peri-urban areas including land, inland water and marine areas. Its purpose is to promote landscape protection, management and planning in relation to all landscapes regardless of whether their quality and condition is considered outstanding, ordinary or degraded.

6.3.3 National Guidance

The Draft Revised Wind Energy Development Guidelines (DWEDG) were published in December 2019, and a public consultation ran until 19th February 2020, which is a review

[1] European Commission (2014) Directive 2014/52/EU [Online] Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32014L0052&from=EN (Accessed 27/06/2022)

[2] Department of Housing, Planning and Local Government (2019) Draft Revised Wind Energy Development Guidelines [Online] Available at: https://www.housing.gov.ie/sites/default/files/public-consultation/files/draft_revised_wind_energy_development_guidelines_december_2019.pdf (Accessed 27/06/2022)

[3] Environmental Protection Agency (2022) Guidelines on the Information to be Contained in Environmental Impact Assessment Reports [Online] Available at: https://www.epa.ie/publications/monitoring--assessment/assessment/EIAR_Guidelines_2022_Web.pdf (Accessed 27/06/2022)

of the Wind Energy Development Guidelines (2006) by the Department of Housing, Planning and Local Government (DoHPLG).

This document addresses a number of issues of wind energy developments, and presents considerations and guidance on LVIA, including ancillary structures and modifications, and connection to electricity distributors.

6.3.4 Regional Planning Policy

This assessment has taken into account the current legislation, policy and guidance relevant to the LVIA. In landscape and visual terms, the planning policies of relevance to the Development are presented within this section of the LVIA.

The Development is located within CCC (See Figure 6.1).

The following documents are also considered relevant to the Development, and detailed in full in **Chapter 3: Planning and Energy Policy**:

- Carlow County Development Plan 2022-2028[4] (Adopted in 2022);
- Carlow County Renewable Energy Strategy (Adopted in 2022) ('the CCRES') (Appendix 6 of the Carlow County Development Plan 2022-2028[5]); and
- Carlow County Landscape Character Assessment and Schedule of Protected Views (CCLCA) (July 2015)[6].

6.3.5 Landscape Planning Designations

There are no landscape planning designations within the Study Area (defined in Section 6.6.1). The closest landscape receptor is an area of ancient woodland at Clogrennan, 3 km north east of the Development, and a Natural Heritage Area, situated 7.5 km north west of the Development (refer to Figure 6.8, Volume II).

6.4 LVIA METHODOLOGY & GUIDELINES

The LVIA has been undertaken to identify key landscape and visual issues in accordance with the industry best practice guidance including, but not limited to, the following guidance documents:

- Landscape Institute and Institute of Environmental Management and Assessment *'Guidelines for Landscape and Visual Impact Assessment'*, 2013 (GLVIA3)[7];
- Landscape Institute and Institute of Environmental Management and Assessment, *'GLVIA3 Statement of Clarification 1/13'*, 2013[8];
- DoHPLG *'The Draft Revised Wind Energy Development Guidelines'*[9] (DWEDG) December 2019; and
- EPA 'Guidelines on the Information to be Contained in Environmental Impact Assessment Reports' 2022.

[4] Carlow County Development Plan 2022-2028 [Online] Available at: https://consult.carlow.ie/en/consultation/carlow-county-development-plan-2022-2028 (Accessed 06/07/2022)
[5] Carlow County Development Plan 2022-2028 VI. Renewable Energy Strategy [Online] Available at: https://consult.carlow.ie/en/consultation/carlow-county-development-plan-2022-2028/chapter/vi-renewable-energy-strategy (Accessed 06/07/2022)
[6] Carlow County Landscape Character Assessment and Schedule of Protected Views, July 2015http://www.carlow.ie/wp-content/documents/uploads/carlow-county-development-plan-appendix-6-landscape-character-assessment.pdf (Last accessed 27/06/2022)
[7] Landscape Institute and Institute of Environmental Management and Assessment, 2013, *Guidelines for Landscape and Visual Impact Assessment (GLVIA3)*, 3rd Edition, Routledge, London (Last accessed 27/06/2022)
[8] https://www.landscapeinstitute.org/technical-resource/glvia3-clarifications/ (Last accessed 27/06/2022)
[9] Department of Housing, Planning and Local Government (2019) Draft Revised Wind Energy Development Guidelines [Online] Available at: https://www.housing.gov.ie/sites/default/files/public-consultation/files/draft_revised_wind_energy_development_guidelines_december_2019.pdf (Accessed 27/06/2022)

A detailed description of the methodology used has been provided in Appendix A6 – LVIA Methodology.

6.4.1 LVIA Methodology

The two components of LVIA referred to throughout the EIA Report are based on the following definitions:

- *"Assessment of landscape effects: assessing effects on the landscape as a resource in its own right"*[10]; and
- *"Assessment of visual effects: assessing effects on specific views and on the general visual amenity experienced by people."*[11]

The Development may have a direct (physical) effect on the landscape in which it is located, as well as an indirect or perceived effect from landscape character areas surrounding it. The potential landscape effects, occurring during the construction of the Development and operational stages of the Development may therefore include, but are not restricted to, the following:

- Changes to landscape elements: the addition of new elements or the removal of vegetation, and buildings and other characteristic elements of the landscape character type;
- Changes to landscape qualities: degradation, erosion, or reinforcement of landscape elements and patterns, and perceptual characteristics, particularly those that form key characteristic elements of landscape character types;
- Changes to landscape character: landscape and character may be affected through the effect on characteristic elements (including perceptual characteristics), landscape patterns and attributes and the cumulative addition of new features, the magnitude and presence of which is sufficient to alter a notable part of the overall landscape character type of a particular area; and
- Cumulative landscape effects: where more than one development may lead to a potential landscape effect.

Visual effects are concerned wholly with the effect of the Development on visual receptors and general visual amenity. Visual effects are identified for different receptors (people) who would experience the view such as at their places of residence, during recreational activities, at work, or when travelling through the area. Visual effects may include the following:

- Visual effect: change in the appearance of the landscape as a result of the Development. This may include changes to the quality of the view, ability of the visual receptor to appreciate the view, or changes to the characteristic elements within the view. These changes can be positive (i.e. beneficial or an improvement) or negative (i.e. adverse or a detraction); and
- Cumulative visual effects: the cumulative or incremental visibility of similar types of development may combine to have a cumulative visual effect.

6.4.1.1 Cumulative Assessment

The cumulative assessment considers the extent to which the Development, in combination with other wind farms, may change landscape character through either incremental effect on characteristic elements, landscape patterns and quality, or by the cumulative addition of new features.

[10] Landscape Institute and Institute of Environmental Management and Assessment, 2013, *Guidelines for Landscape and Visual Impact Assessment*, 3rd Edition, Routledge, London. Paragraph. 2.21, page 21. (Last accessed 27/06/2022)
[11] Ibid. page 21.

Detailed guidance on the cumulative assessment of wind farm developments is provided in the Draft Revised Wind Energy Development Guidelines[12] (DWEDG) and NatureScot document, (formerly Scottish Natural Heritage (SNH)), 'Guidance: Assessing the Cumulative Impact of Onshore Wind Energy Developments'[13].

The search area for the Cumulative Landscape and Visual Assessment (CLVIA) is based on a 20 km radius circle from the proposed wind turbines, and identifies those wind energy developments already built, those consented but not yet built, and those for which a detailed planning application has been submitted but not yet determined.

Cumulative effects are defined as follows:

- Cumulative Landscape Effects: Where more than one wind development may have an effect on a landscape designation or particular area of landscape character; and
- Cumulative Visual Effects: the cumulative or incremental visibility of similar types of development may accumulate and give rise to a combined visual effect with the Scheme adding an increment of change to a pre-defined baseline's presence. These can be:
  - *Simultaneous or combined* – where two or more developments may be viewed from a single fixed viewpoint simultaneously, within the viewer's field of view and without requiring them to turn their head. Note: A person's field of view is variable but is approximately 90° when facing in one direction;
  - *Successive or repetitive* – where two or more developments may be viewed from a single viewpoint successively as the viewer turns their head or swivels through 360°; and
  - *Sequential* – where a number of developments may be viewed sequentially; or repeatedly from a range of locations when travelling along a route.

The cumulative development of wind farms within a particular area may build up to create different types of cumulative effect, as follows:

- The wind farms are seen as separate isolated features within the landscape character type, too infrequent and of insufficient significance to be perceived as a characteristic of the area;
- The wind farms are seen as a key characteristic of the landscape, but not of sufficient dominance to be a defining characteristic of the area; or
- The wind farms appear as a dominant characteristic of the area, seeming to define the character type as a 'wind farm landscape character type.'

Those schemes which have been included in the cumulative assessment of the Development are listed in Table 6.1.

Table 6.1: Wind Energy Developments Included within the CLVIA

Wind Farms within 20 km of the Site	**Details**				
	No.	**HH**	**RD**	**BT**	**Distance (km)**
Operational Wind Farms					
Gortahile Wind Farm	8	80	90	**125**	1.5
Ballon Meats, Raheenkillane	1	80	39	**99.5**	17.8

Key: HH Hub Height (m)

[12] Department of Housing, Planning and Local Government (2019) Draft Revised Wind Energy Development Guidelines [Online] Available at: https://www.housing.gov.ie/sites/default/files/public-consultation/files/draft_revised_wind_energy_development_guidelines_december_2019.pdf (Last accessed 27/06/2022)

[13] NatureScot, formerly Scottish Natural Heritage, *Guidance: Assessing the Cumulative Impact of Onshore Wind Energy Developments*, 2012 (Last accessed 27/06/2022)

No.	Number of turbines proposed	RD	Rotor Diameter (m)
BT	Blade Tip (m)	Distance	Distance from the wind farm site centre.

Gortahile Wind Farm is within County Laois, and Ballon Meats is within County Carlow. Data is correct as of the 26th November 2020.

Please refer to Figures 6.11 – 6.14, and Figures 6.17 – 6.24 for the location of the wind farms listed above, cumulative ZTVs, and wireline illustrations.

A Detailed CLVIA Study Area was established at 10 km radius from the Site centre, focussing on the operational Gortahile Wind Farm which is the only cumulative wind farm within 10 km of the Site.

The cumulative assessment will take into consideration the operational Gortahile Wind Farm situated 1.5 km north of the Development, the Consented Grid Route and local forestry operations.

Refer to Figures 6.11 and 6.13, Volume II.

6.4.1.2 Information Sources

A number of different sources of information were used to help understand the land within the Site and the surrounding landscape context:

- Ordnance Survey Ireland mapping at 1:50,000, 1:25,000 and 1:10,000;
- Aerial Photography;
- Google Earth, Street View and Maps;
- LVIA prepared for the Consented Wind Farm (please refer to the Planning Statement for detailed information on this application);
- Carlow County Wind Energy Statement[14];
- Carlow County Landscape Character Assessment & Schedule of Protected Views[15].
- A review of the Carlow County Planning Portal, and neighbouring authorities, to confirm the cumulative baseline information for existing, consented and proposed wind energy schemes within the study area; and
- Carlow County Landscape Character Assessment & Schedule of Protected Views[16].

6.4.2 Significance Criteria

In accordance with the EIA Regulations, it is essential to determine whether the predicted effects are likely to be 'significant'.

Significant landscape and visual effects, in the assessor's opinion, resulting from the Development would be all those effects that normally result in a ''Profound' effect with any exceptions being clearly explained (refer to Table 6.1 below). There may for example be exceptions in the case of lower magnitudes of change affecting receptors of higher landscape and or visual sensitivity and leading to a moderate effect that in some circumstances are considered to be significant. A full description of the methodology used in this assessment is set out in Appendix A6.

[14] Carlow County Wind Energy Statement, June 2008 [Online]http://www.carlow.ie/wp-content/documents/uploads/carlow-county-development-plan-appendix-5-wind-energy-strategy.pdf (Last accessed 27/06/2022)
[15] Carlow County Landscape Character Assessment and Schedule of Protected Views, July 2015http://www.carlow.ie/wp-content/documents/uploads/carlow-county-development-plan-appendix-6-landscape-character-assessment.pdf (Last accessed 27/06/2022)
[16] Carlow County Landscape Character Assessment and Schedule of Protected Views, July 2015http://www.carlow.ie/wp-content/documents/uploads/carlow-county-development-plan-appendix-6-landscape-character-assessment.pdf (Last accessed 27/06/2022)

Table 6.1: Matrix for Determining Level of Effect

Magnitude of Change	Landscape & Visual Receptor Sensitivity			
	High	**Medium**	**Low**	**Negligible**
High	Profound – Very Significant	Significant – Moderate	Moderate - Slight	Slight - Imperceptible
Medium	Substantial - Moderate	Moderate	Slight	Imperceptible
Low	Moderate - Slight	Slight	Slight – Not Significant	Imperceptible
Negligible	Slight - Imperceptible	Imperceptible	Imperceptible	Imperceptible

6.5 SCOPE OF ASSESSMENT

6.5.1 The Development

There are no changes to turbine locations of the Consented Wind Farm proposed as part of the Development, as shown in Figure 5.1 Site Layout Plan.

This LVIA includes an assessment to assess whether the Development would result in any significant effects and whether these are different from those previously assessed within the Original Wind Farm 2011 Environmental Impact Statement LVIA (the 2011 EIS LVIA) and the Consented Modification 2020 Environmental Impact Statement LVIA (the 2020 EIA LVIA).

6.5.2 Study Area

GLVIA3 states that the study area for an LVIA should *"include the site itself and the full extent of the wider landscape around it which the proposed development may influence in a significant manner….it may also be based on the extent of the area from which the development is potentially visible."*[17]

After a review of the planning history of the Site, and with specific reference to the 2011 EIS LVIA for the Original Wind Farm, an LVIA study area of 10 km radius has been selected, with a detailed study area of 5 km. A 2 km radius has also been included specifically for the visual assessment of views from residential properties and view from National Inventory of Architectural Heritage (NIAH) Buildings & Gardens and National Monuments.

A 20 km Cumulative Study Area has been selected for the cumulative assessment of nearby cumulative schemes, focussing on the Detailed Cumulative Study Area of 10 km radius. This results in having to assess the Development with the operational Gortahile Wind Farm and the Consented Grid Route.

This is a reflection of the study areas for the LVIA of the Consented Wind Farm on the site, and the conclusions drawn within the previous LVIAs.

The Landscape & Visual Study Area is illustrated in Figure 6.1 and covers an area of 10.39 km radius from the Development (based on a minimum 10 km distance from each of the consented turbine locations).

[17] Landscape Institute and Institute of Environmental Management and Assessment, 2013, *Guidelines for Landscape and Visual Impact Assessment (GLVIA3)*, para 5.2, page 70, 3rd Edition, Routledge, London (Last accessed 27/06/2022)

6.5.3 Zone of Theoretical Visibility (ZTV)

Following identification of the landscape components which define landscape character such as topography, vegetation, built form, infrastructure and land use and to help identify the landscape and visual receptors, the LVIA has been informed by a ZTV. ZTVs are computer generated from a digital terrain model of the study area. They illustrate the theoretical visibility of the proposed turbines throughout the study area based on the average eye height (1.7m) of an adult person.

ZTVs do have some limitations which need to be considered when looking at the theoretical visibility illustrated. Firstly, they do not take account of screening elements such as buildings, vegetation and local landform which can substantially reduce visibility. Notwithstanding their limitations, ZTVs are currently the best tool for predicting the likely visibility of the Development and used to refine the scope of the LVIA.

6.5.4 Viewpoints

The viewpoints presented within this LVIA are the same viewpoints illustrated within the 2011 EIS LVIA for the Original Wind Fam and the 2020 EIA LVIA for the Consented Modification, in order to be able to appropriately assess the y the Development, which is unchanged from the Consented Development.

A summary of the illustrated viewpoints is provided in Table 6.2 below. All viewpoints are located in the public realm, and focus on the indicative location of the proposed turbines. Site photography was undertaken during periods of fine weather and clear visibility. Refer to Figure 6.16 for Viewpoint Locations, and Figures 6.17 – 6.24 for the baseline landscape photographs presented with wireline images and photomontages of the proposed turbines.

Table 6.2: LVIA Viewpoints

Viewpoint Number	Viewpoint Name	Description	Distance to the Consented Turbines
1	Bilboa Village	Viewpoint to illustrate the landscape context from the edge of the village of Bilboa, north east of the site. The viewpoint is representative of views available for local road users, residents, within the Uplands LCT.	1.4 km
2	Third Class Road (West)	The viewpoint is representative of views available for local road users directly west of the site, and a residential property, within the Uplands LCT.	2.6 km
3	Third Class Road	The viewpoint is representative of views available for local road users directly north east of the site, in the Uplands LCT.	2.6 km
4	Third Class Road	The viewpoint is representative of views available for local road users and two residential properties directly south east of the site, in the Uplands LCT.	0.6 km
5	Third Class Road (South West)	The viewpoint is representative of views available for local road users on the Scenic Route No. 7 – Road to the Butts, in the Uplands LCT.	3.0 km

Viewpoint Number	Viewpoint Name	Description	Distance to the Consented Turbines
6	Motorway Bridge	The viewpoint is representative of views available for motorway and local road users, in the Farmed Lowland LCT.	5.7 km
7	N9 (South East)	The viewpoint is representative of views available for motorway users, and recreational users of the Sport Ireland National Trail, the Barrow Way, in the Broad Valley LCT.	6.0 km
8	Third Class Road	The viewpoint is representative of views available for local road users in the Farmed Lowlands LCT, east of the site.	8.1 km

6.6 BASELINE CONDITIONS

The following section describes the existing environment in terms of landscape character and visual amenity, the baseline against which the impacts of the Development will be assessed, including sensitivity of landscape and visual receptors.

Overall, there is no change from 2011 EIS LVIA baseline conditions for the Original Wind Farm and the 2020 EIA LVIA baseline conditions for the Consented Modification.

6.6.1 Landscape Planning Designations

Figure 6.8 identifies landscape planning policies, designations and constraints relevant to this LVIA. Table 6.3 summarises the constraints within the study area.

Table 6.3: Landscape Designations and Protected Heritage Assets

Landscape Designations & Protected Heritage Assets	Present Within Site Boundary	Present within study area (10 km radius)
Scheduled Monuments	No	Yes
NIAH Buildings & Gardens	No	Yes

6.6.2 Regional / County Landscape Character

The landscape character is considered at a regional level, based on the landscape character areas within the CCLCA. This document was published in 2015.

The 'host' LCA is the Killeshin Hills LCA within which the Development is sited (Figure 6.5). The landscape character areas (LCAs) are sub divided into landscape character types (LCTs) and the 'host' LCT is the Uplands LCT (Figure 6.6).

The LCAs and LCTs identified within the 2015 CCLCA are unchanged from the CCLCA, which was referenced in the 2011 EIS LVIA for the Consented Wind Farm.

6.6.2.1 Killeshein Hills Landscape Character Area (LCA) & Uplands Landscape Character Type (LCT)

The key characteristics of the Killeshein LCA include:

- Rural character with few settlements. There are no significant settlements in the area, with farm buildings enclosed within shelterbelts, and within the rolling hills;

- Field boundaries are a combination of hedges, stone walls, wire fences and grassy banks;
- Distinct prominence of Castlecomer Plateau forms a backdrop to the area and separates the County from Kilkenny;
- Mixture of grassland on lower elevations, with rough gazing and forestry plantations on higher elevations. Field units are of a medium scale;
- River Barrow forms eastern edge of area;
- Isolated stone quarries and lime workings have notable landscape features; and
- Open views and vistas with extensive views across the entire County from ridges and from the Castlecomer Plateau.[18]

This character area is situated on the western border of County Carlow, adjoining the counties of Kilkenny and Laois. The area is bounded to the east by the river Barrow Valley within which the N90 lies along the east side of the valley. The landscape adjoining the river valley includes gently undulating hills which ascend steeply to uplands to the west. There are panoramic views of the across the county available from the eastern slopes, upon which there are a number of scenic routes and protected views located. There are no specific tourism targets for this area.

The changes to the landscape character baseline since the 2011 EIS LVIA include the addition of sub divided LCTs within the LCAs and the addition of a Landscape Sensitivity Map within the 2015 LLCA, however this was picked up and included in the assessment contained within the 2020 EIA LVIA.

The CCLCA (2015) identifies the Killeshein Hills LCA as having a 'moderate sensitivity' to 'wind farming'[19], and the Upland LCT has having the highest, Level 5, landscape sensitivity.

In addition, the CCRES repeats the findings of the CCLCA (2008 and 2015) to identify the Killeshein Hills LCA as having a 'moderate capacity' to accommodate wind energy development[20].

Within the CCLCA the following scenic routes and viewpoints are identified within the study area:

- Scenic Routes 6, 7, 8 and 9 within 5 km radius of the Development (Figure 6.9); and
- Scenic Viewpoints No. 31 and 32 located south of the Development (Figure 6.9).

6.6.2.2 Transitional Marginal LCT

The Development is situated within the Transitional Marginal Landscape LCT, which is identified within the CCWES, and described in the DoEHGL Guidelines for Wind Energy Development[21] within which the key landscape characteristics are described as:

- Comprises something of both mountain moorland and farmland, thus involving a mix of small fields, tight hedgerows and shelterbelts;
- May include relatively rugged and rocky terrain, and thus a reasonable degree of spatial enclosure;

[18] Carlow County Landscape Character Assessment and Schedule of Protected Views, July 2015http://www.carlow.ie/wp-content/documents/uploads/carlow-county-development-plan-appendix-6-landscape-character-assessment.pdf (Last accessed 02.12.19), page 27 (Last accessed 27/06/2022)
[19] Carlow County Landscape Character Assessment and Schedule of Protected Views, July 2015http://www.carlow.ie/wp-content/documents/uploads/carlow-county-development-plan-appendix-6-landscape-character-assessment.pdf (Last accessed 27/06/2022)
[20] Carlow County Council (2021) *Draft Carlow County Renewable Energy Strategy* [Online] Available at: VI. Renewable Energy Strategy | Carlow County Council's Online Consultation Portal (Accessed 27/06/2022)

[21] https://www.opr.ie/wp-content/uploads/2019/08/2006-Wind-Energy-Development-1.pdf (Last accessed 27/06/2022)

- Higher ground tends to be wet and boggy. Lower areas are usually cultivated and managed as fields;
- Houses and farmsteads are usually fairly common; and
- This landscape type bridges the organised and intensively managed farmland and the more naturalistic moorland.[22]

Further design guidance for the wind energy development within the Transitional Marginal LCT was followed in the design of the Consented Wind Farm.

6.6.2.3 Landscape Character of the Site

The landscape character of the Site has been assessed as having:

- **Landform & Scale** – the land form comprises of rolling hills with a medium scale;
- **Land use** – the current land use on site is commercial forestry, with the surrounding landscape comprising of coniferous plantation and farmland;
- **Settlement / Man made influence** – this is a man modified landscape, with farmland, quarry operations, and forestry operations;
- **Movement** – this is a settled landscape with limited movement associated with local traffic between isolated properties and settlements. Movement along the M9 motorway corridor is more evident in the east and south east of the study area;
- **Skylines & Key views** – the Development is situated within an elevated area within the Killeshein Hills, and the east facing slopes have panoramic views across the River Barrow and lowlands to the east;
- **Perceptual Aspects** – the site has an open character, with views across the rolling farmland landscape; and
- **Cumulative Wind Energy** – Gortahile Wind Farm, situated 1.5 km and is visible to the north north-west of the Consented Wind Farm and the Development.

6.6.3 Landscape Designations

There are no landscape designations within the Site, nor within the 10 km radius study area, as shown on Figure 6.8.

There is one area of Ancient Woodland within the study area, Clogrennane Woods, 4 km north east of the Site.

6.6.4 Scheduled Monuments

A 2 km radius for the baseline study of scheduled monuments has been adopted to reflect the study area of the Cultural Heritage assessment within the 2011 EIS for the Consented Wind Farm. There are no scheduled monuments within 2 km of the Site.

6.6.5 NIAH Buildings & Gardens

A 2 km radius for the baseline study of NIAH Buildings & Gardens has been adopted to reflect the study area of the Cultural Heritage assessment within the 2011 EIS for the Original Wind Farm and the 2020 EIA for the Consented Modification.

There are two listed buildings within 2 km of the Site, as shown on Figure 6.8:

- No.1 - Bilboa Church of Ireland Church (Reg. No. 10300601); and
- No.2 – Three Counties Bridge (Reg. No. 12400611).

6.6.6 Visual Receptors

The visual assessment draws from the ZTV and viewpoint analysis, and assesses the potential visual effects on views and visual amenity likely to be experienced by receptors (people) within the landscape as follows:

- Views from residential properties and settlements;
- Views experienced while travelling through the landscape (recreational road users, walkers, horse riders, cyclists for example); and
- Views from tourist and recreational destinations.

The visual assessment focuses on those receptor areas where significant effects are most likely, as detailed in the sections below.

Visual effects would be experienced by the people who live and work in the area, along with those enjoying recreational activities in this area or simply passing through. Whilst it is people who are the actual receptors of visual effects, it is the places they may occupy, and from which the proposed wind turbines may be seen, that are listed below.

6.6.6.1 Recreational Receptors

Whilst the potential visual effects on tourists, or those engaging in recreation activities, may be brief in nature by passing through the area by vehicle, or on horse, foot or bike, their sensitivity to landscape and visual change is high because their purpose/activity is to enjoy the landscape and surroundings.

The 2011 EIS LVIA identified that there are no major tourist attractions in Bilboa or its vicinity. This remains the same as of July 2022, and the area is also not identified within the CCDP as being an important area for tourism.

The visual assessment considers views from recreational receptors within 5 km of the Development. Nearby recreational receptors (Refer to Figure 6.9) within the Detailed Study Area include:

- Sport Ireland Trail 396, a multi activity recreational trail, which is situated 3.5 km north east of the Site at Clogrenanne Wood Loop;
- Sport Ireland Trail 2, a multi activity recreational trail, which is situated 5 km east of the Site, the Barrow Way, along the River Barrow corridor;
- Scenic Routes 6, 7, 8 and 9 within 5 km radius of the Site; and
- Scenic Viewpoints No. 32 and 31 are located 1 km and 4 km south of the Site.

6.6.6.2 Residential Properties & Settlements

Particular attention is dedicated to the Development's effect on local residents because the receptors would experience the turbines from different locations, at different times of the day, usually for longer periods of time, and in different seasons.

The visual assessment considers views from groups of residential properties within 1 km of the proposed turbines (Figure 6.10).

The methodology for the assessment of the visual effects on view from residential properties is included within Appendix A6.

The assessment of visual effects likely to be experienced from settlements includes consideration of residential areas, the public realm, and public open spaces within the settlement boundaries that would be frequented by people.

The only settlement within 5 km radius from the Site is the village of Bilboa.

6.6.6.3 Transport Routes

It is important to take account of how the Development would be experienced from the surrounding road network. The visual assessment considers the potential visual effects likely to be experienced by people travelling through the landscape on main roads and the local road network. Views would vary depending on proximity of the Development to the road, the mode of transport, the angle of view, and intervening landscape features.

Figure 6.9 illustrates key roads and cycle routes, which are located within 5 km area from the Site, which include:

- M9 motorway; and
- The local road network surrounding the site.

6.6.7 Future Baseline

It is not anticipated that the baseline conditions as described above would change to those encountered today. Within the 30 year operational phase assessed within this LVIA, the location of the existing Gortahile Wind Farm, the dominant land use of the area being agriculture, the existing quarrying and forestry operations would remain, and the proximity to residential properties is expected to remain consistent.

At some point, during the operation of the Development, Gortahile Wind Farm may be decommissioned, or granted an extension after the approved operational period. However, the outcome of this is unknown and, the overall baseline is not expected to change fundamentally during the operational phase of the Development.

6.6.8 Receptors Scoped Out of the LVIA

Given the planning history, and a review of the assessment presented within the 2011 EIS LVIA for the Original Wind Farm and the 2020 EIA LVIA for the Consented Variation, this LVIA focuses on indirect landscape effects of the Killeshein Hills LCA and Uplands LCT, and potential visual effects from those nearest receptors only.

Further to the information presented above, the following landscape and visual receptors have been scoped out of this assessment:

- All LCAs other than the 'host' Killeshein Hills LCA and Uplands LCT within the 10 km study area;
- There are no scheduled monuments within the 2 km radius;
- All NIAH Buildings & Gardens beyond the 2 km radius;
- Sport Ireland Trail 396, a multi activity recreational trail, which is situated 3.5 km north east of the Site, but located within woodland which restricts views;
- All residential properties beyond 1 km radius;
- All settlements beyond 5 km radius;
- All recreational trails beyond 5 km radius;
- All transport routes beyond 5 km radius; and
- All temporary construction effects, there would be no additional temporary landscape and visual effects arising from the construction of the Development, and these are not considered further.

6.7 THE DEVELOPMENT

The Development has maintained the design objectives and all components associate with the Consented Wind Farm. The 2011 EIS LVIA and the 2020 EIA LVIA identified the following key principles from the DoEHLG Wind Energy Development Guidelines for the siting and design of wind energy development within the Transitional Marginal LCT:

- Location - to achieve a clear separation from the complexities of lower ground, by being located on higher ground within the Killeshein Hills;
- Spatial Extent – Wind energy development within this landscape should be relatively small in extent. The Consented Wind Farm, of five turbines, is small in

turbine number, and the layout achieves a best fit with the receiving landscape, which is not changed by the Development;
- Spacing – irregular spacing is deemed more appropriate given the complexity of the landform and land cover within this LCT, and the design of the Consented Wind Farm adopted an irregular layout which is not changed by the Development;
- Layout – a clustered layout on the broad hilltop has been adopted, in contrast to a linear layout which is more appropriate to a ridge location;
- Height – tall turbines are more appropriate in open and visually extensive upper ground locations, as is the case with the location of the Consented Wind Farm and is not altered by the Development; and
- Cumulative Effect – Gortahile Wind Farm has been included within the landscape and visual assessment of the 2011 EIS LVIA, and considered in the design & layout of both the Consented Wind Farm, and subsequently, the Development and the Consented Grid Route.

6.8 EMBEDDED MITIGATION

Key embedded mitigation of the Development is the maintenance of all component infrastructure at the same location and scale as has been assessed as acceptable and consented (under planning applications Ref: 11/154 & 21/15).

Refer to **Chapter 5: Project Description** for further detail.

6.9 ASSESSMENT OF CONSTRUCTION EFFECTS

The construction phase would result in localised and direct landscape effects on the Uplands LCT and Hills and Uplands LCT, and the landscape elements within the Site itself.

However, the Development would result in landscape and visual construction effects which have been assessed as acceptable as part of the EIS & EIA for the Consented Wind Farm, and would not result in a significant landscape effect.

6.10 ASSESSMENT OF RESIDUAL LANDSCAPE EFFECTS

The landscape character is considered at two levels:

- At a regional setting, in relation to the County Carlow LCA (2015) and the landscape character types identified within the CCWED (2009); and
- Local setting, based on field observations to confirm the key features and characteristics pertinent to the study area and the application site.

6.10.1 County Landscape Character Area – Killeshein Hills LCA

The Killeshein Hills is the 'host' LCA for the Development. The Killeshein Hills LCA has been assessed as having:

- **Landscape value** – the area within the detailed study area is an undesignated landscape, and is considered to be of a low to medium landscape value across the LCA;
- **Landscape quality** – there is an overall positive landscape quality within the LCA, but with large areas of coniferous / commercial forestry plantations, and isolated quarry operations, the LCT is a man modified landscape. Overall, the LCA is considered to be of a low to medium landscape quality across the LCA;
- **Capacity to change** – there is a medium capacity for the LCA to accommodate the Development, which would not detract from the overall existing landscape quality, features and characteristics of the LCA;
- **Landscape susceptibility** – According to GLVIA3, landscape susceptibility means, "the ability of the landscape to accommodate the development without undue consequences for maintenance of the baseline situation and/or the

achievement of landscape planning policies and strategies." As demonstrated by the previously accepted planning application for the Consented Wind Farm and consultee responses, it has been demonstrated that the landscape can accommodate the Consented Wind Farm. Therefore, the landscape would be able to accommodate the Development, taking account of the existing character and quality of the landscape and neighbouring Gortahile Wind Farm; and

- **Landscape sensitivity** – this is an undesignated landscape, and the LCA is considered to be of a low - moderate landscape sensitivity overall.

The CCWES provides a summary of sensitivity and capacity for the LCAs within County Carlow, and highlights there is a 'moderate' capacity for wind energy development within the Killeshein Hills LCA,

"*Subject to appropriate mitigation measures there may also be moderate scope to absorb extractive industry and wind farming.*"[23].

There is no magnitude of change or change to the landscape effects when the Development is compared to the previous EIA and EIA. The principle of acceptability associated with the Development has been established and would not exceed the previously identified levels, which are small and non-significant for the LCA overall.

6.10.2 County Landscape Character Type – Uplands LCT

The CCLCA (2015) sub divided the LCAs into discrete Landscape Character Types (LCT). The landscape character of the Site and immediate surrounding area is within the Uplands LCT.

The landscape of the Uplands LCT is of a high sensitivity, as reported in the CCLCA (2015). A review of the CCLCA revealed that the high level of sensitivity for the Uplands LCT is attached to the inter-visibility within the LCT, and the broad, open views towards the Central Plain and Blackstairs Mountains to the east. The sensitivity is not a result of particular landscape quality / condition, or rarity, recreation value, nor conservation interests. The landscape sensitivity has been assigned as high due to the scenic quality, and the recreational value of the two scenic viewpoints and four scenic routes within the Uplands LCT on the western boundary of Carlow County within the study area.

There would be no change to the key characteristics of the LCT, and aesthetic and / or perceptual attributes of the landscape character. The Development would occupy a small extent of the LCT as a whole, but given the open nature of the LCT, the wind farm would be perceptible across the whole of the LCT. However, this was previously assessed in the 2011 EIS LVIA and 2022 EIA LVIA as a non-significant landscape effect, and the Development would not result in any change to this conclusion of the level of effect.

Given the proximity of Gortahile Wind Farm, the Uplands LCT would be able to accommodate the Development, without undue adverse effects, taking account of the existing character and quality of the landscape.

6.10.3 Landscape Character of the Site

The landscape character of the site has been assessed as having:

- **Landscape value** – the area within the detailed study area is an undesignated landscape. The landscape of the site is considered to be of a low landscape value;
- **Landscape quality** – the commercial forestry is considered to be of a low landscape quality;

[23] Carlow County Landscape Character Assessment and Schedule of Protected Views, July 2015http://www.carlow.ie/wp-content/documents/uploads/carlow-county-development-plan-appendix-6-landscape-character-assessment.pdf page 34 (Last accessed 27/06/2022)

- **Capacity to change** – given the presence of existing Gortahile Wind Farm, there is a medium capacity for the landscape character of the Site to accommodate the Development, which would not detract from the overall existing landscape character, landscape quality, features and characteristics of the site, shared by the surrounding Killeshein Hills. This results in a medium susceptibility to the Development taking account of the existing character and quality of the landscape; and
- **Landscape sensitivity** – this is an undesignated landscape used for commercial forestry, and the Site is considered to be of a low landscape sensitivity overall.

Landscape effects have been assessed and considered acceptable as part of the 2011 EIS LVIA and 2020 EIA LVIA. There would be no change to the determination of landscape effects within the site area arising as a result of the Development.

Indirect landscape effects of the existing nearby wind turbines at Gortahile Wind Farm are already evident in the landscape character of the Site, and the baseline reflects the key characteristics of the local landscape character.

There is no change to the non-significant landscape effects identified in the 2011 EIS LVIA assessment and 2020 EIA LVIA.

6.11 ASSESSMENT OF RESIDUAL VISUAL EFFECTS

The felling is located within the forest, and not at the edge of the forest. There would be no direct view of construction activity as the Development is located within commercial forest, therefore the Proposed Felling would be screened from view, and have not been included within the visual assessment. This LVIA has focussed on the Development only.

6.11.1 Viewpoint Assessment

An appraisal of visual effects was undertaken from eight viewpoints, which were selected to represent typical views from key receptors at varying distances and orientations from the site, including all viewpoints previously assessed within the LVIA for the Consented Wind Farm.

From each viewpoint the following information is provided:

- A representative baseline photograph (90 / 180 / 360 degree horizontal angle of view) to show the context of location of the viewpoint;
- A wireline illustration (53.5 degree horizontal angle of view) of the Original Wind Farm and Consented/Proposed Development;
- A photomontage illustration (53.5 degree horizontal angle of view) of the Original Wind Farm and Consented/Proposed Development;
- A description of the existing view;
- A qualitative assessment of the potential visual effects considering the sensitivity of the receptor and magnitude of change arising from the Development in the view.

The viewpoint locations are shown on Figure 6.16. Photographs and photomontages of the Development from each viewpoint, and are shown in Viewpoints 1 – 8, Figures 6.17 to 6.24. These visualisations include wirelines / photomontages of the Development.

A review of the assessment within the 2011 EIS LVIA and the 2020 EIA LVIA for the Consented Wind Farm revealed that there would be no change in the overall visual assessment of the majority of the views of the Development from each of the assessment viewpoints within the 2011 EIS LVIA and the 2020 EIA LVIA, with the exception of Viewpoint 4.

Viewpoint 4 is also representative of views from a residential property, built since the 2011 EIS LVIA, and after the Original Wind Farm was consented.

A summary of the viewpoint analysis of the Development has been provided in Table 6.5. Please refer to the wirelines and photomontages in Figures 6.17 – 6.24.

Table 6.5: Summary of Viewpoint Analysis of the Development

Viewpoint Number	Distance to the nearest turbine	LVIA Viewpoint Analysis		
		Sensitivity	Scale of Visual Effects	Impact Significance
1 - Bilboa Village	1.4 km	High	Medium	Significant - Moderate
2 - Third Class Road (West)	2.6 km	Medium	Medium	Moderate
3 - Third Class Road	2.6 km	Medium	Medium	Moderate
4 - Third Class Road & residential property (new build)	0.6 km	Medium	Medium	Moderate
5 - Third Class Road (South West) & Scenic Route No. 7	3.0 km	High	Medium	Significant - Moderate
6 - Motorway Bridge	5.7 km	Low	Low	Slight - Not significant
7 - N9 (South East)	6.0 km	Low	Low	Slight - Not significant
8- Third Class Road	8.1 km	Medium	Medium	Moderate

6.11.2 Visual Effects on Views from Residential Receptors & Settlements

The effect of the Development on local residents requires particular attention because they would experience the Development from different locations within the property curtilage, at different times of the day, usually for longer periods of time, and in different seasons.

Whilst individual or specific observations are made concerning views or potential views in the direction of the Development in respect of the residential properties, a 'summation' is offered based on an opinion 'in the round'. For example, the visual assessment includes the various potential views from a property, views from the surrounding garden/ amenity areas around a property, and the access/egress points at a property. In addition, alternative views from the property, which may be available, for example, the main elevation of a property may be in the opposite direction of the development, and this alternative view is described in the assessment. The sensitivity of residential receptors is considered to be high.

There are 25 properties within 1 km radius of the Development, therefore, the properties have been grouped in order to assess the visual effects on views from the properties (illustrated in Figure 6.10).

Table 6.6: Visual Effects on Residential Properties from Development

Property Locations Relative to the Site	**Description of Effect from Development**
North	There are a number of properties within the village of Bilboa, clustered around the cross road junction within the village, and also along the local road which borders the site to the north. **Nearest consented turbine:** 0.5 km (the closest turbine). **Description:** There are views to the existing Gortahile Wind Farm from the rear of the Bilboa properties, filtered by local tree and hedgerow, and garden vegetation. Properties to the north of the Site are orientated to both the north and south, some with open views at driveways, and with screened garden areas. **Cumulative Developments:** The Gortahile Wind Farm is visible from the properties at a distance of 1.3 km to the north. **Magnitude of Change:** there would be a negligible magnitude of change arising from the Development. **Change of Effect due to the Development: *Slight – Imperceptible*** The nature of these effects would be not significant, long-term (reversible), indirect and neutral.
South	There are a number of properties south of the Development along the local road which borders the site to the south. **Nearest consented turbine:** 0.6 km (the closest turbine) **Description**: Properties to the south of the Development are orientated to both the north and south along the road bounding the site to the south, and some are orientated to the east to take advantage of the open views across the farmed lowland. The properties have open gardens and driveways, and with screened garden areas, providing localised screening / filtering of views to the north. **Cumulative Developments:** The Gortahile Wind Farm is not visible from the properties. **Magnitude of Change:** there would be a small magnitude of change arising from the Development. **Change of Effect due to the Development: *Moderate /Minor*** The nature of these effects would be not significant, long-term (reversible), indirect and neutral.

Property Locations Relative to the Site	**Description of Effect from Development**
East	There are a number of properties east and north east of the Development along the local roads at Tomard Lows and Whelan's Cross Roads. **Nearest consented turbine:** 1.2 km (the closest turbine). **Description:** Properties to the east of the Development at Whelan's Cross Roads are orientated to the west. The properties have open gardens and driveways, and with screened garden areas, and roadside hedgerows, providing localised screening / filtering of views to the west. Where they are available, views to the west are across a medium scale landscape of the commercial forestry plantation. Further south at Tomard Lows, there is a cluster of residential properties around the cross roads. These are orientated in a number of directions, with garden vegetation, and road side vegetation filtering views. However, where views are available, they are open across the medium scale landscape of the commercial forestry to the north. **Cumulative Developments:** The Gortahile Wind Farm is visible on the horizon 2.2 km from the properties. **Magnitude of Change due to the Development:** there would be a negligible magnitude of change arising from the Development. **Change of Effect due to the Development:** ***Slight – Imperceptible*** The nature of these effects would be not significant, long-term (reversible), indirect, cumulative and neutral.
West	There are no properties within 1 km of the turbines to the west of the Development, due to the extent of the commercial forestry in this area.

The assessment of likely visual effects likely to be experienced from settlements includes consideration of residential areas, the public realm, and public open spaces within the settlements that would be frequented by people. The sensitivity of residential receptors within settlements is considered to be high.

The only settlement within 5 km of the Site is Bilboa, which has been assessed in Table 6.7 below.

Table 6.7: Visual Effects on Settlements

Property	**Description of Effect**
Bilboa	Nearest Consented Turbine: 1.4 km **Description:** Bilboa is a former mining village. There are a number of properties clustered north of the road, with garden vegetation and road side trees, and also along the local road running east west, as a ribbon Development, north of the Development. The village is well screened to the south by vegetation, tree and hedgerow, cover. Please refer to Viewpoint 1 – Bilboa Village (Figure 6.17) **Cumulative Schemes:** the operational Gortahile Wind Farm is visible 1.39 km north west of the village. **Magnitude of Change:** there would be a negligible magnitude of change arising from the Development. **Change of Effect due to the Development:** ***Slight – Imperceptible*** The nature of these effects would be not significant, long-term (reversible), indirect, cumulative and neutral.

6.11.3 Visual Effects on Views from NIAH Buildings & Gardens

There are two listed buildings within 2 km of the Development:

- No.1 - Bilboa Church of Ireland Church (Reg. No. 10300601); and
- No.2 – Three Counties Bridge (Reg. No. 12400611).

The sensitivity of visitors to the two NIAH Buildings is to be high.

Table 6.8: Visual Effects on Views from NIAH Buildings

Property	Description of Effect
Bilboa Church of Ireland Church	**Nearest Consented Turbine:** 1.4 km **Description:** The Bilboa Church of Ireland Church is located on a minor road west of Bilboa. Given the extensive mature roadside tree and hedgerow cover, open views are limited along this road. However, where there are clearances in the vegetation, there are views of Gortahile Wind Farm to the north of the road, and potential views of the Development to the south east. The Church is located on the northern edge of the woodland within which the Development is situated. **Cumulative Schemes:** Gortahile Wind Farm **Magnitude of Change:** There would be a negligible magnitude of change arising from the Development when viewed from Bilboa Church (where views are available). **Change of Effect due to the Development:** ***Slight – Imperceptible*** The nature of these effects would be not significant, long-term (reversible), indirect, cumulative and neutral.
Three Counties Bridge	**Nearest Consented Turbine:** 0.5 km **Description:** The Three Counties Bridge is located on a minor road west of Bilboa, and 0.5 km north west of the Development. Given the extensive mature roadside tree and hedgerow cover, open views are limited along this road. However, where there are clearances in the vegetation, there are views of Gortahile Wind Farm to the north of the road, and potential views of the Development to the south east. **Cumulative Schemes:** Gortahile Wind Farm 1 km north east of the bridge. Magnitude of Change: there would be a small magnitude of change arising from the Development when viewed from the Three Counties Bridge (where views are available). **Change of Effect due to the Development**: ***Minor – Moderate.*** This would be from views at the top of the bridge only, there would be no available views from the river bank, and the bridge below. The nature of these effects would be not significant, long-term (reversible), indirect, cumulative and neutral.

6.11.4 Visual Effects on Views from Scenic Routes, Scenic Viewpoints & the Barrow Way

There are a number of scenic routes and scenic viewpoints in the local landscape, and a national promoted route, the Barrow Way, within the study area (refer to Viewpoints 5 & 7, Figures 6.21 and 6.23).

The visual effects that would be experienced by the walkers, riders, drivers or cyclists using these routes are described below in Table 6.9. The assessment of the potential effects on these routes has been assisted by the use ZTV maps. The sensitivity of all these receptors is considered to be high.

Table 6.9: Visual Effects on Scenic Routes, Scenic Viewpoints & the Barrow Way

Route	Description of Effect
Scenic Route 6- Ridge Cross Road (Refer to Figure 6.9)	**Nearest Consented Turbine**: 3.2 km **Description:** This is a short scenic route along the local road network, offering views across the broad valley lowlands to the east and the Blackstairs Mountains on the horizon. Views to the north and south are screened along the route by

Route	Description of Effect
	mature tree and hedgerow cover, but views open up at the north end of the route to the across the upland landscape. **Cumulative Schemes:** The existing Gortahile Wind Farm lies 5.25 km distance to the north of the scenic route, but is not visible. **Magnitude of Change:** there would be a negligible magnitude of change arising from the Development when viewed from Scenic Route 6, and would be largely imperceptible at this distance. **Change of Effect due to the Development**: ***Slight – Imperceptible*** (from the northern end of the route only) and no view from the rest of the route. The nature of these effects would be not significant, long-term (reversible), indirect and neutral.
Scenic Route 7 – Road to The Butts (Refer to Figure 6.9)	**Nearest Consented Turbine:** 3.7 km **Description:** This is a short scenic route (refer to VP 5) along the local road network, offering clear and open views across the upland landscape to the north and east. **Cumulative Schemes:** The existing Gortahile Wind Farm lies 4.47 km distance to the north east of the scenic route. **Magnitude of Change:** there would be a negligible magnitude of change arising from the Development when viewed from Scenic Route 7, and would be largely imperceptible at this distance. **Level of Effect due to the Development: *Slight – Imperceptible*** The nature of these effects would be not significant, long-term (reversible), indirect, cumulative and neutral.
Scenic Route 8 – Tomard Wood (Refer to Figure 6.9)	**Nearest Consented Turbine:** 0.5 km **Description:** This is a short scenic route along the local road network, offering views across the broad valley lowlands to the east and the Blackstairs Mountains on the horizon. Views to the north and south are screened along the route by mature tree and hedgerow cover edge to the plantation woodland, screening views to the north. However, at the western end of the route, where the tree cover is thinner at the edge of the plantation, there are views to the woodland edge to the north. **Cumulative Schemes:** The existing Gortahile Wind Farm lies 3.25 km distance to the north of the scenic route, but is not be visible. **Magnitude of Change:** there would be a small magnitude of change arising from the Development when viewed from Scenic Route 8. **Change of Effect due to Development: *Minor - Moderate*** (from the western end of the route only) and no view from the rest of the route. The nature of these effects would be not significant, long-term (reversible), indirect and neutral.
Scenic Route 9 – Tomard Lower (Refer to Figure 6.9)	**Nearest Consented Turbine:** 1.74 km **Description:** This is a short scenic route along the local road network, offering views across the broad valley lowlands to the east and south east and the Blackstairs Mountains on the horizon. Views to the north and north west are filtered along the route by road side mature tree and hedgerow cover edge. However, at the western end of the route, where the tree cover is thinner and the land rises towards Tomard Lower, there are views to the Site to the north west. Approximately half of the route lies outwith the ZTV. **Cumulative Schemes:** The existing Gortahile Wind Farm lies 3.75 km distance to the north of the scenic route, but is not be visible. **Magnitude of Change:** there would be a negligible magnitude of change arising from the Development when viewed from Scenic Route 9. **Change of Effect due to the Development: *Slight – Imperceptible*** (from the western end of the route only), and no view from the rest of the route.

Route	Description of Effect
	The nature of these effects would be not significant, long-term (reversible), indirect and neutral.
Scenic Viewpoint 31 – Ridge Cross (Refer to Figure 6.9)	There would be no view of the Development from the Scenic Viewpoint 31 at Ridge Cross. Garden vegetation and houses screen all views to the north and north east.
Scenic Viewpoint 32 – Tuolocreen Cross (Refer to Figure 6.9)	**Nearest Consented Turbine**: 1.74 km **Description:** This is a viewpoint at a crossroads upon the local road network, offering views across the broad valley lowlands to the east and south east and the Blackstairs Mountains on the horizon. Views to the north are filtered by roadside mature tree and hedgerow cover edge in locations, and the conifer plantation woodland to the north, with open views to the north where there are clearings. There are views to the Site to the north. **Cumulative Schemes:** The existing Gortahile Wind Farm lies 3.1 km distance to the north of the scenic route, but is not be visible. **Magnitude of Change:** there would be a negligible magnitude of change arising from the Development when viewed from Scenic Viewpoint 32. **Change of Effect due to the Development:** ***Slight – Imperceptible*** The nature of these effects would be not significant, long-term (reversible), indirect and neutral.
Sport Ireland – National Trail 2 - Barrow Way (Refer to Figure 6.9)	**Nearest Consented Turbine**: 4.5 km Description: This is a nationally promoted recreational route along the River Barrow, following the river corridor. Views to the west and east are filtered along the route by riparian mature tree and hedgerow cover, screening views to the west and Killeshein Hills. However, where there are views to the Site to the west, the Development would be viewed at an elevated location, and alongside Gortahile Wind Farm. Cumulative Schemes: The existing Gortahile Wind Farm lies 4.75 km distance to the west and north west of the scenic route. Magnitude of Change: there would be a negligible magnitude of change arising from the Development when viewed from Sport Ireland Route 2 – the Barrow Way. **Change of Effect due to the Development**: ***Slight - Imperceptible*** The nature of these effects would be not significant, long-term (reversible), indirect and neutral.

6.11.5 Visual Effects on Views from Transport Routes

This section considers the views from the main transport routes and the likely visual effects on receptors, visual experience whilst using the M9, and local road network within the Detailed Study Area. The views from these routes would be experienced transiently by road and the sensitivity of all these receptors is considered to be low - medium - high (low for motorway users where potential views are fleeting and travelling at speed, medium for users of the local road network, and high for recreational users). Those routes outside the ZTV have not been assessed.

Table 6.10: Visual Effects on Transport Routes

Receptor	Description of Effect
M9	**Nearest Consented Turbine:** 4.25 km The sensitivity of visual receptors using the M9 road are considered to be low. **Description:** The M9 is a 119 km motorway, which links the M7 to Waterford. The M77 is situated within the within the Farmed Lowland of the Killeshein Hills LCA within the detailed study area.

Receptor	Description of Effect
	At its closest point the M9 motorway passes within 4.25 km of the proposed turbines. Views to the west and east are filtered along the route by riparian mature tree and hedgerow cover, screening views to the west and Killeshein Hills. However, where there are views to the Site to the west, the Development would be viewed at an elevated location, and alongside Gortahile Wind Farm. **Cumulative Schemes:** The existing Gortahile Wind Farm lies 7.25 km distance to the north west of the M9 motorway, at its closest point. **Magnitude of Change:** there would be a negligible magnitude of change arising from the Development when viewed from the M9. **Change of Effect due to the Development: *Imperceptible*** The nature of these effects would be not significant, long-term (reversible), indirect and neutral.
Local Road Network	The sensitivity of receptors on the local road network is medium. **Description:** The Development is situated within a landscape with a complex network of local roads and tracks. Given the extensive mature roadside tree and hedgerow cover, open views are limited within the local road network. However, where there are clearances in the vegetation, there are views across the Killeshein Hills, the farmed lowland, and Blackstairs Mountains to the east. **Cumulative Schemes:** The existing Gortahile Wind Farm is also visible from the local road network, and would be viewed alongside the Development. **Magnitude of Change:** there would be a negligible magnitude of change arising from the Development when viewed from the local road network (where views are available). **Change of Effect due to the Development: *Slight – Imperceptible (within 3 km radius) to Minor (within 0.6 km radius).*** The nature of these effects would be not significant, long-term (reversible), indirect, cumulative and neutral.

6.12 CUMULATIVE EFFECTS

The predicted cumulative effects of the Development, Gortahile Wind Farm, and the Consented Grid Route are embedded within the landscape and visual assessment as a whole.

The consolidation of wind farms within a landscape provides opportunity to reduce pressure elsewhere, and meet renewable energy targets.

The main cumulative effect is the relationship of the Development with Gortahile Wind Farm, as the closest existing wind farm to the Development.

In the majority of viewpoints there is inter-visibility between the Development and Gortahile Wind Farm. Wider views of the Development and Gortahile Wind Farm, across the Killeshein Hills reveal the Development to be viewed in an open, simple landscape, with an existing wind farm.

The assessment has concluded that the Development would contribute towards cumulative landscape and visual effects; however, negligible, non-significant, cumulative landscape and visual effects would occur as a result of the Development and the principle of acceptability exists from the Consented Wind Farm.

Potential cumulative effects of the Development with the grid connection works as part of Consented Grid Route would be temporary only for the duration of the construction works. There would be no cumulative landscape and visual effects once the cable was installed underground.

In addition, the proposed track upgrades as part of the Consented Grid Route would include works on existing track, and new tracks, within the woodland. There would be no direct visibility of these works, and no cumulative and landscape visual effects arising as a result of the Development.

Minor junction works at the entrance to the Site would be visible to local road users, and these works would be viewed in combination with the Development. However, the magnitude of change arising from these works, in combination with the Development, would be small, resulting in a Minor, and non-significant cumulative visual effects, arising from the construction of the junction, and the Development.

The construction of the substation included as part of the Consented Grid Route, would not bring about significant cumulative landscape effects. The Development is located within the Killeshin Hills LLCA (County Carlow) and the proposed substation is located within the Hills & Uplands LLCT (County Laois).

There would be limited inter-visibility between the substation and the Development along the local road network, where views of the Development and the substation may be viewed sequentially when travelling in the local landscape. The cumulative magnitude of change arising from these works, in combination with the Development, would be negligible, resulting in an Imperceptible, and non-significant cumulative visual effects, arising from the construction of the substation, and the Development.

Overall, potential, non-significant, cumulative effects are restricted within 3 km radius within the Detailed Study Area where the visual influence of the Development being restricted by the local tree / hedgerow cover along the roadsides and local topography, reduces the extent to which the wind farms are viewed cumulatively, either statically from one location, or sequentially along the local road and scenic route and recreational route networks.

6.13 STATEMENT OF SIGNIFICANCE

The effects of the Development on the landscape and visual receptors are considered to be **non-significant**, long-term (reversible), indirect, cumulative and neutral, in terms of the EIA Regulations. There is no change to the 2011 EIS LVIA assessment conclusions as a result of the Development.

6.14 SUMMARY & CONCLUSION

6.14.1 Predicted Landscape Effects

The Consented Wind Farm is situated within the Killeshein Hills LCA, with a moderate capacity for wind energy development. As such the Development is well sited within the landscape, viewed alongside the Gortahile Wind Farm. The Development is located within an open expansive, working rural landscape, a man modified landscape with conifer plantations, and isolated quarries.

There would be no change to the landscape character of the site, or surrounding area, as a result of the Development. There is no change to the 2011 EIS LVIA and 2020 EIA LVIA assessment conclusions as a result of the Development.

6.14.2 Predicted Visual Effects

The visual appraisal indicates that views of the, from the surrounding areas, would be ***Minor – Moderate*** within 0.6 km radius, ***Slight - Imperceptible*** within a 3 km radius, and imperceptible beyond that distance. This is due to:

- The location of the Development, which forms a continuation of wind turbines within the Killeshein LCA, within an area which is characterised (indirectly) by the operational Gortahile Wind Farm;
- The location takes advantage of the gentle rolling plateau landform. The siting and design of the Development allows for visual effects to be concentrated within a 3 km radius, within this lightly settled landscape;
- There would be Slight – Imperceptible to Minor - Moderate visual effects from the Development on viewpoints in proximity to the Development with clear and open views of the turbines including from Bilboa, the local road network to the north and west, and from Scenic Route 7;
- There would be Slight – Imperceptible visual effects from the Development for those recreational receptors using the scenic routes and scenic viewpoints within 3 km of the Development;
- There would be Slight – Imperceptible to Minor - Moderate visual effects on those residential properties within 1 km of the Development; and
- There would be a range of visual effects on the road users within the surrounding landscape of the Development, ranging from Slight – Imperceptible to Minor - Moderate. This variation is as a result of localised screening by plantation woodland, and roads side vegetation, and local topography within the local landscape.

The predicted visual effects arising from the Development are ***Minor - Moderate*** at most (within 0.6 km of the Site) and ***Slight – Imperceptible*** for the majority of the study area, as illustrated in the wirelines and photomontages within Figures 6.17 – 6.24.

6.15 CONCLUSION

The Development would not result in significant landscape and visual effects, either individually or cumulatively.

7 BIODIVERSITY

7.1 INTRODUCTION

This Chapter of the Environmental Impact Assessment Report (EIA Report) assesses the impact of the proposed development of Bilboa Wind Farm, on the ecological resources at the Development site and within the surrounding area. This assessment was undertaken by Fehily Timoney & Co. on behalf of Arcus Consultancy Services Limited (Arcus).

The Development consists of the following:

- 5no. wind turbines, each with a height to blade tip of 136.5 m, a hub height of 78 m, and a rotor diameter of 117 m;
- Control building;
- Substation (21 MW capacity);
- Turbine laydown area;
- Temporary crane hardstanding areas (30 m x 62.5 m);
- 1no. borrow pit;
- Upgrading of existing access track;
- Construction of new access tracks
- Temporary construction compound;
- Underground cabling;
- Anemometer mast; and
- Up to 18 ha of forestry felling.

This Chapter of the EIA Report is supported by the following Figures provided in Volume II EIA Report Figures:

- Figure 7.1: Bird Activity Survey Vantage Point Locations and viewshed
- Figure 7.2: Winter and Breeding Bird Transects;
- Figure 7.3: Hinterland and Barn Owl Survey Sites;
- Figure 7.4: European Sites in proximity to the proposed development;
- Figure 7.5: National Sites in proximity to the proposed development;
- Figure 7.6a-b: Habitat Map;
- Figure 7.7: Non-native Invasive Plant Species;
- Figure 7.8: Mammal Signs and Sightings; and
- Figure 7.9: Habitat Loss Comparison

This Chapter of the EIA Report is supported by the following Technical Appendix documents provided in Volume III Technical Appendices:

- A7.1: Bat Report;
- A7.2: Aquatic Ecology Report;
- A7.3: Flight Activity Survey Details and Results [year 1];
- A7.4: Target Species Flight Lines [year 1];
- A7.5: Ornithology Report [year 2];
- A7.6: Botanical Survey Results;
- A7.7: Natura Impact Statement;
- A7.8: Replant Lands Assessment;
- A7.9: Habitat & Species Management Plan;
- A7.10: Collision Risk Modelling Report;
- A7.11: Invasive Species Management Plan;
- A7.12: Summary of Construction-stage Impacts
- A7.13: Hydrogeology Report

This Chapter includes the following elements:

- Key Conclusions of Previous Assessments;
- Legislation, Policy and Guidance;
- Assessment Methodology and Significance Criteria;
- Baseline Conditions;
- Assessment of Potential Effects;
- Cumulative Effects Assessment;
- Mitigation and Residual Effects;
- Summary of Effects;
- Statement of Significance; and
- Glossary.

This Chapter was written by Ben O'Dwyer (BSc), a Project Ecologist at Fehily Timoney (FT). Bat activity surveys were undertaken by Tom O'Donnell (MSc, MCIEEM). Aquatic ecology surveys were carried out by Ecofact Environmental Consultants. Botanical and habitat surveys were carried out by Jonathon Dunn (FT Ecologist; PhD, MCIEEM). Botanical, bird, mammal and otter surveys were carried out by Joseph Adamson (MSc, MCIEEM). Bird surveys were also carried out by Aidan Duggan, a highly skilled ornithologist with extensive commercial experience and a former voting member of the Irish Rare Bird Committee (IRBC) operating under the auspices of Birdwatch Ireland. This chapter has been reviewed by Jon Kearney (BSc, MSc), Principal Ecologist at FT.

7.2 KEY CONCLUSIONS OF PREVIOUS ASSESSMENTS

7.2.1 2011 EIS

An Environmental Impact Statement (EIS) was prepared in 2011 as part of the original planning application. The key conclusions of the Original Wind Farm 2011 (2011 EIS) are as follows:

Overall, the site is primarily a highly modified habitat (i.e. coniferous forest) with no significant intrinsic ecological value. However, the remnant blanket bog appears typical of the original habitat previously covering this upland area. The project design avoided areas of higher-value habitat.

A number of ground-based faunal species were recorded, however within these, badger and common frog were the only species potentially subject to effects. Mitigation including pre-constructions surveys, translocation and sett closure (licensed by NPWS) were proposed to prevent significant negative effects.

Common bird species characteristic of coniferous forest, and some of peatland habitats were recorded onsite. No signs of red grouse were recorded in areas of bog. The only raptor recorded was kestrel. Some bird habitat loss and disturbance (limited to conifer plantation which is abundant in the area) will occur. Potential turbine collision risk was acknowledged however it was considered highly unlikely such losses would be of a scale which could result in adverse effects on local bird populations. Restricting vegetation clearance to outside the bird breeding season (March – August inclusive) was considered sufficient mitigation to prevent significant negative effects to avifauna.

A total of seven bat species were identified as occurring in the area by the desktop study; however, common pipistrelle was the only species recorded onsite during the activity survey. Leisler's bat, although not recorded on site was considered likely to occur. Leisler's would be a higher risk species due to its flight habits and known vulnerability to turbine strike.

Mitigation for turbine strike proposed was a 50m buffer zone between turbine blade tips and surrounding trees. The requirement for bridge inspections for bats was noted if any bridges would be affected by works.

The adjudged worst-case scenario is that the turbine development may cause injury or death to a few individual specimens of Leisler's bat over time. The impact on local populations was considered minor if the buffer zone is provided.

Aquatic surveys included habitat assessments including targeted salmonid, lamprey crayfish and freshwater pearl mussel habitat suitability survey. These were carried out at 17 locations within 9 km downstream in both the Barrow and Nore catchments. Electrofishing not carried out due to seasonal constraints. Biological sampling was carried out at 3 locations in the Barrow catchment and 3 in the Nore catchment.

Q values between Q3-4 and Q5 were recorded in the minor watercourses downstream. Poor- fair quality salmonid habitat was recorded in the minor watercourses downstream, however the better-quality habitat was inaccessible to salmonids. The river Dinin main channel up to 10km downstream contains significant salmon and brown trout spawning and nursery habitat. White-clawed crayfish, river and brook lamprey could be present in the Dinin in low densities; however, the habitat available was not considered to be optimal. There was considered to be no possibility for freshwater pearl mussel to occur in the potential zone of influence within the Nore catchment.

Within the Barrow catchment, no significant quality habitat for crayfish (i.e. fair or better) was recorded within 2 km downstream of the Consented Wind Farm site. Further downstream, significant crayfish habitat quality was recorded at some sites. Since no significant freshwater pearl mussel habitat was recorded within 7 km downstream of the Consented Wind Farm site and this species is considered absent from the Barrow main channel, potential effects could safely be discounted.

Potential effects on the aquatic environment arising from construction including sediment, nutrient and hydrocarbon pollution were considered in detail, in addition to hydrological effects. Comprehensive mitigation measures to avoid significant effects on the aquatic receiving environment were detailed and it was concluded that the project would not result in significant ecological effects if the prescribed mitigation was adhered to.

7.2.2 2011 FI REQUEST

The 2011 FI included one item relating to Biodiversity. The council had become aware that a pond at the site used by spawning frogs had been infilled and requested the applicants investigate and to reinstate the pond if required. Subsequently, representatives of the landowner met with NPWS onsite (5th September 2011) and all parties agreed the pond would be reinstated in its original condition prior to the next breeding season.

7.2.3 2020 GRID CONNECTION & ACCESS EIAR

An Environmental Impact Assessment Report (EIAR) was submitted in June 2020, covering a new application for the grid connection, underground cabling, access tracks and variations to the originally consented wind farm. The key conclusions of the 2020 Grid and Access Application are as follows:

No rare or protected plants were encountered during field surveys.

No habitats of high importance will be directly affected by the Cable Route, However, the River Dinin may be vulnerable to indirect effects. The Upgraded Access Track will be along an existing forestry road, which is of Negligible importance. The Re-orientated Crane Hardstanding and most of the Onsite Access Track will involve the clearance of conifer plantation; this habitat is of Negligible botanical importance. Part of the Onsite Access Track between Turbines 2 and 3 will cross an area of scrub. Beneath the trees there are also some patches of overgrown wet heath habitat. These habitats are common around the margins of the conifer plantation and are of Negligible importance.

The Upgraded Access Track will cross a tributary of the River Dinin (this is discussed in the previous section). The forest road passes over this watercourse in a culvert, but no modification of the culvert is required. The northern section of the Upgraded Access Track will be within 15 m of the River Dinin, which may be vulnerable to indirect effects.

No habitats of high importance will be directly affected by these components of the Development.

Common bird species characteristic of coniferous forest were recorded onsite. A dipper was observed on the River Dinin approximately 50 m from the grid connection route. Two species

(Goldcrest and House sparrow) are of Amber status (medium conservation concern) on the Birds of Conservation Concern Ireland (BoCCI) list[1]. All other species recorded are common, widespread and are considered to be of Negligible importance. Nonetheless, it is noted that all birds receive protection under the Wildlife Act 1976 (as amended).

The conifer plantation, hedgerows, treelines, scrub and grassy verge habitat could all provide foraging opportunities and commuting routes for bats. No mature broadleaf trees, buildings, masonry bridges or any other potential bat roost features were recorded within the Study Area. The Study Area does not support any habitat or roosting features that are unusual in the surrounding landscape; and is therefore considered to be of Negligible importance for bats.

No breeding or resting sites of protected mammals (e.g. badger setts, squirrel dreys) were observed during field surveys. No field signs of protected mammal species were recorded, but the plantation woodland was considered suitable for pine marten and red squirrel. The hedgerows and associated grassy verges along the cable route provide suitable foraging habitat for small mammal species such as hedgehog and pygmy shrew. On a precautionary basis, roadside hedgerows are considered to be of Local importance for these species. Both are protected under the Wildlife Act 1976 (as amended).

Ephemeral pools of standing water were observed within the plantation woodland, many of which contained spawn of common frog. This species is very common and widespread throughout Ireland, so the Development Site is considered to be of Negligible importance for this species. However, the common frog receives protection under the Wildlife Act 1976 (as amended). No permanent waterbodies were recorded that would provide potential breeding habitat for smooth newt. Some habitats could provide suitable foraging habitat for common lizard. However, this species occurs at very low density in Ireland, and the Development Site is considered to be of Negligible importance.

No devil's-bit scabious was recorded, so there would not be any potential breeding sites for the marsh fritillary butterfly.

Where possible, the Cable Route, Upgraded Access Track and Onsite Access Track were aligned with existing public roads and forestry tracks. Along the Turbine Delivery Route, road re-alignment works will only be required at a small number of locations, and the remainder of the route will be undisturbed. This has substantially reduced the overall footprint of the development and avoided effects on habitats and protected fauna. The contractor will employ an Ecological Clerk of Works (ECoW) to oversee the implementation of mitigation measures.

The following preconstruction surveys were advised. A survey for invasive plant species (notably Japanese knotweed) will be carried out during the growing season (usually May to October, inclusive); If construction work will take place during the nesting season for birds (March to August, inclusive), any vegetation proposed for clearance will be inspected; If construction work will take place during the breeding season for frogs, (March to May, inclusive), any areas of standing water will be searched for frog spawn; A survey of breeding / resting places for pine marten and red squirrel in affected areas of the conifer plantation will be carried out at any time of the year.

Pollution-prevention measures to prevent negative effects on the aquatic environment are included in the outline Construction and Environmental Management Plan (oCEMP).

It is strongly recommended that any tree or shrub removal is carried out between September and February (inclusive). If this is not possible, an ecologist will survey relevant vegetation in advance in order to determine whether any protected fauna are present. If any are encountered, the vegetation clearance will be delayed until the protected fauna have moved away from the area, e.g. when chicks have fledged and a nest has been abandoned.

[1] Gilbert, G., Stanbury, A., Lewis, L., 2021 Birds of Conservation Concern in Ireland 4: 2020–2026. Irish Birds 43 (2021)

The measures listed above will ensure there will be no residual effects on protected fauna.

7.2.4 2021 ROTOR MODIFICATION EIAR

An Environmental Impact Assessment Report was submitted in January 2021, covering an increase in rotor diameter and hardstanding dimensions (variations to the originally consented wind farm). The key conclusions of the 2020 Rotor Modification Application are as follows:

The site does not overlap any designated nature conservation site but is upstream of the River Barrow and River Nore SAC (002162); a number of small streams drain The Site and surrounding lands drain towards the Dinin (tributary of the Nore) and also towards the Barrow (The site Straddles both the Barrow and Nore catchments. The Natura Impact Statement assesses the effects of The Development on European Sites. In terms of Nationally designated sites, there is one Natural Heritage Area (NHA) and three proposed Natural Heritage Areas (pNHAs) within 10 km of The Development.

Conifer plantation is the most dominant habitat within the wind farm site accounting for 94% of the study area. Habitats present within and adjacent to The Site include Eroding Upland Rivers, Drainage Ditches, Conifer Plantation, Scrub, Buildings and Artificial Surfaces, Recolonising Bare Ground, Dense Bracken, Cutover Bog/Wet Heath Mosaic, [Degraded] Raised Bog, Artificial Lakes and Ponds, and Recently Felled Woodland.

Flight activity (vantage point) surveys undertaken during both winter 2019-20 and summer 2020 seasons covered The Site and surrounding area. Breeding bird surveys including common bird census, barn owl survey and breeding wader surveys were undertaken in 2020, while winter walkover surveys, hinterland surveys and hen harrier winter roost checks were carried out during winter 2019/2020. A total of 49 bird species were recorded during both breeding and winter season surveys. Target species and secondary species present within and outside of the site included Grey Heron, Golden Plover, Woodcock, Snipe, Sparrowhawk, Kestrel, Peregrine Falcon, Lesser Black-backed Gull, Buzzard and Hen Harrier.

During mammal surveys the following mammals and/or their field signs were observed on or adjacent to the proposed development site: badger, fox, red squirrel, pine marten, deer and American mink (an invasive species). While not observed during surveys, species such as hedgehog, otter, Irish hare, Irish stoat, wood mouse and pygmy shrew are likely to occur on site.

A total of eight bat species were recorded onsite during Static detector surveys during the 2020 bat activity season: common, Nathusius' and soprano pipistrelle, Leisler's bat, Natterer's bat, Daubenton's Bat, Brown Long-eared bat and Whiskered bat.

Atlantic salmon were recorded downstream at Black Bridge (within the River Barrow and River Nore SAC), No other protected aquatic species including white-clawed crayfish and freshwater pearl mussel were recorded. Freshwater pearl mussel have not been historically recorded downstream of the Development in the Rivers Barrow and Dineen. The main Nore population occurs between Durrow and Abbeyleix (not downstream of the Development).

No signs of otter or otter holts were found during surveys of the study area, although it is noted that the species has been recorded in the vicinity. The surrounding river network provides some foraging and commuting habitat for otter but no prime foraging or breeding habitat.

The drains and ponds within the study area offer potential breeding habitat for frogs and newts, although none were recorded during current surveys. Areas of scrub and peatland offer potential habitat for common lizard.
Impact assessment was undertaken for key receptors, and mitigation measures were detailed for all key receptors. Following mitigation, the significance of residual effects was reduced to levels

ranging from Imperceptible to Not significant. Therefore, the overall effect of The Development on Biodiversity is 'Not Significant'.

7.2.5 ROTOR MODIFICATION FI REQUEST

An extensive FI request response was submitted in December 2021. This covered a number of submissions from stakeholders including Carlow Co. Council, NPWS and interested 3rd parties. The response provided clarity and additional detail as required, and also included the results of 2nd year bird surveys, and an assessment of the full two years of ornithological data including collision risk modelling (CRM). The FI response is available through the Carlow Co. Council online planning search system (planning ref. 21/15).

7.3 LEGISLATION, POLICY AND GUIDANCE

The following legislation, policy and guidance is of relevance:

- (Planning and Development) (Environmental Impact Assessment) Regulations 2018 (S.I. No. 296 of 2018);
- Regulation 49: prohibition on introduction and dispersal of certain species (listed on Schedule III) of the European Communities (Birds and Natural Habitats) Regulations 2011 [S.I. No. 477 of 2011] was enacted in 2015. This prohibits the spread of non-native invasive species listed on Schedule III;
- Carlow County Development Plan 2015-2021[2];
- Carlow County Development Plan 2022-2028[3];
- National Parks and Wildlife Service (NPWS) National Peatlands Strategy[4];

The following detailed guidance on surveys, impact assessment and mitigation for birds and bats are of relevance. The following guidance documents are considered key elements in the assessment of potential effects from wind farm developments on these groups:

- Recommended bird survey methods to inform impact assessment of onshore wind farms[5];
- Recommended bird survey methods to inform impact assessment of onshore wind farms. Version 2[6];
- Guidelines for consideration of bats in wind farm projects - Revision 2014[7];
- Bats and Onshore Wind Turbines: Survey, Assessment and Mitigation[8];
- Bat Surveys: Good Practice Guidelines 2nd Edition[9]; and
- Bat Surveys: Good Practice Guidelines 3rd Edition [10].

[2] Carlow Council (2015) Carlow Council Development Plan 2015-21. Available at http://www.carlow.ie/wp-content/documents/uploads/carlow-county-dev-plan-2015-2021.pdf (Accessed 10/08/2022)

[3] Carlow Council (2021) Carlow Council Development Plan 2022-28. Available at https://consult.carlow.ie/en/consultation/draft-carlow-county-development-plan-2022-2028 (Accessed 10/08/2022)

[4] NWPS (2017) National Peatlands Strategy [Online] Available at: https://www.npws.ie/sites/default/files/general/Final%20National%20Peatlands%20Strategy.pdf (Accessed 10/08/2022)

[5] Scottish Natural Heritage (2014). *Recommended bird survey methods to inform impact assessment of onshore wind farms*. Battleby: SNH.

[6] Scottish Natural Heritage (2017). *Recommended bird survey methods to inform impact assessment of onshore wind farms*. Version 2. Battleby: SNH.

[7] Rodrigues, L. Bach, M. J. Cubourg-Savvage, B. Karapandza, D. Kovac, T. Kervyn, J. Dekker, A. Kepel, P. Bach, J. Collins, C. Harbusch, K. Park, B. Micevski, J. Minderman (2015): Guidelines for consideration of bats in wind farm projects - Revision 2014.EUROBATS Publication Series No. 6 (English Version) UNEP/EUROBATS Sccretarist, Bonn, Germany, 133 pp.

http://www.eurobats.org/sites/default/files/documents/publications/publication_series/pubseries_no6_english.pdf

[8] Scottish Natural Heritage (2019; updated 2021). *Bats and Onshore Wind Turbines: Survey, Assessment and Mitigation*. Battleby: SNH.

[9] Hundt, L. (2012). *Bat Survey Guidelines: Best Practice Guidance- 2nd Edition.* Bat Conservation Trust.

[10] Collins, J. (ed.) (2016) *Bat Surveys for Professional Ecologists: Good Practice Guidelines* (3rd edn).
The Bat Conservation Trust, London.

- A Guide to Identification and Assessment for Tree-Care and Ecology Professionals[11]
- CIEEM Bat Mitigation Guidelines 2021[12].
- NPWS Bat mitigation guidelines for Ireland v2. Irish Wildlife Manuals, No. 134[13]
- EC Guidance document on the strict protection of animal species of Community interest under the Habitats Directive[14]
- UNEP/EUROBATS: Guideline for consideration of bats in wind farm projects[15]
- Natural England TIN051: Bats and onshore wind turbines – Interim Report[16]
- EC Guidance document on wind energy developments and EU nature legislation[17]
- NIEA 2021 Guidance on Bat Surveys, Assessment and Mitigation for Onshore Wind Turbine Developments in Northern Ireland[18]

The following EPA and CIEEM guidance documents for impact assessment and ecological impact assessment are key tools in completing the assessments herein:

- Guidelines on the information to be contained in Environmental Impact Assessment Reports.[19] [20];
- Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal, 2nd edition [21]; and
- Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine, 3rd edition (version 1.1 updated September 2019)[22].

The following are the current red Lists for mammals, vascular plants, bryophytes, amphibians, reptiles & freshwater fish, and birds.

The flora protection order (FPO) (2015) is the current definition of protected flora.

- Ireland Red List No. 12: Terrestrial Mammals [23];

[11] BTHK (2018) *A Guide to Identification and Assessment for Tree-Care and Ecology Professionals*. Pelagic Publishing, Exeter UK.

[12] CIEEM (2021) Bat Mitigation Guidelines. A guide to impact assessment, mitigation and compensation for developments affecting bats. Beta version 1.0

[13] NPWS (2022). Bat mitigation guidelines for Ireland v2. Irish Wildlife Manuals, No. 134

[14] European Commission (2021). Commission notice. Guidance document on the strict protection of animal species of Community interest under the Habitats Directive

[15] UNEP/EUROBATS: Guideline for consideration of bats in wind farm projects, Publication Series No. 3

[16] Natural England Technical Information Note TIN051: Bats and onshore wind turbines – Interim Report

[17] European Commission (2020). Guidance document on wind energy developments and EU nature legislation. Brussels, 18.11.2020 C(2020) 7730 final

[18] NIEA, Natural Environment Division (2021). Guidance on Bat Surveys, Assessment and Mitigation for Onshore Wind Turbine Developments in Northern Ireland

[19] EPA, (2017) *Guidelines on the information to be contained in Environmental Impact Assessment Reports* Draft May 2017

[20] EPA, (2022) *Guidelines on the information to be contained in Environmental Impact Assessment Reports*

[21] CIEEM (2016) *Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal, 2nd edition*. Chartered Institute of Ecology and Environmental Management, Winchester

[22] CIEEM (2018) *Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine, 3rd edition*. Version 1.1. Chartered Institute of Ecology and Environmental Management, Winchester

[23] Marnell, F., Looney, D. & Lawton, C. (2019) *Ireland Red List No. 12: Terrestrial Mammals*. National Parks and Wildlife Service, Department of the Culture, Heritage and the Gaeltacht, Dublin, Ireland.

- Ireland Red List No. 10: Vascular Plants [24];
- Ireland Red List No.8: Bryophytes [25];
- Ireland Red List No. 5: Amphibians, Reptiles & Freshwater Fish [26];
- Birds of Conservation Concern in Ireland 2014–2019 [27];
- Birds of Conservation Concern in Ireland 2020–2026 [28]
- Flora Protection Order (2015)[29].

Three rounds of the Article 17 Habitats Directive reports have been published:

- The Status of EU Protected Habitats and Species in Ireland. Volumes 1-3 (NPWS, 2007)[30]
- The Status of EU Protected Habitats and Species in Ireland. Habitat Assessments Volume 2. Version 1.1 (NPWS, 2013a)[31]
- The Status of EU Protected Habitats and Species in Ireland. Species Assessments Volume 3, Version 1.0 (NPWS, 2013b)[32]
- The Status of EU Protected Habitats and Species in Ireland. Volume 2: Habitat Assessments (NPWS, 2019a)[33]
- The Status of EU Protected Habitats and Species in Ireland. Volume 3: Species Assessments (NPWS, 2019b)[34]

[24] Wyse Jackson, M., FitzPatrick, Ú., Cole, E., Jebb, M., McFerran, D., Sheehy Skeffington, M. & Wright, M. (2016) *Ireland Red List No. 10: Vascular Plants*. National Parks and Wildlife Service, Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs, Dublin, Ireland.

[25] Lockhart, N., Hodgetts, N. & Holyoak, D. (2012) *Ireland Red List No.8: Bryophytes*. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland.

[26] King, J.L., Marnell, F., Kingston, N., Rosell, R., Boylan, P., Caffrey, J.M., FitzPatrick, Ú., Gargan, P.G., Kelly, F.L., O'Grady, M.F., Poole, R., Roche, W.K. & Cassidy, D. (2011) *Ireland Red List No. 5: Amphibians, Reptiles & Freshwater Fish*. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland.

[27] Colhoun, K. and Cummins, S. (2013). *Birds of Conservation Concern in Ireland 2014-2019*. BirdWatch Ireland.

[28] Gilbert, G., Stanbury, A., Lewis, L., 2021 Birds of Conservation Concern in Ireland 4: 2020–2026. Irish Birds 43 (2021)

[29] S.I. No. 356/2015 - Flora (Protection) Order, 2015. Available at: http://www.irishstatutebook.ie/eli/2015/si/356/made/en/print [accessed 10/08/2022]

[30] https://www.npws.ie/publications/article-17-reports/article-17-reports-2007

[31] NPWS (2013). *The Status of EU Protected Habitats and Species in Ireland. Habitat Assessments Volume **2**. Version 1.1.* Unpublished Report, National Parks & Wildlife Services. Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland.

[32] NPWS (2013). *The Status of EU Protected Habitats and Species in Ireland. Species Assessments Volume **3**, Version 1.0*. Unpublished Report, National Parks & Wildlife Services. Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland.

[33] NPWS (2019). *The Status of EU Protected Habitats and Species in Ireland. Volume 2: Habitat Assessments*. Unpublished NPWS report. Edited by: Deirdre Lynn and Fionnuala O'Neill

[34] NPWS (2019). *The Status of EU Protected Habitats and Species in Ireland. Volume 3: Species Assessments*. Unpublished NPWS report. Edited by: Deirdre Lynn and Fionnuala O'Neill

7.4 ASSESSMENT METHODOLOGY AND SIGNIFICANCE CRITERIA

7.4.1 Pre-Application Consultation Responses

Consultation for this EIA Report topic was undertaken with the organisations shown in Table 7-1.

Table 7-1: Consultation Responses

Consultee	Type and Date	Summary of Consultation Response	Response to Consultee
Irish Wildlife Trust	Pre-Application consultation letter (30/09/2020)	None received	N/A
EPA	Pre-Application consultation letter (30/09/2020)	Acknowledged receipt, forwarded for attention.	N/A
NPWS (via DAU)	Pre-Application consultation letter (30/09/2020)	Acknowledged receipt. Noted co-ordinated response will be issued in the event of observations	N/A
Birdwatch Ireland	Pre-Application consultation letter (30/09/2020)	Acknowledged receipt, forwarded for attention of Policy Officer.	N/A
Bat Conservation Ireland	Pre-Application consultation letter (30/09/2020)	Acknowledged receipt, does not have capacity to comment on planning applications.	N/A
Irish Red Grouse Association	Pre-Application consultation letter (30/09/2020)	None received	N/A
Irish Raptor Study Group	Pre-Application consultation letter (30/09/2020)	None received	N/A
Irish Peatland Conservation Council	Pre-Application consultation letter (30/09/2020)	None received	N/A
Inland Fisheries Ireland	Pre-Application consultation letter (30/09/2020)	None received	N/A
An Taisce	Pre-Application consultation letter (30/09/2020)	None received	N/A

7.4.2 Planning Stage Submissions

A number of detailed submissions on the consented rotor modification were received from Carlow Co. Council, NPWS and 3rd Parties in the form of a further information request. A detailed response providing clarity and additional detail as required, the results of 2nd year bird surveys, and an assessment of the full two years of ornithological data including collision risk modelling (CRM) was submitted Carlow Co. Council. Planning permission for the rotor modification application was subsequently granted. The relevant additional material from the FI response has been incorporated into this chapter.

The FI response is available on the Carlow Co. Council online planning search system (Planning Ref. 21/15).

7.4.3 Scope of Assessment

The key issues for the assessment of potential ecological effects relating to the Development (during construction, operation and decommissioning) are as follows:

- Temporary effects arising from the construction phase such as disturbance and displacement of species and changes in water quality.
- Permanent effects such as terrestrial habitat loss, degradation or alteration of aquatic habitats downstream; avoidance of turbines by birds (displacement); collision risk and barrier effect.
- Indirect effects, including disturbance/displacement, changes in water quality and the associated potential for the conveyance of pollutants to downstream habitats via hydrological links.
- Cumulative effects which could potentially occur in combination with other plans/projects

7.4.4 Elements Scoped Out of Assessment

No ecological factors have been scoped out of the assessment.

7.4.5 Study Area / Survey Area

The full project description is detailed in **Chapter 5: Project Description**, along with details of previous applications (both consented and subject to assessment).

The overall study area is comprised of the different study areas defined for each particular group or ecological feature. These are as follows:

Habitat/Botanical/Invasive Species Survey: The proposed Wind Farm land ownership boundary and adjacent habitats, including: Grid Application access route; cable route and substation site; TDR pinch points. This includes all elements of the project, including the consented grid application and proposed wind farm.

Mammal surveys were undertaken within and up to 50m from the footprint of the proposed felling buffers (the study area is > 50m from the footprint of the Development). The study area can be considered to extend beyond this to the local area when considering historical (desktop) records and mobile species (the extent of the zone of influence is dependent on species and landscape-scale habitat considerations).

Otter and Kingfisher surveys covered all watercourses in close proximity to wind farm infrastructure, and watercourses 150m up and down-stream from Grid Application cable route/access route crossing points. When considering historical records and potential indirect effects the study area can be considered to extend as far downstream as effects may be predicted to occur (defined on a case by case basis).

Bat activity surveys were carried out within and bounding the proposed Wind Farm land ownership boundary and along the Grid Application cable route. Transects followed existing tracks and roads (see Figures 4.1 to 4.4 in the accompanying bat report in Appendix 7.1). Static detector surveys were at proposed turbine locations. When considering historical records and potential effects on local bat populations the study area can be considered to extend to the landscape scale.

Bird surveys at the Site covered a core study area defined by a 450m buffer around the land ownership boundary. This buffer fully encompasses the 500m turbine buffer required by SNH Guidance[5] [6] .The hinterland and barn owl surveys, in addition to the desktop study and assessment of potential effects extend the study area to a regional/landscape scale.

Aquatic surveys were carried out at ten sites, eight of which are located downstream of the Development (see Figure 3 in the accompanying aquatic ecology report in Appendix 7.2). The furthest away was located 3.7 km from the Site. As such the survey area encompassed the River Dinin upstream of the Development, and tributaries of the Nore and Barrow downstream of the Development. The study area includes the survey area described above, in addition to the Grid Application cable route, and extends as far downstream as effects may be predicted to occur (defined on a case by case basis).

7.4.6 Desktop Study

7.4.6.1 Designated Nature Conservation Sites

Nationally designated sites within 10 km of the proposed wind farm, such as Natural Heritage Areas (NHAs) and proposed Natural Heritage Areas (pNHAs) have been identified. European sites within 15km of the Development namely Special Areas of Conservation (SACs) and Special Protection Areas (SPAs) for birds were identified as part of this ecological assessment using the Map Viewer at www.npws.ie. In addition, the desktop study examined the potential for links with designated sites beyond these initial search buffers.

These designated sites are described in Section 7.5.2.1. A separate Natura Impact Statement (NIS) was prepared to evaluate the potential effects to European sites as a result of the Development.

7.4.6.2 Flora and Fauna

A desk study was carried out to collate and review available information, datasets and documentation sources pertaining to the site’s natural environment. Records available on the NPWS and the National Biodiversity Data Centre websites were reviewed, in addition to records of rare/sensitive species within the 10km grid squares overlapped by a 5 km buffer surrounding the study area obtained by request from NPWS (received 1st July 2022).

Other data sources include Ireland’s Wetlands and their Waterbirds: Status and Distribution[35], the Atlas of Wintering Birds in Britain and Ireland[36], the Atlas of Breeding Birds in Britain and Ireland[37] and the Breeding and Winter Birds of Britain and Ireland Bird Atlas 2007-11 (Balmar et al., 2013)[38].

Botanical species were assessed in accordance with their occurrence on the Flora Protection Order 2015 and the Ireland Red List No. 10: Vascular Plants[24].

Other sources included:

- Bat Landscapes (NBDC Dataset)
- OSI Aerial photography and 1:50000 mapping;
- Teagasc Soil area maps;
- Geological Survey Ireland (GSI) area maps;
- EPA website datasets (soil, surface water quality, ground water quality, designated sites);
- Environmental Sensitivity Mapping (geohive.ie)
- IFI; and
- South Eastern River Basin District (SERBD) datasets (Water Framework Directive).

[35] Crowe, O. (2005) *Ireland’s Wetlands and their Waterbirds: Status and Distribution,* Birdwatch Ireland, Newcastle, Co. Wicklow.

[36] Lack P. (1986). *The Atlas of Wintering Birds in Britain and Ireland.* T. & A.D. Poyser Ltd., London

[37] Sharrock, J.T.R. (1976). *The Atlas of Breeding Birds in Britain and Ireland,* T. & A.D. Poyser, Calton

[38] Balmer, D., Gillings, S., Caffrey, B., Swann, B., Downie, I. and Fuller, R. (2013). *Bird Atlas 2007-2011. The breeding and wintering birds of Britain and Ireland (British Trust for Ornithology)* Hardcover – 15 Nov 2013

7.4.7 Baseline Survey Methodology

A general ecological survey of the Proposed Wind Farm Site, Grid Application Site and adjacent areas was carried out, in addition to habitat, botanical, mammal, ornithological, bat and aquatic ecology surveys.

7.4.7.1 Habitat and Botanical Surveys

General Habitat and Botanical Surveys

The habitats within the study area encompassing the proposed wind farm site, the footprint of the Grid Application cable route and turbine delivery route (TDR) were identified and classified, according to 'A Guide to Habitats in Ireland' [39]. All plant species encountered were identified.

The habitat survey was completed on 9th and 21st July 2020 during favourable weather conditions.

Habitats have been appraised and evaluated according to their occurrence as protected habitats under Annex I of the EU Habitats Directive (92/43/EEC) and for their capacity to support rare, threatened and endangered species. The methodology used to assess the impact on habitats is based on NRA guidelines[40] [41], (CIEEM guidelines and EPA guidelines). The habitat mapping exercise had regard to the 'Best Practice Guidance for Habitat Survey and Mapping' [42] published by the Heritage Council.

Scientific and common names for plants follow Parnell and Curtis[43] and Blamey et al.[44] respectively. In addition to habitat identification, each habitat was assessed for its ecological significance, based on the National Roads Authority (NRA) Site Evaluation Scheme40 41 (see Table 7-14).

Habitat boundaries and associated attribute data were mapped using desk-based GIS software, namely ArcGIS 10.4.1, which was also used to calculate habitat areas and lengths.

Relevé Surveys

Intensive surveying within relevés was carried out at eight randomly selected locations within areas of remnant bog between T2, T3 and T4 on 27th September 2020 during favourable weather conditions.

Prior to the site visit, random monitoring stops within the remnant bog areas were generated using GIS software. The number of monitoring stops was dictated by the size of the habitat to be assessed as outlined in the NPWS Guidance *'Guidelines for a national survey and conservation assessment of upland vegetation and habitats in Ireland'* [45].

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[39] Fossitt J.A. (2000). *A Guide to Habitats in Ireland*. Heritage Council, Kilkenny

[40] NRA (2009). *Guidelines for the Assessment of Ecological Impacts of National Road Schemes,* National Roads Authority

[41] NRA (2009). *Ecological surveying techniques for protected flora and fauna during the planning of National Road Schemes – Version 2*

[42] Smith, G., O'Donoghue, P., O'Hora, K., and Delaney, E. (2011). *Best Practice Guidance for Habitat Survey and Mapping.* Kilkenny, Ireland.: The Heritage Council.

[43] Parnell, J: Curtis, T; and Cullen, E. (2012): Webb's an Irish Flora. Hardback, 8th Edn (March 2012), Trinity College Dublin.

[44] Blamey, M., Fitter, R. and Fitter, A. (2003). *Wild Flowers of Britain and Ireland*. London: A & C Black.

[45] Perrin, P.M., Barron, S.J., Roche, J.R. & O'Hanrahan, B. (2014). Guidelines for a national survey and conservation assessment of upland vegetation and habitats in Ireland. Version 2.0. *Irish Wildlife Manuals*, No. 79. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland.

All species within each 2 x 2m relevé were identified and assigned a cover value using the DAFOR scale. The DAFOR scale determines what vegetation is Dominant (>75% cover), Abundant (51-75% cover), Frequent (26-50% cover), Occasional (11-25% cover) and Rare (<11% cover) at each selected quadrat.

Data from the Relevé surveys was also analysed using ERICA[46], the online tool for classification of Irish vegetation communities. Details of the analysis are included in Appendix A7.6: Botanical Survey Results & Assessment.

7.4.7.2 Mammals (General)

Mammal surveys were undertaken on 27th September 2020 and on December 9th 2020.

During these surveys the footprint of the Development was surveyed for signs of mammal activity; this included the footprint of vegetation clearance and earthworks, as well as a buffering distance of 50m from the proposed felling footprint. Sightings, tracks or signs (including droppings, resting places, burrows and setts) of mammals occurring within, or in the vicinity, of the site footprint were recorded using field notes and/or handheld GPS units with records subsequently digitised using ArcGIS.

Surveys were undertaken in accordance with the NRA's '*Ecological Surveying Techniques for Protected Flora and Fauna During the Planning of National Road Schemes*'[41].

7.4.7.3 Otter

An otter survey was undertaken on December 10th 2020.

These surveys covered the watercourses in the vicinity of the Site, and those intersected by and in close proximity to the proposed Grid Application access route and cable route: Boolyrathronan/Tomard; Rathornan, un-named Tributaries of Dinin (segments 15_916 & 15_424); Boolyvanannan; Dinin and Rossmore. The Boolyvanannan, un-named segment 15_424 and Rossmore which are intersected by the access and/or grid routes were surveyed to 150m up and down-stream of crossing points.

The Boolyvanannan was also surveyed further upstream to its source. The un-named segment 15_916 was surveyed from 150m downstream of the area where it runs adjacent to the permitted Grid Application access route up to its source. The Boolyrathronan/Tomard and Rathornan were surveyed to 150m from the proposed wind farm land ownership boundary. The Dinin was surveyed from the permitted Grid Application northern site entrance crossing point to the Ardough/Huntspark confluence (this section of the Dinin runs parallel to the access route).

During these surveys the study area which included the watercourses identified above and their banksides was surveyed for signs of otter such as spraints, feeding remains, prints, slides and holts.

Observations were recorded using field notes and/or handheld GPS units with records subsequently digitised using ArcGIS. Surveys were undertaken in accordance with the NRA's '*Ecological Surveying Techniques for Protected Flora and Fauna During the Planning of National Road Schemes*'[41].

7.4.7.4 Bats

A total of four no. bat activity surveys, and three rounds of static detector surveys were carried out during 2020 (refer to Table 7-2 for details). These surveys followed the guidelines set out by the Bat Conservation Trust in '*Bat Surveys: Good Practice Guidelines*' [9] [10] and Scottish Natural Heritage in '*Bats and onshore wind turbines: survey, assessment and mitigation*'[8]. A detailed bat report is included in Appendix 7.1.

[46] https://biodiversityireland.shinyapps.io/vegetation-classification/ (accessed 10/082022)

Table 7-2: Bat Surveys 2020

Survey Type	Survey Date	Surveyor
Bat Activity Survey 1	30-06-2020	Tom O'Donnell CEnv MCIEEM
Bat Activity Survey 2	23-07-2020	Tom O'Donnell CEnv MCIEEM
Bat Activity Survey 3	04-09-2020	Tom O'Donnell CEnv MCIEEM
Bat Activity Survey 4	05-10-2020	Tom O'Donnell CEnv MCIEEM
Static Detector Survey	14-05-2020 to 04-09-2020	Analysed by Sinead Clifford GradCIEEM and Jason Guile BSc

Bat Activity Surveys

Transects through bat favourable habitats within the Site were either walked or surveyed from a vehicle driven at 15 kph with a detector mounted on the hedge-side of the vehicle. Bat activity was recorded using an Echo Touch Meter Pro 2 full spectrum detector. Transects were undertaken once a month from June to October 2020 (Table 7-2).

Surveys targeted a range of foraging and commuting habitats present within the study area, those associated with linear features such as roadside margins, woodland plantation edges, hedgerows, treelines and waterbodies. Full details of transects are shown Table 7-3 below.

All field surveys were undertaken within the active bat season and during good weather conditions (dry conditions and temperature at 8°C and greater)[47].

Bats were identified by their ultrasonic calls coupled with behavioural and flight observations and on computer by sound analysis of recorded echolocation and social calls with dedicated software (Kaleidoscope 5.1.9g software (Bats of Europe 5.1.0 S/A: 0) using both the auto ID program and analyst determination. Activity survey transect routes are shown in Figure 3-1 in the accompanying bat report contained in Appendix 7.1.

Table 7-3: Transect Details

Transect Name		Mode of Survey	Transect Length (m)	Fossit Habitats along Route
1	Bat Activity Survey 1 – Dusk	Driven and walked	7048.51m	Conifer plantation (WD4) Buildings and artificial surfaces (BL3) Scrub (WS1)
2	Bat Activity Survey 2 – Dusk	Driven and walked	6141.23m	Conifer plantation (WD4) Buildings and artificial surfaces (BL3) Scrub (WS1)
3	Bat Activity Survey 3 – Dusk	Driven and walked	11800.11m	Conifer plantation (WD4) Buildings and artificial surfaces (BL3) Scrub (WS1) Hedgerow (WL1) Treeline (WL2)

[47] Aughney, T., Kelleher, C. & Mullen, D. (2008). *Bat Survey Guidelines: Traditional Farm Buildings Scheme*. The Heritage Council, Áras na hOidhreachta, Church Lane, Kilkenny.

Transect Name		Mode of Survey	Transect Length (m)	Fossit Habitats along Route
				Improved agricultural grassland (GA1)
4	Bat Activity Survey 4 – Dusk	Driven and walked	5835.72m	Conifer plantation (WD4) Buildings and artificial surfaces (BL3) Scrub (WS1)

Static Detector Surveys (2020)

Details of deployment are included in Table 7-4. Static detector locations are identified on Figure 3.2 within the bat report (Appendix A7.1).

A Passive Static Bat Survey involves leaving a static bat detector unit (with ultrasonic microphone) in a specific location and set to record for a specified period of time (i.e. a bat detector is left in the field, there is no observer present and bats which pass the monitoring unit are recorded and their calls are stored for analysis post surveying). The bat detector is effectively used as a bat activity data logger. This results in a far greater sampling effort over a shorter period of time. Bat detectors with ultrasonic microphones are used as the ultrasonic calls produced by bats cannot be heard by human hearing.

Song Meter SM4BAT Full spectrum bat recorders use Real Time recording as a technique to record bat echolocation calls and using specific software, the recorded calls are identified. It is these sonograms (2-d sound pictures) that are digitally stored on the SD card (or micro SD cards depending on the model) and downloaded for analysis. These results are depicted on a graph showing the number of bat passes per species per hour/night. Each bat pass does not correlate to an individual bat but is representative of bat activity levels. Some species such as the pipistrelles will continuously fly around a habitat and therefore it is likely that a series of bat passes within a similar time frame is one individual bat. On the other hand, Leisler's bats tend to travel through an area quickly and therefore an individual sequence or bat pass is more likely to be indicative of individual bats.

As per SNH (2021) guidance, static units (Song Meter SM4BAT) were programmed to commence half an hour before sunset and finish half an hour after sunrise to ensure that bat species that emerge early in the evening and return to roosts late are recorded. Detectors were left out for a minimum of 10 consecutive nights across three survey periods: spring (April-May), summer (June-mid-August) and autumn (mid-August-October. See Table 7-4 for further details.

Static units were located in the vicinity of the locations of the turbines.

SNH (2021) guidance states that "*Detectors should be placed at all known turbine locations at wind farms containing less than ten turbines. Where developments have more than ten turbines, detectors should be placed within the developable area at ten potential turbine locations plus a third of additional potential turbine sites up to a maximum of 40 detectors for the largest developments*". Thus, for the development, detectors were placed at or close to the locations of all five indicative turbine locations.

The data was analysed using Kaleidoscope 5.1.9g software (Bats of Europe 5.1.0 S/A: 0).

The location of the static detectors is presented in Figure 3-2 within the bat report (Appendix A7.1).

Table 7-4: Details of Static Detector Deployment

Box location	Habitat types	First recording (Spring)		Second recording (Summer)		Third recording (Autumn)	
		Date deployed	Number of nights deployed [48]	Date deployed	Number of nights deployed	Date deployed	Number of nights deployed
1	Conifer plantation (WD4)	14/05/2020	12	08/07/2020	10	04/09/2020	10
2	Conifer plantation (WD4)	14/05/2020	12	08/07/2020	10	04/09/2020	10
3	Conifer plantation (WD4)	14/05/2020	12	08/07/2020	10	04/09/2020	10
4	Conifer plantation (WD4)	14/05/2020	12	08/07/2020	10	04/09/2020	10
5	Conifer plantation (WD4)	14/05/2020	12	08/07/2020	10	04/09/2020	10

Bat Survey Analysis

All recordings during static and transect surveys were made in full spectrum sonograms (2-d sound pictures) real time recordings, retaining all amplitude and harmonic information from the original bat call, that are digitally stored on the SD card and downloaded for analysis. All data were analysed with Kaleidoscope 5.1.9g software.

These results are depicted on a graph showing the number of bat passes per species per hour/night. Each bat pass does not correlate to an individual bat but is representative of bat activity levels.

The static data was uploaded and analysed using the Ecobat tool as per SNH guidance[8]. This analysis was undertaken for each survey period separately.

The reference range datasets were stratified to include:

- Only records from within 30 days of the survey date.
- Only records from within 100 km^2 of the survey location.
- Records using any make of bat detector.

Categorisation of activity level is based on the following table:

[48] Note that data will be recorded for the morning on the date of collection. Thus, if a detector was left out on 09/05/2020 and collected on 20/05/2020, the detector will have been left out for a total of 11 complete nights. However, there will be 12 unique dates where data was (potentially) recorded. Ecobat automatically includes every distinct date as a night and so reports one more night than is actually recorded.

Table 7-5: Percentile Score and Categorised Level of Bat Activity

Percentile	Bat Activity
81 to 100	High
61 to 80	Moderate to High
41 to 60	Moderate
21 to 40	Low to Moderate
0 to 20	Low

Raw data upon which the Ecobat analyses were based is presented in Appendix C of the bat report (Appendix 7.1).

Using the SNH guidelines outlined in Table 7-6, a site risk assessment for the individual turbines in relation to each bat species recorded was completed using the following values:

- Project Size
- Habitat Risk

The site risk value is multiplied by the Ecobat value for the four most common bat species recorded which are also High Risk species (i.e. Leisler's bat, Nathusius' pipistrelle, common pipistrelle and soprano pipistrelle) for two separate value categories. The overall value of the site is based on the summary tables for these four species yielded from Ecobat analysis.

- Highest Ecobat activity category recorded;
- Most frequent activity category (i.e. median value).

Overall assessment value (i.e. Turbine Risk value) is then compared to the ranges below:

- Low (green) 0-4
- Medium (amber) 5-12
- High (red) 15-25

Table 7-6: Initial site risk assessment (SNH, 2021)

Site Risk Level (1-5)*	**Project Size**			
Habitat Risk		**Small**	**Medium**	**Large**
	Low	1	2	3
	Moderate	2	3	4
	High	3	4	5

Key: Green (1-2) - low/lowest site risk; Amber (3) - medium site risk; Red (4-5) - high/highest site risk.

* Some sites could conceivably be assessed as being of no (0) risk to bats. This assessment is only likely to be valid in more extreme environments, such as above the known altitudinal range of bats, or outside the known geographical distribution of any resident British species.

Habitat Risk	**Description**
Low	Small number of potential roost features, of low quality. Low quality foraging habitat that could be used by small numbers of foraging bats. Isolated site not connected to the wider landscape by prominent linear features.
Moderate	Buildings, trees or other structures with moderate-high potential as roost sites on or near the site. Habitat could be used extensively by foraging bats. Site is connected to the wider landscape by linear features such as scrub, tree lines and streams.
High	Numerous suitable buildings, trees (particularly mature ancient woodland) or other structures with moderate-high potential as roost sites on or near the site, and/or confirmed roosts present close to or on the site. Extensive and diverse habitat mosaic of high quality for foraging bats. Site is connected to the wider landscape by a network of strong linear features such as rivers, blocks of woodland and mature hedgerows. At/near edge of range and/or on an important flyway. Close to key roost and/or swarming site.

Project Size	**Description**
Small	Small scale development (≤10 turbines). No other wind energy developments within 10km. Comprising turbines <50m in height.
Medium	Larger developments (between 10 and 40 turbines). May have some other wind developments within 5km. Comprising turbines 50-100m in height.
Large	Largest developments (>40 turbines) with other wind energy developments within 5km. Comprising turbines >100m in height.

Habitat Assessment

Habitats adjacent to the Development may be considered in terms of extent, diversity, naturalness, rarity, fragility, typicalness, recorded history, position, potential value and intrinsic appeal[49]. The potential of these habitats for bat fauna is considered in this framework also.

- Bats may use trees with heavy ivy growth as occasional roosts. Bats may use mature trees with tree holes etc., as roosting sites all year around. However, in general, there is a paucity of these two types of mature trees within the survey area. They are present in the adjacent landscape or within the blocks of agricultural land enclosed by the survey area.
- Foraging and commuting areas are available to bats adjacent to and within the Site areas along scrub habitats, treeline tracks and riparian linear features. There is less foraging and commuting capacity over bare peat and similar low height vegetation habitats. The exception to this is Leisler's bats and Nathusius' pipistrelles, which are bat species that fly high over the landscape. They are not as reliant on linear habitats to traverse through the landscape.

7.4.7.5 Avifauna

Two full years of ornithological surveys were carried out, covering the winter seasons 2019-20/2020-21 and summer (breeding) seasons 2020 and 2021.

The surveys carried out followed the methodologies given in the guidance documents *Recommended bird survey methods to inform impact assessment of onshore wind farms* [Version 2][6] and *Bird Monitoring Methods – a manual of techniques for key UK species*[50]. The following surveys were carried out:

- Vantage Point Surveys (Breeding and Non-Breeding Season);
- Hinterland/Wetland Bird Surveys
- Barn Owl Survey
- Hen Harrier (potential roost) Survey
- Breeding Bird Surveys
- Winter Transects

Vantage Point (Flight Activity) Surveys

Vantage Point (VP) surveys were carried out at the Site from December 2019 to August 2021 inclusive, covering both the breeding and non-breeding seasons in accordance with the Scottish Natural Heritage Methodology[6]. These surveys took place within the summer (April-September) 2020 / 2021 and Winter (December - March) 2019-20 / 2020-21 seasons. It is noted that two watches per VP were undertaken in February and March 2020.

Three fixed VP locations (VP1, VP2 and VP3) which overlook the Site and surrounding study area were used during these surveys. The vantage points when combined cover a comprehensive viewshed of all turbine locations, and also to allow observation of the wider area surrounding the Site. A 450m buffer around the larger land ownership boundary was used as the core study area (see Figure 7.1). This area encompassed the 500m buffer around turbine locations required by SNH Guidance [6].

[49] Regini, K. (2000) Guidelines for ecological evaluation and impact assessment, In Practice: Bulletin of the Institute of Ecology and Environmental Management, 29, 1-7.

[50] Gilbert, G., Gibbons, D.W., & Evans, J. (1998) *Bird Monitoring Methods: A Manual of Techniques for UK Key Species.* The Royal Society for the protection of Birds, Sandy, Bedfordshire, England.

Three fixed VP locations (VP1, VP2 and VP3) which overlook the Site and surrounding study area were used during these surveys.

The vantage points when combined cover a comprehensive viewshed of all turbine locations, and also to allow observation of the wider area surrounding the Site. A 450m buffer around the larger land ownership boundary was used as the core study area. This area is referred to as the '**Flight Activity Area**'. The flight activity area fully encompassed the 500m buffer around turbine locations required by SNH Guidance and was based on the largest possible layout of turbines for the site including a minimum set back distance of 50m inside the site boundary for turbines (450m buffer outside the site boundary and 50m setback for turbines within the site = 500m buffer). The vantage points used gave 100% coverage of the 450m site buffer and 500m turbine buffer (see Figure 7.1). The study area for the survey and the subsequent viewshed was more conservative and larger than the required study area under the SNH Guidance. The survey details for each VP (year 1) are tabulated in Appendix A7.3 (Flight Activity Survey Details and Results); target species flight lines for year 1 are tabulated in EIAR Appendix A7.4. All survey details and results for year 2 are included in Appendix A7.5 (Bilboa Wind Farm Year 2 Bird Report).

The main purpose of vantage point survey watches is to collect data on target species that will enable estimates to be made of:

- The time spent flying over the defined survey area;
- The relative use of different parts of the defined survey area; and
- The proportion of flying time spent within the upper and lower height limits as determined by the rotor diameter and rotor hub height.

Vantage Point locations are shown in Table 7-7 and Figure 7.1.

Table 7-7: Vantage Point Locations

VP	Location (ITM)
1	663405.4 670372.9
2	665756.3 671414.6
3	662562.7 671993.2

Vantage point locations were based on observations from walkover/reconnaissance surveys and viewshed analysis (using GIS). The number and locations of vantage points were selected to achieve visibility of the entire study area.

In line with recommended best practice[6] [51], viewshed analysis was undertaken using ArcGIS Desktop 10.4.1., to calculate a theoretical zone of visibility from each vantage point. Visibility is calculated from each vantage point along an invisible layer suspended at the predicted lowermost height passed through by the rotor blade tips, using an observer height of 1.5m.

We note the following from SNH guidance[6] in respect of priority areas for viewshed analysis (emphasis added):

[51] Band, W., Madders, M., & Whitfield, D.P. (2007). *Developing field and analytical methods to assess avian collision risk at wind farms*. In: de Lucas, M., Janss, G.F.E. & Ferrer, M. (eds.) Birds and Wind farms: Risk Assessment and Mitigation, pp. 259-275. Quercus, Madrid.

*"Where the key purpose is to estimate the risk of collision with turbines, **it is the visibility of the airspace to be occupied by the turbine rotors (the collision risk volume) that is of prime importance**. Therefore, it is recommended that visibility be calculated using the least visible part of this airspace, i.e. an imaginary layer suspended at the lowermost height passed through by the rotor blade tips (typically about 20-30m above ground level). Predicting visibility at this level is a simple task using GIS, however it should be noted that the baseline should take account of any forestry or other features that will potentially obstruct the view. For example, forestry may be 10-30m high and if viewshed height is taken as 20-30m ground level the visible area could be overestimated if there is forestry within the viewshed. Being able to view all or most of the site to ground level can be helpful in gauging overall bird activity and usage of the site but is not as important as being able to view the collision risk volume."*

Data recorded included flight activity of target species (flight height, duration, directionality) in addition to metrics such as flock size (per recorded transit) and time of observation. Detailed notes of each observation of a target bird species was recorded including behaviour, gender (where possible), numbers, flight height, associated habitat and the period of time spent within the study area. Successful foraging events were also noted if they arose. Other bird species seen or heard during the VP surveys were also noted as incidental records and were considered separately as additional species. Flight activity was annotated onto field maps. The activity of target species is summarised in section 7.5.8.1 and detailed comprehensively in Appendix 7.3 and flight lines are mapped in Appendix 7.4; survey details such as weather conditions, visibility, and duration are detailed in Appendix 7.3. Binoculars and field scopes were used to scan the viewshed for target species.

Flight heights were estimated visually as allowed for in SNH guidance[6]. Flight height estimation using a clinometer or rangefinder is accepted as an alternative means of determining flight height however this is often not practicable (equipment may be clumsy and birds may be lost from view whilst trying to focus additional equipment on a target species rapidly moving out of sight); it should be noted that in practice many flocks of swans do not fly close enough to a surveyor for a rangefinder to be used, resulting in most flights heights being estimated in any case. As is often the case an experienced observer will be able to record accurate observations at a higher frequency resulting in a larger dataset for analysis.

The proportion of survey time that activity was recorded inside and outside the flight activity area was used as part of the overall analysis and assessment of target species usage of the study area. All surveys were conducted during suitable weather conditions.

As previously noted, winter VP surveys were carried out at the Site from December 2019 onwards, and as such additional rounds were completed in February and March 2020 to make up a full season of survey effort (36 hours per VP) for winter 2019/20 as required by SNH guidance[6]. Winter VPs during 2020-21 covered the full season (October- March inclusive). Summer VP surveys covered the full breeding season (April-August/September) for both 2020 and 2021.

It is noted that the total survey effort for VP surveys amounted to the requisite 144 hours per VP over the course of 2 years of surveys. For clarity, VP survey effort per season is detailed below in Table 7-8:

Table 7-8: VP survey effort per season

Vantage Point	Hours Per Season			
	Winter 2019-20	Summer 2020	Winter 2020-21	Summer 2021
VP1	36	35	36	37
VP2	36	34	36	38
VP3	36	34	36	38

Target Species

The following criteria has been utilised to select target species for the current study. Scottish Natural Heritage (SNH) guidance[6] on the assessment of the effects of wind farms on ornithological interests suggests there are four important species lists from which target species be drawn, as follows:

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

In addition to the above, consideration was given to species identified locally as being of conservation concern, regionally or those particularly susceptible to impact from wind farm development. Note that not all species on the above lists would be categorised as target species, e.g. most passerine species and general lowland farmland birds are not considered to be particularly susceptible to effects from wind farms[6]. Target species identified during avifauna surveys can be found in Table 7-9 below.

In the Irish context, it is considered that target species should be taken from species of conservation concern in Ireland (BOCCI)[28], those likely to occur within the vicinity of the Development, and those most at risk from particular effects such as disturbance and displacement [52].

'Birds of Conservation Concern in Ireland' (BoCCI) are classified into three separate categories; red, amber and green. Red-listed species are of high conservation concern, Amber-listed species are of medium conservation concern and Green-listed species are not considered to be of conservation concern[28].

The conservation status of bird species found in this study was assessed using the most recent (2021) BoCCI List[28]. Additionally, a review of the bird species listed on Annex I on the EU Birds Directive (2009/147/EC) was undertaken in assessing the conservation status of birds. Annex I species are often afforded additional protection through the designation of Special Protection Areas (SPAs) throughout EU countries in addition to existing National legislation.

Table 7-9 below outlines the 15 species for which past records exist within the 10 km grid squares (S66 & S67) overlapping the flight activity survey study area which meet one or more of the criteria outlined above. To ensure other species which may be sensitive to wind farms were also considered, all other species of gull, wader, duck, goose, swan as well as cormorant (*Phalacrocorax carbo*) and heron (*Ardea cinerea*) were included as secondary species. See below table for list of target and secondary species.

[52] Nairn, R. & Partridge, K. (2013). Assessing wind energy impacts on birds- towards best practice. CIEEM 2013 Irish Section Conference: Presentations.

Table 7-9: Target Species and Secondary Species

Species	Suitable Breeding Habitat
Target Species	
Black-headed Gull (*Larus ridibundus*)	Coast and large lakes in western Ireland
Common Buzzard (*Buteo buteo*)	Trees, cliffs/quarries
Common Goldeneye (*Bucephala clangula*)	Tree-holes near clear lakes with abundant invertebrate and fish prey
Eurasian Curlew (*Numenius arquata*)	Bog
Golden Plover (*Pluvialis apricaria*)	Heather moors, blanket bogs, acidic grassland in the uplands northwest Ireland
Hen Harrier (Circus cyaneus)	Uplands and bogs, heather moorland, young forestry plantations and coastal wetlands
Herring Gull (*Larus argentatus*)	Widespread; coast and inland lakes, marsh and bogs
Kestrel (*Falco tinnunculus*)	Trees, buildings, cliffs/quarries
Barn Owl (*Tyto alba*)	Trees, buildings
Long-eared Owl (*Asio otus*)	Usually uses nests of large birds, often in conifers
Merlin (*Falco columbarius*)	Ground-nesting on moorland, mountain and blanket bog. Also uses woodland – particularly forestry plantations adjacent to moorland. May use old corvid nests.
Northern Lapwing (*Vanellus vanellus*)	Lowland wet grassland, arable farmland, cutover bog with pools and wet grassland
Northern Shoveler (*Anas clypeata*)	Eutrophic lakes with rich vegetation or marshes with open areas
Peregrine Falcon (*Falco peregrina*)	Cliffs, quarries, buildings; rarely in disused nests
Sparrowhawk (*Accipiter nisus*)	Trees
Whooper Swan (*Cygnus cygnus*)	Lowland open farmland and inland wetlands
Target/Secondary Species/Groups	
Gulls	Coastal and various inland wetland habitats
Waders	Coastal and various inland wetland and bog habitats
All geese, swans and duck species	Wetlands, Lake/Lowland River Fringes
Cormorant (*Phalacrocorax carbo*)	Coastal habitat and inland waterbodies
Heron (*Ardea cinerea*)	The edge of wetlands, rivers, streams and marshy ground

Hinterland Surveys

The methodology used for wetland sites during winter hinterland surveys followed I-WeBS (Irish Wetland Bird Survey) methodology[53], whereby each location was surveyed for the duration necessary to identify and obtain a count for all target species present. The same approach was adapted for non-wetland sites.

[53] Lewis, L. J., Burke, B., Fitzgerald, N., Tierney, T. D. & Kelly, S. (2019) Irish Wetland Bird Survey: Waterbird Status and Distribution 2009/10-2015/16. Irish Wildlife Manuals, No. 106. National Parks and Wildlife Service, Department of Culture, Heritage and the Gaeltacht, Ireland.

A hinterland survey for raptors was conducted in accordance with Raptors: a field guide to survey and monitoring[54] to assess Hen Harrier and other raptor activity over the winter and breeding periods in the greater surroundings. Surveys for Hen Harrier breeding and roosting sites were also carried out within 5km of the proposed Wind Farm, fulfilling and exceeding the requirement set out in SNH Guidance (2017).

While hinterland surveys included potential breeding wader habitat during summer 2021, the same approach used for winter surveys was employed (each location was surveyed for the duration necessary to identify and obtain a count for all target species present).

Hinterland survey sites were selected based on desktop studies of the designated nature conservation sites network and potentially suitable habitats for target species indicated by mapping and aerial imagery. This was refined and added to by the field ornithologists based on observations of the area during the course of surveys.

These sites were chosen as they had suitable habitat for the following target species: raptors, geese, swans, waders, waterfowl and Barn Owl.

Winter 2019/20

A total of five hinterland survey rounds were undertaken over the course of the survey period (January 2020- March 2020). Hinterland survey sites were located at bogs, rivers, wetlands and quarries in the area surrounding the Proposed Wind Farm.

A total of 12 Hinterland sites were visited during each round of surveys. Survey dates and sites are shown in Table 7-10 and mapped in Figure 7.3.

Winter 2020/21

Hinterland surveys were undertaken over the course of the survey period (October 2020-March 2021). Hinterland survey sites were located at bogs, rivers, wetlands and quarries in the area surrounding the Proposed Wind Farm.

A total of 12 Hinterland sites were visited during surveys. Survey dates and sites are shown in Table 7-10 and mapped in Figure 7.3.

Summer 2020

A total of three sites in the vicinity of the Site were identified as having potential to support breeding waders during reconnaissance for the summer 2020 hinterland survey. Survey dates and sites are shown in Table 7-10 and mapped in Figure 7.3.

Summer 2021

A total of 15 hinterland sites were surveyed during summer 2021. These sites included areas suitable for breeding waders, raptors, water birds and other target species.

Survey dates and sites are shown in Table 7-10 and mapped in Figure 7.3.

Table 7-10: Hinterland Survey Details

Location [distance to closest turbine]	**Map ref (Fig. 7.3)**	**Dates visited**			
		Winter 2019-20	**Summer 2020**	**Winter 2020-21**	**Summer 2021**
Coan Bogs NHA (1) [2.9 km]	7	26/01/2020 18/02/2020 29/02/2020	Not surveyed	06/11/2020 16/12/2020 28/01/2021	26/04/2021 21/05/2021 24/08/2021

[54] Hardey, J., Crick, H., Wernham, C., Riley, H., Etheridge, B. & Thompson, D. (2013). Raptors: a field guide to survey and monitoring (3rd Edition). The Stationery Office, Edinburgh.

Location [distance to closest turbine]	**Map ref (Fig. 7.3)**	**Dates visited**			
		Winter 2019-20	**Summer 2020**	**Winter 2020-21**	**Summer 2021**
		14/03/2020 25/03/2020		13/02/2021 21/03/2021	12/09/2021
Coan Bogs NHA (2) [7 km]	6	26/01/2020 18/02/2020 29/02/2020 14/03/2020 25/03/2020	Not surveyed	06/11/2020 16/12/2020 28/01/2021 13/02/2021 21/03/2021	26/04/2021 21/05/2021 24/08/2021 12/09/2021
River Barrow and River Nore SAC (1) [4.6 km]	8	26/01/2020 18/02/2020 29/02/2020 14/03/2020 25/03/2020	Not surveyed	06/11/2020 16/12/2020 28/01/2021 13/02/2021 21/03/2021	26/04/2021 21/05/2021 29/07/2021 24/08/2021 12/09/2021
River Barrow and River Nore SAC (2) [3.7 km]	9	26/01/2020 18/02/2020 29/02/2020 14/03/2020 25/03/2020	Not surveyed	06/11/2020 16/12/2020 28/01/2021 13/02/2021 21/03/2021	26/04/2021 21/05/2021 29/07/2021 24/08/2021 12/09/2021
River Barrow and River Nore SAC (3) [2.6 km]	11	26/01/2020 18/02/2020 29/02/2020 14/03/2020 25/03/2020	Not surveyed	06/11/2020 16/12/2020 28/01/2021 13/02/2021 21/03/2021	26/04/2021 21/05/2021 29/07/2021 24/08/2021 12/09/2021
River Barrow and River Nore SAC (4) [3 km]	12	26/01/2020 18/02/2020 29/02/2020 14/03/2020 25/03/2020	Not surveyed	06/11/2020 16/12/2020 28/01/2021 13/02/2021	21/05/2021 12/09/2021
River Barrow and River Nore SAC (5) [5.2 km]	13	26/01/2020 18/02/2020 29/02/2020 14/03/2020 25/03/2020	Not surveyed	06/11/2020 16/12/2020 28/01/2021 13/02/2021 21/03/2021	Not surveyed
Ballymoon Esker pNHA [11 km]	16	26/01/2020 18/02/2020 29/02/2020 14/03/2020 25/03/2020	Not surveyed	06/11/2020 16/12/2020 28/01/2021 13/02/2021 21/03/2021	Not surveyed
Clogheristick Wood pNHA [4.8 km]	15	26/01/2020 18/02/2020 29/02/2020 14/03/2020 25/03/2020	Not surveyed	06/11/2020 16/12/2020 28/01/2021 13/02/2021 21/03/2021	Not surveyed

Location [distance to closest turbine]	Map ref (Fig. 7.3)	Dates visited			
		Winter 2019-20	Summer 2020	Winter 2020-21	Summer 2021
Clogheristick Wood pNHA (1) [4.8 km]	15	26/01/2020 18/02/2020 29/02/2020 14/03/2020 25/03/2020	Not surveyed	06/11/2020 16/12/2020 28/01/2021 13/02/2021 21/03/2021	Not surveyed
Whitehall Quarries pNHA [8.9 km]	14	26/01/2020 18/02/2020 29/02/2020 14/03/2020 25/03/2020	Not surveyed	06/11/2020 16/12/2020 28/01/2021 13/02/2021 21/03/2021	Not surveyed
Quarries (Rossmore/Clon-grennan) [3 km]	10	26/01/2020 18/02/2020 29/02/2020 14/03/2020 25/03/2020	12/05/2020 05/06/2020 25/06/2020 02/07/2020	21/10/2020 06/11/2020 16/12/2020 28/01/2021 13/02/2021 21/03/2021	26/04/2021 21/05/2021 28/06/2021 29/07/2021 24/08/2021 12/09/2021
Potential Barn Owl Site (1) [1.2 km]	4	Not surveyed	09/05/2020 02/07/2020	Not surveyed	11/06/2021 16/07/2021
Potential Barn Owl Site (2) [2.6 km]	5	Not surveyed	09/05/2020 02/07/2020	Not surveyed	11/06/2021 16/07/2021
Breeding Wader Site 1 [3.3 km]	1	Not surveyed	12/05/2020 05/06/2020 25/06/2020 02/07/2020	Not surveyed	21/05/2021 16/07/2021
Breeding Wader Site 2 [1.8 km]	2	Not surveyed	12/05/2020	Not surveyed	21/05/2021 16/07/2021
Breeding Wader Site A [4.5 km]	A	Not surveyed	Not surveyed	Not surveyed	26/04/2021 21/05/2021 28/06/2021 16/07/2021 29/07/2021 24/08/2021 12/09/2021
Breeding Wader Site B [2 km]	B	Not surveyed	Not surveyed	Not surveyed	26/04/2021 21/05/2021 28/06/2021 16/07/2021 29/07/2021 24/08/2021 12/09/2021

Location [distance to closest turbine]	**Map ref (Fig. 7.3)**	**Dates visited**			
		Winter 2019-20	**Summer 2020**	**Winter 2020-21**	**Summer 2021**
Breeding Wader Site C [2.6 km]	C	Not surveyed	Not surveyed	Not surveyed	26/04/2021 28/06/2021 16/07/2021 29/07/2021 24/08/2021 12/09/2021
Breeding Wader Site D [0.75 km]	D	Not surveyed	Not surveyed	Not surveyed	26/04/2021 21/05/2021 28/06/2021 16/07/2021 24/08/2021 12/09/2021
Breeding Wader Site E [2.8 km]	E	Not surveyed	Not surveyed	Not surveyed	26/04/2021 21/05/2021 28/06/2021 16/07/2021 29/07/2021 24/08/2021 12/09/2021
Breeding Wader Site F [1.8 km]	F	Not surveyed	Not surveyed	Not surveyed	26/04/2021 21/05/2021 28/06/2021 16/07/2021 29/07/2021 24/08/2021 12/09/2021

Hen Harrier

The hinterland survey for raptors was conducted in accordance with *Raptors: a field guide to survey and monitoring*[54] to assess Hen Harrier and other raptor activity over the winter and breeding periods in the greater surroundings. Surveys for Hen Harrier breeding and roosting sites were also carried out within 5km of the proposed Wind Farm, fulfilling and exceeding the requirement set out in SNH Guidance (2017).

Barn Owl

Barn owl surveys were carried out during May/June/July 2020 and 2021 (see Table 7-10 and Figure 7.3).

Two ruined buildings in the surrounding area with potential to be inhabited by breeding barn owl were identified on 12th May 2020. These were assessed for their potential to be used by nesting barn owl.

Both buildings were resurveyed in summer 2021 (11th June and 16th July).

Woodcock

Surveys to assess the presence of breeding Woodcock were completed during the months of April, May and June 2021.

Woodcock surveys were carried out following the UCC Breeding Woodcock Survey methodology[55] [56]. One point (ITM 664653 671005) central to the site and located in an open area surrounded by conifer plantation was selected, from which the surveyor observed Woodcock activity.

All specimens encountered (seen or heard) were recorded and their abundance, behaviour, sex/age and breeding status noted. Table 7-11 below, details the survey dates and weather conditions.

Table 7-11: Woodcock Survey Details

Date	Location	Cloud (Okta)	Precipitation	Visibility	Wind
23/04/21	Bilboa	2/8	none	Excellent	F1 SE
14/05/21	Bilboa	7/8	none	Excellent	F2 SE
11/06/21	Bilboa	2/8	none	Excellent	F1 NW

Transect Surveys

A total of two transects, TR-1 and TR-2 were established within and bounding the Site land ownership boundary (see Figure 7.2) and surveyed during winter 2019/20, winter 2020/21, summer 2020 and summer 2021.

Winter 2019/20, 2020/21

Winter 2019/20 walkover transect surveys were carried out on 23rd and 25th January 2020 (Round 1); 12th and 16th February 2020 (Round 2) as well as the 7th and 8th March 2020 (Round 3).

Winter 2020/21 walkover transect surveys were carried out on 21st October 2020 (Round 1) and 10th December 2020 (Round 2).

An adapted Common Bird Census (CBC) methodology was used. All birds seen and heard were identified and recorded.

Summer 2020, 2021

Summer 2020 breeding bird surveys were undertaken along transects TR-1 and TR-2. Round 1 was completed on 20th May 2020; Round 2 was completed on 25th June 2020. An adapted Common Bird Census (CBC) methodology was used. All birds seen and heard were identified and recorded.

Summer 2021 breeding bird surveys were undertaken along transects TR-1 and TR-2. Round 1 was completed on 20th April 2021; Round 2 was completed on 11th June 2021. An adapted Common Bird Census (CBC) methodology was used. All birds seen and heard were identified and recorded.

Kingfisher Survey

A search for potential Kingfisher nesting and foraging habitat was carried out on 10th December 2020 in conjunction with the otter survey (the same study area was used). Features such as sandy banks, hollow trees, perches and suitable fishing habitat were searched for.

7.4.7.6 Aquatic Ecology

Selection of Watercourses for Assessment

[55] https://www.ucc.ie/en/ornithology/projects/woodcock-phd/step2/

[56] Hoodless, A., Lang, D., Aebischer, N., Fuller, R., & Ewald, J., 2009. *Densities and population estimates of breeding Eurasian Woodcock Scolopax rusticola in Britain in 2003.* Bird Study (2009) 56, 15–25

All watercourses / water bodies which could potentially be affected were considered as part of the current appraisal. Generally, only streams and other watercourses shown on the EPA online maps were examined, as watercourses smaller than this are not normally of fisheries or aquatic ecological significance.

A total of 10 sites were selected for detailed assessment prior to arrival at the study area. It is noted that Site 7 and Site 8 were found to be unsuitable for electrofishing as they were too small. An alternative site for each was surveyed on the main River Dinin instead. The sites selected for assessment are given in Table 7-12 and the location of these sites is shown in Figure 3 in the accompanying aquatic report in Appendix 7.2, including the alternative Site 7 and alternative Site 8.

The surveys completed at each site were at a level required to make an evaluation of biological water quality, fisheries value, aquatic habitat value, and presence of rare/protected/notable aquatic species at each site. Generally, watercourses were observed from public roads and this allowed such watercourses to be adequately evaluated for the purpose of the current appraisal.

Table 7-12: Location of aquatic ecology survey sites

Site No.	Catchment	Sub-Catchment	Watercourse Name	Watercourse Order	Segment Code	EPA Code
1	Barrow	Barrow_SC_110	Rathornan	3rd	14_82	14R43
2	Barrow	Barrow_SC_110	Boolyrathornan_or_Tomard	1st	14_1264	14B91
3	Barrow	Barrow_SC_110	Boolyrathornan_or_Tomard	1st	14_1264	14B91
4	Barrow	Barrow_SC_110	Rathornan	2nd	14_1159	14R43
5	Barrow	Barrow_SC_110	Rathornan	1st	14_1105	14R43
6	Nore	Dinin (South)_SC_010	Dinin (South)	3rd	15_85	15D08
7	Nore	Dinin (South)_SC_010	Unnamed tributary	1st	15_916	15D08
7(a)	Nore	Dinin (South)_SC_010	Dinin (South)	2nd	15_84	15D08
8	Nore	Dinin (South)_SC_010	Boolyvannanan	1st	15_915	15B58
8(a)	Nore	Dinin (South)_SC_010	Dinin (South)	2nd	15_86	15D08
9	Nore	Dinin (South)_SC_010	Dinin (South)	2nd	15_1	15D08
10	Nore	Dinin (South)_SC_010	Dinin (South)	1st	15_711	15D08

Aquatic surveys were carried out at all of the survey sites in September 2020. The majority of the watercourses were categorised as watercourses of insignificant aquatic ecological importance. Each site was assessed for potential lamprey, salmon and white-clawed crayfish habitat.

An electrical fishing survey was undertaken at the 10 sites during September 2020. This was completed under authorisation from the Department of Communication, Energy and Natural Resources under Section 14 of the Fisheries Act (1980). Sites were surveyed following the methodology outlined in the CFB guidance "*Methods for the Water Framework Directive - Electric fishing in wadeable reaches*" [57]. A portable electrical fishing unit (Smith Root-LR 24 backpack) was used during the assessments. Fishing was carried out continuously for 5 minutes at each of the sites. Captured fish were collected into a container of river water using dip nets. On completion of the survey fish were then anaesthetised using a solution of 2-phenoxyethanol, identified, and measured to the nearest mm using a measuring board. Subsequent to this the fish were allowed to recover in a container of river water and were the released alive and spread evenly over the sampling area. No mortalities were recorded. Strict biosecurity measures were followed during all fieldwork as per IFI guidance[58]. Juvenile lamprey surveys generally followed the methodology for ammocoete surveys given in the manual 'Monitoring the River, Brook and Sea Lamprey, *Lampetra fluviatilis*, *L. planeri* and *Petromyzon marinus* [59]. Electrical fishing for juvenile lampreys was carried out at three 1m^2 habitat patches where habitat was available.

General kick sampling to assess biological water quality was undertaken at all survey sites. The survey had regard to the methodology given in Toner *et al.* [60].

An estimated Q-rating biotic index was assigned for each site based on the macroinvertebrate species recorded and presence of siltation / filamentous algae growths.

Specific sweep netting assessments were completed for white-clawed crayfish. Also, electrical fishing work was completed which would also have captured crayfish.

Only Site 6 had potential (marginal) freshwater pearl mussel habitat present and mussels were confirmed absent by a visual survey.

Table 7-13: Relationship between Q-value and Ecological Status for macroinvertebrates.

Q Value*	WFD Status	Pollution	Condition**
Q5, Q4-5	High	Unpolluted	Satisfactory
Q4	Good	Unpolluted	Satisfactory
Q3-4	Moderate	Slightly polluted	Unsatisfactory
Q3, Q2-3	Poor	Moderately polluted	Unsatisfactory
Q2, Q1-2, Q1	Bad	Seriously polluted	Unsatisfactory

7.4.7.7 Other Fauna

Observations of other fauna (such amphibians and invertebrates) and associated habitats were recorded as they arose during ecological site walkovers.

[57] CFB (2008) Methods for the Water Framework Directive - Electric fishing in wadable reaches. Central Fisheries Board.

[58] IFI (2010) Biosecurity protocols for fieldwork. Inland Fisheries Ireland. https://www.fisheriesireland.ie/documents/73-biosecurity-protocol-for-field-survey-work-1/file.html

[59] Harvey J & Cowx I (2003). Monitoring the River, Brook and Sea Lamprey, Lampetra fluviatilis, L. planeri and Petromyzon marinus. Conserving Natura 2000 Rivers Monitoring Series No. 5, English Nature, Peterborough.

[60] Toner, P., Bowman J., Clabby, K., Lucey J., McGarrigle, M., Concannon, C., Clenaghan, C., Cunningham, P., Delaney, J., O'Boyle, S., MacCárthaigh, M., Craig, M. and Quinn R., (2005). *Water Quality in Ireland 2001 – 2003*. Environmental Protection Agency, Ireland.

7.4.7.8 Replant Lands

A desktop study and field surveys (habitat and general ecology surveys) were carried out in order to identify the existing environment of the replant lands proposed for use as part of the development (Located at Carrigthomas, Co. Cork).

The habitats in the footprint of the proposed replant lands were identified and classified, according to 'A Guide to Habitats in Ireland' [39], during a walkover survey on 3rd December 2019. The site was resurveyed on 30th September 2020. The dominant plant species present in each habitat type was recorded. Habitats have been appraised and evaluated according to their occurrence as protected habitats under Annex I of the EU Habitats Directive (92/43/EEC) and for their capacity to support rare, threatened and endangered species.

Habitat boundaries and associated attribute data were mapped using desk-based GIS software, namely ArcGIS 10.4.1, which was also used to calculate habitat areas and lengths.

The total footprint of the proposed replant lands was walked by experienced ecologists for potential signs of mammals within the study area. As well as direct observations of mammal features such as tracks, trails, fur, droppings and shelter (setts, dreys and holts) were also recorded using GPS.

Watercourse crossings within and adjacent to the proposed replant lands were surveyed for evidence of otter.

Other species of fauna including birds, invertebrates and habitats that may be of value to these species were also noted.

7.4.8 Methodology for the Assessment of Effects

7.4.8.1 Ecological Resource Evaluation

The value of the ecological resources/receptors at the subject site was evaluated using the ecological evaluation guidance given in the NRA guidance on assessment of ecological effects of National Road Schemes[40].

This guidance provides ratings for resources based primarily on geographic context and allows for resources at International, National, County and Local (higher and lower value) levels. Key ecological receptors (for assessment) are those deemed to be above the 'Local Importance (lower value) evaluation. Evaluation criteria are outlined below in Table 7-14.

Table 7-14: Ecological Resource Evaluation Criteria (from NRA, 2009)

Resource Evaluation	Defining Criteria
International Importance	'European Site' including Special Area of Conservation (SAC), Site of Community Importance (SCI), Special Protection Area (SPA), candidate Special Area of Conservation (cSAC) or proposed Special Protection Area (pSPA). Sites that fulfils the criteria for designation as a 'European Site' (see Annex III of the Habitats Directive, as amended). Features essential to maintaining the coherence of the Natura 2000 Network. Site containing 'best examples' of the habitat types listed in Annex I of the Habitats Directive. Resident or regularly occurring populations (assessed to be important at the national level) of the following: Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive; and/or Species of animal and plants listed in Annex II and/or IV of the Habitats Directive.

Resource Evaluation	Defining Criteria
	Ramsar Site (Convention on Wetlands of International Importance Especially Waterfowl Habitat 1971). World Heritage Site (Convention for the Protection of World Cultural and Natural Heritage, 1972). Biosphere Reserve (UNESCO Man and The Biosphere Programme). Site hosting significant species populations under the Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animals, 1979). Site hosting significant populations under the Berne Convention (Convention on the Conservation of European Wildlife and Natural Habitats, 1979). Biogenetic Reserve under the Council of Europe. European Diploma Site under the Council of Europe. Salmonid water designated pursuant to the European Communities (Quality of Salmonid Waters) Regulations, 1988, (S.I. No. 293 of 1988).
National Importance	Site designated or proposed as a Natural Heritage Area (NHA). Statutory Nature Reserve. Refuge for Fauna and Flora protected under the Wildlife Acts. National Park. Undesignated site fulfilling the criteria for designation as a Natural Heritage Area (NHA); Statutory Nature Reserve; Refuge for Fauna and Flora protected under the Wildlife Act; and/or a National Park. Resident or regularly occurring populations (assessed to be important at the national level) of the following: Species protected under the Wildlife Acts; and/or Species listed on the relevant Red Data list. Site containing 'viable areas' of the habitat types listed in Annex I of the Habitats Directive.
County Importance	Area of Special Amenity. Area subject to a Tree Preservation Order. Area of High Amenity, or equivalent, designated under the County Development Plan. Resident or regularly occurring populations (assessed to be important at the County level) of the following: Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive; Species of animal and plants listed in Annex II and/or IV of the Habitats Directive; Species protected under the Wildlife Acts; and/or Species listed on the relevant Red Data list. Site containing area or areas of the habitat types listed in Annex I of the Habitats Directive that do not fulfil the criteria for valuation as of International or National importance. County important populations of species, or viable areas of semi-natural habitats or natural heritage features identified in the National or Local BAP, if this has been prepared. Sites containing semi-natural habitat types with high biodiversity in a county context and a high degree of naturalness, or populations of species that are uncommon within the county. Sites containing habitats and species that are rare or are undergoing a decline in quality or extent at a national level.
Local Importance (Higher Value)	Locally important populations of priority species or habitats or natural heritage features identified in the Local BAP, if this has been prepared; Resident or regularly occurring populations (assessed to be important at the Local level) of the following: Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive; Species of animal and plants listed in Annex II and/or IV of the Habitats Directive; Species protected under the Wildlife Acts; and/or Species listed on the relevant Red Data list. Sites containing semi natural habitat types with high biodiversity in a local context and a high degree of naturalness, or populations of species that are uncommon in the locality;

Resource Evaluation	Defining Criteria
	Sites or features containing common or lower value habitats, including naturalised species that are nevertheless essential in maintaining links and ecological corridors between features of higher ecological value.
Local Importance (Lower Value)	Sites containing small areas of semi natural habitat that are of some local importance for wildlife; Sites or features containing non-native species that are of some importance in maintaining habitat links.

7.4.8.2 Avifauna Receptor Evaluation

Avifauna resources are to be initially evaluated as to whether or not they constitute key receptors for the assessment following NRA guidance as outlined in Table 7-14 above. For the purposes of impact assessment, a receptor 'importance value' or sensitivity, following published guidance as in Percival[61] , SNH[5] [6] and literature review of published information on birds and wind farms[62] [63] [64] [65] [66] is to be calculated. Where provided receptor values from Percival[61] are below those recommended in guidance within the Irish context[40] ; then the evaluation has been increased in line with the recommended Irish evaluation as a precautionary principle. Table 7-15**Error! Reference source not found.** illustrates the combined receptor evaluation criteria used to assign sensitivity levels to key receptors.

Table 7-15: Avian Resource Evaluation Criteria

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

[61] Percival, S.M. (2007) Predicting the effects of wind farms on birds in the UK: the development of an objective assessment method. [ed.] M., Janss, F.E., Ferrer, M. De Lucas. Madrid : Quercus, 7, pp. 137-152.

[62] Pearce-Higgins, J.W., Stephen, L., Douse, A., Langston, R.H.W. (2012). *Greater Impacts of wind farms on bird populations during construction than subsequent operation: results of a multi-site and multi-species analysis.* Journal of Applied Ecology, Vol. 49, pp. 386-394.

[63] Pearce-Higgins, J.W., Leigh, S., Langston, R.H.W., Bainbridge, Ian P., Bullman, R. (2009). The distribution of breeding birds around upland wind farms. Journal of Applied Ecology, 2009, Vol. 46, pp. 1323-1331.

[64] Masden, E.A., Haydon, D.T., Fox, A.D., Furness, R.W., Bullman, R., Desholm, M. (2009) Barriers to movement: impacts of wind farms on migrating birds. ICES, 2009, Journal of Marine Science, Vol. 66, pp. 746–753.

[65] Drewitt, A. L. & Langston, R. H. (2006). *Assessing the impacts of wind farms on birds*. Ibis, Vol. 148, pp. 29-42.

[66] Drewitt, A. L. & Langston, R.H. (2008). *Collision Effects of Wind-power Generators and Other Obstacles on Birds*. 1134, Annals of the New York Academy of Sciences, pp. 233-266.

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

Sensitivity of key receptor	Percival 2007 criteria	NRA Resource Evaluation	NRA Criteria	Combined Criteria
Low	Species covered above which are present very infrequently or in very low numbers. Any other species of conservation interest not covered above, e.g. species listed on the red or amber lists of the BoCC.	Local Importance (High Value)	Locally important populations of priority species or habitats or natural heritage features identified in the Local BAP, if this has been prepared; Resident or regularly occurring populations (assessed to be important at the Local level) of the following: Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive; Species protected under the Wildlife Acts; and/or Species listed on the relevant Red Data list.	Locally important populations of priority species identified in the Local BAP, if this has been prepared; Resident or regularly occurring populations (assessed to be important at the Local level) of the following: Species of bird, listed in Annex I and/or referred to in Article 4(2) of the Birds Directive; Species protected under the Wildlife Acts; and/or Species listed on the relevant Red Data list. Amber listed species.
Negligible	Species that remain common and widespread	Local Importance (Low Value)	n/a	Species that remain common and widespread. Green Listed Species.

7.4.8.3 Aquatic Receptor Evaluation

Ecological features are assessed on a scale ranging from international-national-county-local (see Table 7-14). The local scale is approximately equivalent to one 10 km square but can be operationally defined to reflect the character of the area of interest.

Watercourses, evaluated following the NRA criteria[40] were evaluated on the basis of a number of characteristics and features defined as follows:

- Aquatic habitat refers to the in-water conditions of any watercourse; including substrate and stream structure (i.e. proportion of riffles, runs and pools).
- The fisheries value of a watercourse refers to its suitability for fish, primarily Salmonids (Salmon and Trout), and to the associated value for recreational angling purposes.
- Annex II species are those that are listed under the EU Habitats Directive (92/43/EEC).
- Annex I habitats are those that are listed under the EU Habitats Directive, including Priority Habitats.
- The evaluation of water quality uses a five-point biotic index (Q-value) based on the presence and relative abundance of various invertebrates using the Environmental Protection Agency's (EPA) standard technique.

7.4.8.4 Assessing Effect Significance

Once the value of the identified ecological receptors (features and resources) was determined, the next step was to assess the potential effect or impact of the project on the identified key ecological receptors.

Table 7-16 to Table 7-21 outline the EPA evaluation criteria[20] utilised in this appraisal of the Environmental Factor, Biodiversity. These criteria are included in the Guidelines on the Information to be contained in Environmental Impact Assessment Reports[19] [20].

Table 7-16: Probability of Effects (EPA, 2022)

Likely Effects	Unlikely Effects
The effects that can reasonably be expected to occur because of the planned project if all mitigation measures are properly implemented.	The effects that can reasonably be expected not to occur because of the planned project if all mitigation measures are properly implemented.

Table 7-17: Quality of Effects (EPA, 2022)

Quality of Effect	Description
Positive Effect	A change which improves the quality of the environment (for example, by increasing species diversity; or the improving reproductive capacity of an ecosystem, or removing nuisances or improving amenities)
Neutral Effect	No effects or effects that are imperceptible, within the normal bounds of variation or within the margin of forecasting error.
Negative/Adverse Effect	A change which reduces the quality of the environment (for example, lessening species diversity or diminishing the reproductive capacity of an ecosystem; or damaging health or property or by causing nuisance).

Table 7-18: Significance of Effects (EPA, 2022)

Significance of Effect	Description
Imperceptible	An effect capable of measurement but without significant consequences
Not Significant	An effect which causes noticeable changes in the character of the environment but without significant consequences
Slight	An effect which causes noticeable changes in the character of the environment without affecting its sensitivities
Moderate	An effect that alters the character of the environment in a manner that is consistent with existing and emerging trends
Significant	An effect which, by its character, magnitude, duration or intensity alters a sensitive aspect of the environment
Very Significant	An effect which, by its character, magnitude, duration or intensity significantly alters most of a sensitive aspect of the environment
Profound	An effect which obliterates sensitive characteristics

Table 7-19: Duration of Effects (EPA, 2022)

Duration of Effect	Description
Momentary Effects	Effects lasting from seconds to minutes
Brief Effects	Effects lasting less than a day

Duration of Effect	Description
Temporary Effects	Effects lasting less than a year
Short-term Effects	Effects lasting one to seven years
Medium-term Effects	Effects lasting seven to fifteen years
Long-term Effects	Effects lasting fifteen to sixty years
Permanent Effects	Effects lasting over sixty years

Table 7-20: Types of Effects (EPA, 2022)

Type of Effect	Description
Effect/Impact	A change resulting from the implementation of a project
Likely Effects	The effects that are specifically predicted to take place – based on an understanding of the interaction of the proposed project and the receiving environment.
Indirect Effects (a.k.a. secondary effects)	Effects on the environment, which are not a direct result of the project, often produced away from the project site or because of a complex pathway
Cumulative Effects	The addition of many minor or significant effects, including effects of other projects, to create larger, more significant effects.
'Do Nothing' Effects	The environment as it would be in the future should the subject project not be carried out.
'Worst Case' Effects	The effects arising from a project in the case where mitigation measures substantially fail
Indeterminable Effects	When the full consequences of a change in the environment cannot be described.
Irreversible Effects	When the character, distinctiveness, diversity or reproductive capacity of an environment is permanently lost.
Reversible Effects	Effects that can be undone, for example through remediation or restoration
Residual Effects	The degree of environmental change that will occur after the proposed mitigation measures have taken effect
Synergistic Effects	Where the resultant effect is of greater significance than the sum of its constituents (e.g. combination of SOx and NOx to produce smog).

Table 7-21: Definition of Terms – Source, Pathway, Receptor (EPA, 2022)

Term	Description
Source	The activity or place from which an effect originates
Pathway	The route by which an effect is conveyed between a source and a receptor.
Receptor	Any element in the environment which is subject to effects.
Effect/Impact	A change resulting from the implementation of a project

Assessment of Effect Type and Magnitude

Assessment of effects takes into account construction, operational and decommissioning effects with reference to the potential for direct, indirect and cumulative effects.

The assessment also takes account of any residual effects that may persist following the implementation of any mitigation or best practice design. The characterisation of effects reflects the ecological structure and function upon which the key ecological receptors depend. Detailed assessment of effects takes into account the magnitude of effects affecting populations.

This assessment uses the EPA classification of effects in order to describe the quality, significance, duration and type of effect.

7.4.8.5 Assessing Effect Type and Magnitude for Avifauna

Effects on avifauna are to be assessed following published guidance by Percival[67]. Once key avian receptors have been selected and assigned an evaluation of importance or sensitivity, the significance of potential effects are rated as a product of both the magnitude of the predicted effect and the sensitivity if the key receptor affected. The magnitude of effect is based on probability of the likely effect occurring.

The criteria outlined in Table 7-22 below has been developed by Percival[67] to determine the magnitude of potential effects on a species. Methodology for assessing sites outside of European Sites (i.e. SPAs) state 'the test of significance of an impact will be whether the wind farm impact is causing a significant change to the population its range or distribution' [67]. It is important to consider availability of alternative habitat elsewhere during this assessment.

Table 7-22: Determination of Magnitude Effects (Percival, 2003)

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

[67] Percival, S. M., (2003). *Birds and wind farms in Ireland: a review of potential issues and impact assessment.* Report to S.E.I.

The significance of potential effects is assessed by cross tabulating the magnitude of effects and bird sensitivity to predict significance of each potential effect. Population status, distribution and trends of potentially affected species such as migratory winter birds should be taken into consideration when undertaking the assessment. Significant ratings are interpreted as follows, very low and low should not normally be of concern however normal design care should be undertaken to minimise effects, medium represents a potentially significant effect that requires careful individual assessment, while very high and high represents a highly significant effect on bird populations. A significance matrix table, combining magnitude and sensitivity to assess overall significance is presented in Table 7-23:

Table 7-23: Significance matrix: combining magnitude and sensitivity to assess significance (Percival, 2003)

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

7.4.9 Assessment Limitations

No limitations to the assessment exist, as a comprehensive and adequate set of baseline data is available.

7.5 BASELINE CONDITIONS: DESCRIPTION OF THE EXISTING ENVIRONMENT

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

7.5.1 Proposed Wind Farm Study Area

7.5.1.1 Site Description

The Site is located south of Bilboa, Co. Carlow in an upland area known as the Killeshin Hills. The Site is located at the south-eastern side of the plateau of gently sloping hills situated between Portlaoise, Kilkenny and Carlow, which reach over 300m OD in their highest parts. The dominant habitat onsite is commercial conifer plantation, however small areas of cutover and drained bogs are also present. The Grid cable route travels through conifer plantations before turning north-east to follow the L7129 before turning north-west to join the L3896 which it follows until the grid substation.

Both the River Nore and River Barrow catchments fall within the footprint of the development. The watercourses to the north, west and south-west of the Site drain to the Dinin [South] SC010 sub-catchment which drains to the Nore. The watercourses to the north-east and south-east (including the Rossmore stream which intersects The Grid cable route) drain to the Barrow SC 110 sub-catchment.

The core Development study area is covered by peat and fine loamy drift with siliceous stones (EPA map viewer)[68].

[68] https://gis.epa.ie/EPAMaps/

The underlying geology is siliceous, and includes siltstone, mudstone, sandstone and shale. (Geological Survey of Ireland online map viewer)[69].

Land use practices throughout the study area are dominated by improved agricultural pasture, with coniferous afforestation present onsite and present in surrounding upland areas.

7.5.1.2 Description of the Watercourses in the study area

Barrow Catchment

The Site land ownership boundary is located c. 4.6 km north-west of the River Barrow main channel. The south-eastern part of the Development (including half of the combined consented/proposed felling area around turbine 1) is in the Barrow catchment. This part of the Site is drained by small 1st order stream tributaries of the Rathornan River sub-catchment, including the Boolyrathornan / Tomard, the Hill Gallows and the Rathornan River itself. The streams flow from the Site in a south-easterly direction joining the Rathornan before it passes under the M9 Motorway. After the motorway the Tomard_Lower tributary joins the now 4th order Rathornan River.

A further 1.2km downstream of the Tomard_Lower confluence the Rathornan watercourse connects to the main River Barrow approximately 1rkm upstream of the town of Leighlinbridge, County Carlow and 1rkm downstream of the Ballynaboley Stream confluence which joins the Barrow from the opposite (east) side. The River Barrow and River Nore SAC is c. 6.2rkm downstream of the Site land ownership boundary via this route.

The River Barrow is the 2nd longest river in Ireland, the Barrow catchment (Hydrometric Area: 14) drains a total area of 3,025km^2. Carlow Town is the main urban centre in the catchment; other urban centres in the catchment include New Ross, Graiguenamanagh, Athy, Portlaoise, Mountmellick, Portarlington, Monasterevin and Kildare. The River rises in the Slieve Bloom Mountains and flows easterly to Monasterevin before it turns south and continues to its confluence with the River Nore and Suir and onto Waterford Harbour.

Nore Catchment

The Site is located over 18 km north-east of the River Nore main channel. There is a hydrological connection from the Site to the River Nore via the River Dinin, one of the main tributaries of the Nore. Part of the Dinin River is within the River Barrow and River Nore SAC site boundary. The Dinin (South) River is situated c. 700m north of the Site land ownership boundary. The river rises to the north of the village of Bilboa and flows in a south-westerly direction past the Site on the north-west side as a 2nd order watercourse.

The north-western portion of the wind farm, including most of the Development and the Grid Application upgraded access route off the L7129 drains to the Dinin.

Several very small 1st order stream tributaries flow from the wind farm side of the channel in a north-westerly direction into the Dinin (South), these include the Boolyvannanan and two unnamed 1st order watercourses (Segment Codes: 15_916; 15_424). Unnamed Stream (Segment Code: 15_916) rises to the west of the Site and crosses close to an existing/upgraded track, flowing further east into the Dinin (South) River. Unnamed Stream (Segment Code: 15_424) rises east of the Site, flows west before crossing the existing access track near the site entrance and then entering the Dinin (South) River.

[69] https://dcenr.maps.arcgis.com/apps/MapSeries/index.html?appid=a30af518e87a4c0ab2fbde2aaac3c228

A small ephemeral/seasonal stream (dry in summer) was also noted in the vicinity the Grid Application cable route and turbine delivery route where it traverses conifer plantation and intersecting the Grid Application proposed upgraded access route (c. 40m upstream of the Dinin).

Approximately 2.5rkm downstream of the Grid Application proposed upgraded access route the Dinin (South) River enters the designated River Barrow and River Nore SAC at Black Bridge. From Black Bridge the Dinin (South) flows west for a further 11rkm and joins the main Dinin (Nore) River channel just after Dysart Bridge, downstream of the town of Castlecomer as a 4th order river. After joining the main channel, the Dinin River continues in a southerly direction for c. 13.4rkm and joins the main channel of the River Nore just after Dinin Bridge, c. 5.5rkm upstream of Kilkenny City as a 5th order river.

The River Nore catchment (Hydrometric Area: 15) drains an area of 2,595 km^2. The largest urban centre in the catchment is Kilkenny City; other urban centres in the catchment include Abbeyleix, Callan and Thomastown. The River Nore joins the River Barrow upstream of the Suir Estuary, at Ringwood. The River rises in Borrisnoe Mountain or the 'Devil's Bit' in County Tipperary. It flows east to Castle town before turning south towards its confluence with the Barrow.

7.5.2 Designated Sites

7.5.2.1 Sites of International Importance

Special Areas of Conservation (SACs)

Special Areas of Conservation (SACs) are protected under the European Union (EU) 'Habitats Directive' (92/43/EEC), as implemented in Ireland by the European Communities (Natural Habitats) Regulations, 1997. There is one SAC within 15km of the proposed Wind Farm. The full NPWS site synopses for designated areas are available on www.NPWS.ie.

Special Protection Areas (SPAs)

Special Protection Areas (SPAs) were initially designated under Directive 79/409/EEC, The Directive on the Conservation of Wild Birds ('The Birds Directive') and are now protected as European (Natura 2000) Sites under the EU 'Habitats Directive'. There are no SPAs within 15km of the study area, although the River Nore SPA is downstream of the Site.

European sites within the potential zone of influence are listed in Table 7-24 and shown on Figure 7.4.

An Appropriate Assessment (AA) Screening Report and Natura Impact Statement (NIS) have been completed in order to appraise the likely significant effects of the Development either alone or in combination with other plans or project on European Sites (cSACs and SPAs); these documents accompany this planning application.

7.5.2.2 Sites of National Importance

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

While the Wildlife (Amendment) Act 2000 has been passed into law, pNHAs will not have legal protection until the consultative process with landowners has been completed; this process is currently ongoing. However, both pNHA's and NHA's were considered fully designated sites for the purposes of this assessment. One NHA and three pNHAs are present within 10 km of the Development.

These sites are listed in Table 7-25 and shown on Figure 7.5:

Table 7-24: Summary of European Sites within 15 km of the project

Designated Site	Site code	Features of Interest	Distance to Development Boundary (km)
River Barrow and River Nore SAC	002162	Desmoulin's whorl snail *Vertigo moulinsiana* Freshwater pearl mussel *Margaritifera margaritifera* White-clawed crayfish *Austropotamobius pallipes* Sea lamprey *Petromyzon marinus* Brook lamprey *Lampetra planeri* River lamprey *Lampetra fluviatilis* Twaite shad *Alosa fallax* Atlantic salmon *Salmo salar* (only in fresh water) Estuaries Mudflats and sandflats not covered by seawater at low tide *Salicornia* and other annuals colonizing mud and sand Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) Otter Lutra lutra Mediterranean salt meadows (*Juncetalia maritimi*) Killarney fern *Trichomanes speciosum* Nore freshwater pearl mussel *Margaritifera durrovensis* Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation European dry heaths Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels * Petrifying springs with tufa formation (*Cratoneurion*) Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles * Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*)	2.3 km Instream distance: c. 2.5 km from access track crossing point on Boolyvanannan
River Nore SPA	004233	Kingfisher *Alcedo atthis*	18.5 km Instream distance: c. 26 km from access track crossing point on Boolyvanannan

Table 7-25: Summary of pNHAs and NHAs within 10 km of the project

Designated Site	Site code	Features of Interest	Distance to Development Boundary (km)
Coan Bogs NHA	002382	Peatlands	2 km
Cloghristick Wood pNHA	000806	Woodland	4.6 km
Mothel Church, Coolcullen pNHA	000408	Natterer's bat (*Myotis nattereri*)	5 km
Whitehall Quarries pNHA	000855	Nesting Raptors Dry acidic habitats Bilberry (*Vaccinium myrtillus*)	8.1 km

7.5.2.3 Other Designated Sites

Nature Reserves

There are no nature reserves within 10km of the Development. The closest sites are Ballykeefe Wood Nature Reserve, Co. Kilkenny (c. 30 km west) and Timahoe Esker Nature Reserve, Co. Laois (c. 36 km northwest) of the Site.

Ramsar Sites

There are no Ramsar sites within 10km of the Development. The closest Ramsar sites are the Slieve Bloom Mountains, straddling Counties Laois and Offaly (c. 41 km north-west) and Pollardstown Fen, Co. Kildare (c. 47 km north-east) of the Development. Both of these sites are also nature reserves.

7.5.3 Rare and Protected Flora

Detailed botanical surveys (quadrat surveys) were carried out in peatland habitats within the Site land ownership boundary (described in Section 7.4.7.1). The Site is located within Ordnance Survey National Grid 10km Square S67. This 10km grid square was searched for records of plant species through the National Biodiversity Data Centre (NBDC) website (latest search on 14th June 2022). This list was then compared to the lists of species protected under the Flora (Protection) Order of 2015; the Ireland Red List No. 10: Vascular Plants[24] and the Ireland Red List No. 8: Bryophytes[25].

In addition, data on rare/protected species recorded in 10km grid squares within a 5 km radius of the Site and Grid Application cable route was obtained from NPWS (received 1st July 2022); this encompassed grid squares S56, S57, S58, S66, S67, S68, S76, S77. The NPWS FPO Bryophyte Sites map viewer[70] was also consulted.

Table 7-26 presents details of the rare and protected plant and lichen species found within the 10km squares S58, S66, S67, S68, S76, S77 (no records were returned for squares S56 and S57).

[70] http://dahg.maps.arcgis.com/apps/webappviewer/index.html?id=71f8df33693f48edbb70369d7fb26b7e

Information on habitats was completed using; Webb's 'An Irish Flora', 8th edition[43], The British Bryological society's 'Mosses and Liverworts of Britain and Ireland a field guide', first edition[71], Collins 'Wild Flower Guide' second edition[72] and the Lichens of Ireland website[73] (www.habitas.org.uk).

One protected vascular plant species was recorded within the 10 km grid square (S67) which overlaps the Site: red hemp-nettle (latest record 1901). As a species which occurs on calcareous gravels associated with eskers, there is no suitable habitat for this plant at the Site.

The lichen *Cladonia portentosa* has been historically recorded within grid square S67 (latest record 1980). This species was confirmed to be present in the bog habitats onsite.

The remainder of the Site is dominated by conifer woodland and it does not provide suitable habitat for any of the other rare or protected flora identified in the desktop study. No rare or protected flora was found within the Site and surrounding study area, the Grid Application cable route or the TDR during surveys.

No protected bryophyte sites are located within 10 km grid squares S66 and S67 (overlapping and immediately south of the Site).

71 Atherton, I., Bosanquet, D.S., lawley, M. (2010) Mosses and Liverworts of Britain and Ireland a field guide', first edition. British Bryological society
72 Streeter, D. (2016) Collins Wild Flower Guide. Collins
73 https://www.irishlichens.ie/

Table 7-26: Historic Records of protected flora within the 10km Grid Squares (S58, S66, S67, S68, S76, S77) in which the Study Area is located

Species	Grid Square	Location of Record	Year of Last Record	Survey/Dataset	Conservation Status	Habitat	Result of surveys at Bilboa
Annual Knawel (*Scleranthus annuus*)	S76	Fenagh	Historical Record 1979	NPWS Rare/Threatened Plants Database	Flora Protection Order, 2015 (FPO 2015) Vulnerable	Waste land and along roadsides on dry sandy soils. Rare in the north-east, very rare, declining elsewhere (Parnell and Curtis, 2012).	Species not found during surveys.
Basil Thyme (*Clinopodium acinos*)	S77 S58 S76	South of Carlow town Wolfhill Carlow Ballymoon	Historical Record 1963	NPWS Rare/Threatened Plants Database	FPO (2015) Near Threatened	Field margins and sandy or gravelly places in the centre and south-east; rare (Parnell and Curtis, 2012).	Species not found during surveys.
Cornflower (*Centaurea cyanus*)	S77	Carlow Town Carlow Agricultural School	Historical Record 1859	NPWS Rare/Threatened Plants Database	Waiting List (status unknown)(2016) (evaluated as Extinct in 1988 Red Data Book)	Once an agricultural weed of cereal and flax seeds and now almost extinct. Grows along roadsides; scattered and very rare (Parnell and Curtis, 2012).	Species not found during surveys.
Green-winged Orchid (*Anacamptis moreo*)	S66 S76	Ballymoon, Bagenalstown Leighlinbridge	Historical Record 1979	Herbarium and Literature Database 19/02/2013	Vulnerable	Meadows, pastures and sandhills; in the centre and parts of the east of Ireland; rare elsewhere (Parnell and Curtis, 2012).	Species not found during surveys.

Species	Grid Square	Location of Record	Year of Last Record	Survey/Dataset	Conservation Status	Habitat	Result of surveys at Bilboa
Hairy Violet (*Viola hirta*)	S68	Exact location not recorded	Not available	NPWS Rare/Threatened Plants Database	Vulnerable	Species-rich limestone grassland (Wyse Jackson et al. 2016)	Species not found during surveys.
Henbane (*Hyoscyamus niger*)	S77	Brownes Hill	Historical Record 1866	NPWS Rare/Threatened Plants Database	Near Threatened	Rare, on sandy or stony shores throughout Ireland. Often impermanent is rare and declining in the centre of Ireland (Parnell and Curtis, 2012).	Species not found during surveys.
Meadow Saffron (*Colchicum autumnale*)	S77	South of Carlow Town	Historical Record 1836	NPWS Rare/Threatened Plants Database	Endangered	Meadows and riverbanks; only known to grow in the Nore and Barrow Valleys, unknown elsewhere (Parnell and Curtis, 2012)	Species not found during surveys.
Red Hemp-Nettle (*Galeopsis angustifolia*)	S77 S66 S67 S76	Carlow, Kildare	Historical Record 1901	BSBI Atlas Square Record NPWS Rare/Threatened Plants Database	FPO (2015) Vulnerable	Calcareous gravels, particularly eskers in the east-centre of the country; rare (Parnell and Curtis, 2012).	Species not found during surveys.
Shepherd's-needle (*Scandix pecten-veneris*)	S76 S66	Nurney Bagnelstown	1934	NPWS Rare/Threatened Plants Database	Regionally Extinct. Contemporary records are considered neophyte stock	Tilled fields; very rare, maybe extinct (Parnell and Curtis, 2012).	Species not found during surveys.

Species	Grid Square	Location of Record	Year of Last Record	Survey/Dataset	Conservation Status	Habitat	Result of surveys at Bilboa
Weasel's-snout (*Misopates orontium*)	S76	Powerstown	Not available	NPWS Rare/Threatened Plants Database	FPO 2015 Endangered	Arable land in the southeast and southwest where it is rare; elsewhere it is very rare (Parnell and Curtis, 2012). Arable land, cultivated ground on light sandy soils (Streeter, 2016)	Species not found during surveys.
Reindeer moss (*Cladonia portentosa*)	S67 S68	Bilboa Wolfhill Rushes	1984	BLS Lichen Recording Card	EU Habitats Directive Annex V No Red List for Lichens	Grows amongst heather stems on moorland and bogs; occasional to frequent.	Recorded in study area (within The Site land ownership boundary)

7.5.4 Invasive Non-native Flora

The invasive species listed in Table 7-27 have been recorded within the 10 km grid square (grid square S67) overlapping the Site and/or the 10 km grid square immediately south of the Site (S66). Eight invasive plant species have been recorded in these 10km grid squares, five of which (Canadian waterweed, water fern, Himalayan balsam, Japanese knotweed and three-cornered garlic) are listed in Schedule III under Regulation 49 and 50 of the EC (Birds and Natural Habitats) Regulations 2011, which makes it an offence to cause the spread of plant species listed in this Schedule.

Of these eight species, only sycamore was recorded within a 2km grid square in close proximity to the Site. The 2km square abuts the north-eastern land ownership boundary but does not overlap any proposed or consented infrastructure. Sycamore is a widely spread species of 'Medium Risk' and is not Schedule III listed. Whilst Canadian waterweed and water fern were not recorded within the Site, since these can spread within a river system, a search for records near the Site was undertaken which highlighted the closest records are associated with the River Barrow at Milford, c. 4.5 km east (downstream of the Site).

Table 7-27: Invasive Species within 10km of the Site

Species	10 km Grid Square	Invasive Impact	Schedule III	Recorded in study area
Canadian Waterweed *Elodea canadensis*	S67	High	No	No
Water Fern *Azolla filiculoides*	S67 S66	Medium	Yes	No
Cherry Laurel *Prunus laurocerasus*	S67 S66	High	No	Yes (grid route)
Giant Hogweed *Heracleum mantegazzianum*	S67	High	Yes	No
Himalayan Balsam *Impatiens glandulifera*	S67 S66	High	Yes	No
Japanese Knotweed *Fallopia japonica*	S67 S66	High	Yes	Yes (grid route)
Sycamore *Acer pseudoplatanus*	S67 S66	Medium	No	No
Three Cornered Garlic *Allium triquetrum*	S66	Medium	Yes	No

Invasive species recorded within 1km grid squares which overlap the grid connection route are listed in Table 7-28. Sycamore and cherry laurel were the only species recorded along the grid connection route. Canadian waterweed and water fern were not recorded in areas overlapping the proposed grid connection. A search of the closest records to the site again indicated these were at Milford on the Barrow (c. 4 km south-east), downstream of the grid connection route.

Table 7-28: Invasive Species within 1km of the grid connection route

Species	*1 km (grid connection)*	*Invasive Impact*	*Schedule III*	*Recorded in study area*
Canadian Waterweed *Elodea canadensis*	No	High	No	No
Water Fern *Azolla filiculoides*	No	Medium	Yes	No
Cherry Laurel *Prunus laurocerasus*	Yes (2008)	High	No	Yes (grid route)
Giant Hogweed *Heracleum mantegazzianum*	No	High	Yes	No
Himalayan Balsam *Impatiens glandulifera*	No	High	Yes	No
Japanese Knotweed *Fallopia japonica*	No	High	Yes	Yes (grid route)
Sycamore *Acer pseudoplatanus*	Yes (2012)	Medium	No	No
Three Cornered Garlic *Allium triquetrum*	No	Medium	Yes	No

7.5.4.1 Invasive Species Recorded within the Study Area

The Site

No invasive species were observed to be present at the Site.

Aquatic Surveys

No invasive species were present at any of the aquatic ecology survey sites.

Grid Connection

As outlined in Table 7-29**Error! Reference source not found.**, eight invasive species were recorded during the walkover of the proposed grid connection route. These records were associated with hedgerows and road verges along the route. These species comprised two High Risk species, one Medium Risk species, two Low Risk Species and three species whose invasiveness has not yet been determined. Of these eight species Japanese knotweed *Fallopia japonica*, a High-Risk species[74] is also a Third Schedule listed species.

No invasive species are present at the proposed grid substation site.

[74] Kelly, J., O'Flynn, C., and Maguire, C. 2013. Risk analysis and prioritisation for invasive and non-native species in Ireland and Northern Ireland. A report prepared for the Northern Ireland Environment Agency and National Parks and Wildlife Service as part of Invasive Species Ireland.

Table 7-29: Invasive species along grid connection route

Species	***Invasive Impact***	***Legal Status***
Snowberry *Symphoricarpus albus*	Low Risk	None
Cherry Laurel *Prunus laurocerasus*	High Risk	None
Redcurrant *Ribes rubes agg.*	Low Risk	None
Fuchsia *Fuchsia magellanica*	Not Assessed	None
Montbretia *Crocosmis pottsii x aurea = C. x crosmiiflora*	Not Assessed	None
Wilson's Honeysuckle *Lonicera nitida*	Not Assessed	None
Himalayan Honeysuckle *Leycesteria formosa*	Medium Risk	None
Japanese Knotweed *Fallopia japonica*	High Risk	Schedule III

Turbine Delivery Route Pinch Points

A number of invasive species were present in the vicinity of pinch point No. 6: sycamore potentially requiring trimming; redcurrant (nearby) and further away fuchsia and Wilson's honeysuckle.

No invasive species are present at the remainder of pinch points.

7.5.5 Description of Existing Habitats

7.5.5.1 The Site

The habitat survey was undertaken on 9th and 21st July 2020. The Site was revisited on 27th September 2020 to undertake a detailed botanical survey of peatland habitats to define a detailed description of habitat type to assess whether the vegetation composition corresponded with any Annex I habitat types.

The Site study area encompasses a mixture of habitat types, with conifer plantation (WD4) dominating. Access tracks categorised mainly as buildings and artificial surfaces (BL1) and to a lesser extent recolonising bare ground (ED3) provide access throughout the site. Areas of remnant (desiccated) raised bog (PB1) are present, as are areas of cutover bog (PB4) which are recolonising and have links with degraded wet heath (HH3) (not Annex 1 type). Eroding/upland rivers (FW1), other artificial lakes and ponds (FL8) and drainage ditches (FW4) constitute the aquatic habitats present. Limited areas of scrub (WS1), dense bracken (HD1), recently felled (conifer) woodland (WS5) and wet grassland (GS4) are also present.

The habitats present at the Site study area are mapped in Figure 7.6a.

A description of habitats along the Grid Application cable route, access and delivery route is included in Appendix 7.6.

Conifer plantation WD4

Conifer plantation is the dominant habitat on site, consisting of Sitka spruce *Picea sitchensis* and lodgepole pine *Pinus contorta*. Tree heights were typically around 10 m in the south of the Site but there were some smaller, more immature parts of the plantation around 3 m high in pockets to the north. Grey willow *Salix cinerea* saplings were typically present at points along the plantation edges.

The densely planted monoculture offers little in term of botanical biodiversity. However, less dense areas may provide habitat for mammals such as Badger and Red Squirrel. The habitat is considered to be Locally Important (Higher Value).

It is noted however that conifer plantations provide habitat for Red Squirrel.

Plate 1: Conifer plantation WD4

Recolonising bare ground ED3

This habitat was found near the Site entrance in the south and occasionally along parts of the existing forestry tracks. Coltsfoot *Tussilago farfara*, butterbur *Petasites hybridus* and greater plantain *Plantago major* were all abundant. Pineappleweed *Matricaria disoidea*, scentless mayweed *Tripleurospermum inodorum*, rose-bay willowherb *Chamaenerion angustifolium*, dandelion *Taraxacum* spp, common knapweed *Centaurea nigra* were all frequently encountered.

This habitat is of Local Importance (Lower Value) in ecological terms.

Plate 2: Recolonising bare ground ED3

Other artificial lakes and ponds FL8

This habitat was found near to the Site entrance in the south and appeared to be the result of human excavation (likely a flooded quarry / borrow pit). It was clear that this pond had been subject to fly-tipping, with large volumes of human refuse thrown inside. Nevertheless, it supported a reasonable level of macrophytes including bulrushes *Typha latifolia* and common spike-rush *Elocharis palustris*. Pondweed *Potamogeton pectinatus* was also present. On the pond edges, there were rose-bay willowherb *Chamaenerion angustifolium*, greater plantain *Plantago major*, male fern *Dryopteris filix-mas*, brambles *Rubus fruticosus* agg., nettles *Urtica dioica*, foxglove *Digitalis purpurea,* European gorse *Ulex europaeus* and small grey willow saplings *Salix cinerea*. Part of the pond was also bordered by conifer plantation WD4 habitat.

This habitat could potentially be used by spawning frogs. A variety of dragonfly and damselfly species were observed at the pond. Due to its semi-natural character and suitability for invertebrates it is classified as Local Importance (Higher Value).

This pond is within the footprint of the proposed borrow pit.

Plate 3: Other artificial lakes and ponds FL8

Drainage ditches FW4

This habitat was found predominantly alongside forestry tracks and so was typically shaded. Some drainage ditches to the middle of the Site contained abundant blunt-leaved bog moss *Sphagnum palustre*. Common haircap moss *Polytrichum commune* var. *commune*, various willowherb species (*E. hirsutum* in particular, but also rose-bay willowherb *Chamaenerion angustifolium*), common bird's foot trefoil *Lotus corniculatus* and tormentil *Potentialla erecta* were also occasionally found alongside drainage ditches. Grey willow saplings *Salix cinerea*, European gorse *Ulex europaeus*, dandelion *Taraxacum* spp., common dog-violet *Viola riviniana*, soft rush *Juncus effusus* and common couch *Elytrigia repens* were also frequently found alongside drainage ditches. To the north of the Site, wood sorrel *Oxalis acetosella* and pendulous sedge *Carex pendula* were also rarely found alongside drainage ditches.

While not recorded during surveys, this habitat type could provide important breeding habitat for common frogs. As such it is a Local Importance (Higher Value) habitat.

Plate 4: Drainage ditches FW4

Buildings and artificial surfaces BL3

This habitat consisted of gravel forestry tracks and the existing met mast, predominantly constructed from metal. To the edges of the tracks typical species as previously recorded for the recolonising bare ground ED3 habitat type were recorded.

Owing to its artificial nature, this habitat type is generally of low ecological value. However, of interest were multiple heath-spotted orchids *Dactylorhiza maculata*, which were growing in the centre of the forestry tracks in the south west part of the Site. These orchid tracks were extensive and as such increase the ecological interest of this habitat.

The areas of track supporting heath-spotted orchids are considered to be of (Local importance) higher value, while the remainder are lower value.

Plate 5: Buildings and artificial surfaces BL3

Scrub WS1

This habitat was found in pockets throughout the Site but especially between conifer plantation and more open habitats, such as Raised Bog PB1 or recolonising bare ground ED3. The scrub onsite was dominated by grey willow *Salix cinerea* saplings, with brambles *Rubus fruticosus* agg., willowherb *Epilobium* spp and European gorse *Ulex europaeus* all abundant. Also occasional were hogweed *Heracleum sphondylium*, foxglove *Digitalis purpurea*, holly *Ilex aquifolium* and wild angelica *Angelica sylvestris*. Common bird's foot trefoil *Lotus corniculatus* was rarely encountered in this habitat type.

This habitat type could provide important nesting habitat for passerine birds and as such is classified as being of Local Importance (Higher Value).

Plate 6: Scrub WS1

Raised bog PB1

The detailed results of Relevé surveys within the peatland habitats on site are included in Appendix A7.6.

This habitat type was found in the centre of the Site in two areas. Peat depths were generally >2 m. Although it is unusual for this habitat type to be found at higher altitudes (elevation on site is ~300 m OD), the depth of peat and plateau-like topography are consistent with this mode of peat formation.

The ERICA analysis results (see Appendix A7.6) are consistent with the classification of the remaining peat mass as raised bog. It is noted that the peat depths observed straddle the higher and lower ranges for Upland blanket bog and Raised bog respectively (Fossit, 2000).

Species present included ling heather *Calluna vulgaris*, cross-leaved heath *Erica tetralix*, common cotton-grass *Eriophorum angustifolium*, bog asphodel *Narthecium ossifragum*, deergrass *Tricophorum caespitosum,* tormentil *Potentilla erecta* and bilberry *Vaccinium myrtillus*. Moss species present included lustrous bog-moss *Sphagnum subnitens* var. *subnitens*, red bogmoss *Sphagnum capillifolium* and heath plait-moss *Hypnum jutlandicum.* The mosses present were very desiccated during July surveys. The lichen *Cladonia portentosa* was also present.

Based on the assessment of site topography and underlying hydrogeological conditions in conjunction with the floral assemblage, this habitat has been identified as Raised bog.

The bog was desiccated at the time of survey with occasional bare patches of exposed peat present. Occasional sitka spruce saplings were found invading. There was an obvious 'face bank' to the peat approximately 1.5-2 m in depth.

The face bank, desiccated nature of the bog and presence of occasional sitka spruce saplings are all evidence of peat harvesting in adjacent areas with the associated draining drying out of the bog.

Restoration measures are proposed to allow the bog to regenerate (see Appendices A7.9 and A7.13). Following these measures which are proposed to be carried out in conjunction with wind farm construction, this habitat will correspond with the Annex 1 habitat 'Degraded raised bogs still capable of natural regeneration [7120]' (it does not currently correspond with this habitat type).

Despite its current degraded state, this habitat is still classified as being of Local Importance (Higher Value).

This habitat is outside the footprint of the Development. A small area (c. 38m^2) is overlapped by the T3 felling buffer. This area is outside the infrastructure footprint, and is unlikely to be subject to disturbance from felling activities.

Plate 7: Raised bog PB1

Cutover bog PB4/Wet heath HH3 mosaic

This habitat was found in the centre of the Site, abutting the remnants of raised bog described above. The areas of cutover bog PB4/wet heath HH3 mosaic are considered to have once formed part of larger area of raised bog.

Peat depths were generally shallower here (<0.5 m). There was evidence that some forestry vehicles had used part of the mosaic as a turning splay, with peat and vegetation disturbed by vehicle tracks. Similar species to the remnant raised bog were recorded, although bracken *Pteridium aquilinum* and bramble *Rubus fruticosus* agg. had begun to invade, especially at the habitat margins. Ling heather *Calluna vulgaris* and tormentil *Potentialla erecta* was abundant. Bell heather *Erica cinerea* and glittering wood moss *Hylocomium splendens* were rare. There was some purple moor grass *Molina caerulea* in localised patches. Bilberry *Vaccinium myrtillus* was also present. Soft rush *Juncus effusus* was occasionally recorded.

This cutaway area between remnant raised bog areas may regenerate, but over a long time, provided that there is no more encroachment in this area. Restoration could occur through re-wetting, but any improvement in the hydrology, peat accumulation and vegetation would require the successful implementation of restoration measures.

As such, while this habitat has links with the Annex 1 habitat 'Degraded raised bogs still capable of natural regeneration [7120]' it is not considered to be a good example and would require extensive measures and a long timescale without certainty of success. Wet heath has links with the Annex 1 habitat 'Northern Atlantic wet heaths with *Erica tetralix* [4010]' however due to the absence of *E.tetralix* this element of the mosaic does not correspond with the Annex 1 habitat type.

This habitat type lies partly within the footprint of a Grid Application proposed access road and within the proposed felling buffer for T2.

Plate 8: Cutover bog PB4/Wet heath HH3 mosaic

Dense bracken HD1

This habitat type was found separating cutover bog PB4/wet heath HH3 mosaic from conifer plantation WD4. Bracken *Pteridium aquilinum* was monodominant. This habitat is classified as being of Local Importance (Lower Value).

Plate 9: Dense bracken HD1

Eroding/upland rivers FW1

This habitat type was found in the northern part of the Site. The Boolyvannan crossed parts of the existing access track that will be upgraded. The Dinin (South) largely runs around the perimeter of the (upgraded access track) site, separated from the interior habitats by riparian woodland WN5, but is connected by a tributary which crosses the (Grid Application) proposed entrance to the Site in the north.

At the access track crossing, the riverbanks of the Boolyvannan were heavily vegetated with beech *Fagus sylvaticus* overhanging and abundant nettles *Urtica dioca* and brambles *Rubus fruticosus* agg. adjacent. Rosebay willow-herb *Chamaenerion angustifolium* was also frequently recorded nearby. The heavily vegetated nature of the Boolyvannan limits its suitability as foraging habitat for Daubenton's bat, dipper and kingfisher.

The crossing was not visible, but probably consists of a culvert. The Boolyvannan was approximately 40 cm wide, 2 cm deep with a moderate flow. The crossing offered no bat roost potential.

The un-named tributary of the Dinin (South) crossing near the northern site entrance consists of a small, stone culvert ~50 cm tall, surrounded by many ash trees approximately 10 m tall. This culvert has a very low bat roost potential.

This habitat is classified as being of Local Importance (Higher Value).

Plate 10: Eroding/upland rivers FW1

Recently felled woodland WS5

This habitat was found in two discrete pockets in the north of the Site, in the conifer plantation surrounding existing access track (Grid Application -upgrade permitted). There were remnants of sitka spruce and lodgepole pine trees here. This habitat is classified as being of Local Importance (Lower Value).

Plate 11: Recently felled woodland WS5

Wet grassland GS4

This habitat was found in one small section to the northwest of the Site adjacent to an existing onsite access track (Grid Application upgrade permitted). Angelica *Angelica sylvestris*, creeping buttercup *Ranunculus repens*, Yorkshire fog *Holcus lanatus*, soft rush *Juncus effusus* and rose-bay willowherb *Chamaenerion angustifolium*, creeping bent *Agrostis stolinefora*, common knapweed *Centaurea nigrum* and marsh thistle *Cirsium palustre* were all present.

Wet grassland is classified as being of Local Importance (Higher Value) due to its semi-natural character.

Plate 12: Wet grassland GS4

Riparian Woodland WN5

Riparian woodland (WN5) was found along the northern access track site boundary, near to the Dinin [South] river. *Salix cinerea* willows were dominant, with the occasional ash *Fraxinus excelsior* and alder *Alnus glutinosa* present. Wild angelica *Angelica Sylvestris* and meadowsweet *Filipendula ulmaria* were frequently recorded in the field layer. Also abundant were bramble *Rubus fruticosus agg.*, nettles *Urtica dioca* and creeping buttercup *Ranunculus repens.*

This habitat is classified as being of Local Importance (Higher Value).

Plate 13: Riparian Woodland WN5

7.5.5.2 Grid Connection

Grid Substation Site

The habitats present at the Grid Substation Site are mapped in Figure 7.6b.

Wet grassland GS4

The majority of the substation site consisted of this habitat type. The area was heavily grazed by cattle but abundant rush cover was evident. Soft rush *Juncus effusus* dominated with rye grass *Lolium* spp. and meadow grass *Poa* spp also abundant. Occasionally marsh violet *Viola palustre* was recorded.

This habitat is classified as being of Local Importance (Higher Value). The grid substation is located in wet grassland.

Plate 14: Wet grassland GS4

<u>*Poor fen and flush PF2*</u>

Towards the north of the substation site, there was a patch of poor fen and flush. Abundant blunt-leaved bog moss *Sphagnum palustre* and common haircap *Polytrichum commune var. commune* lawns were dominant. Soft rush *Juncus effusus* was abundant. The occasional tormentil *Potentilla erecta* had begun to invade. Also present was straw spear-moss *Straminergon stramineum*. The ground was very wet and water-logged, presumably fed by groundwater and also possibly water flowing from drainage ditches into this habitat area.

This habitat is locally important higher value. It is outside the grid substation footprint.

Plate 15: Poor fen and flush PF2

<u>*Drainage ditches FW4*</u>

Drainage ditches ran through the substation site. Many of the ditches had evidence of damage by cattle. Marsh willowherb *Epilobium palustre*, Yorkshire fog *Holcus lanatus*, creeping bent *Agrostis stolonifera*, soft rush *Juncus effusus* and sharp-flowered rush *Juncus acutiflorus* were frequently found nearby. Occasionally ling heather *Calluna vulgaris* and bog myrtle *Vaccinum myrtillus* were found, owing to the proximity of the site to a nearby bog.

This habitat is locally important higher value. A section of drainage ditch is overlapped by the grid substation footprint.

Plate 16: Drainage ditches FW4

Scrub WS1

This habitat type here consisted of brambles *Rubus fruticosus agg*. and small grey willow Salix cinerea saplings a few metres tall. A variety of rushes had begun to invade certain areas including soft rush *Juncus effusus* and sharp-flowered rush *Juncus acutiflorus*.

This habitat is locally important lower value due to it's immaturity. It is outside the grid substation footprint.

Plate 17: Scrub WS1

Wet willow-alder-ash woodland WN6

There was a small area to the northeast of the substation site where willow trees *Salix cinerea* had grown approximately 5 m in height. This area was topographically much lower than the rest of the site, indicating that some excavation had occurred there historically. Brambles *Rubus fruticosus agg*. and elder *Sambucus nigra* were also present and abundant. It is likely the provenance of this habitat type is scrub which has matured via ecological succession.

This habitat is locally important higher value. It is outside the grid substation footprint.

Plate 18: Wet willow-alder-ash woodland WN6

Recently felled woodland WS5

To the north of the sub-station area was an area of recently-felled conifer plantation. Bilberry *Myrtilus vaccinum* and ling heather *Calluna vulgaris* had begun to spread to a few isolated patches.

This habitat is of limited ecological value. It is outside the grid substation footprint.

Plate 19: Recently felled woodland WS5

Recolonising bare ground ED3

There was a linear strip of recolonising bare ground consisting of what was a track and, also the area adjacent to it. Colts-foot *Tussilago farfara* was abundant, as were brambles *Rubus fruticosus agg*. Meadow grass *Poa spp*. and rye grasses *Lolium spp.* had begun to invade. Also present were dandelions *Taraxacum spp.* and plantains *Plantago spp*.

This habitat is of Local Importance (Lower Value). It is outside the grid substation footprint.

Plate 20: Recolonising bare ground ED3

Grid Connection Route

The habitats present along the permitted grid connection route are mapped in Figure 7.6b and described and/or listed below. The grid connection is predominantly located along existing roads and forestry tracks; however, it also traverses an area of conifer plantation at the wind farm site.

The majority of habitats along the grid connection are common habitats and/or are set back from the route and as such not subject to potential impacts. A stream intersects the route however and as such this habitat requires more detailed consideration.

Eroding/upland rivers FW1

This habitat type was present at the Rossmore Stream (Fushoge) near the north of the grid connection route. Part of this stream had been canalised, as it bordered a residential dwelling. The stream was ~30 cm wide and only a few centimetres deep. The flow was moderate and the riverbed rocky. Owing to the extremely shallow depth, it was not considered likely to afford suitable foraging habitat for kingfisher, dipper or Daubenton's bat. Species recorded nearby included foxglove *Digitalis purpurea*, grey willow *Salix cinerea*, rose-bay willowherb *Chamaenerion angustifolium*, hazel *Corylus avellana*, meadowsweet *Filipendula ulmaria* and nettles *Urtica dioica*.

There were no other EPA mapped watercourses along the rest of the GCR. There was flowing water along some fields adjacent to the L7129 along the middle of the route, which are classified as drainage ditches.

The presence of an ephemeral/seasonal stream (tributary of Dinin) which is not mapped by the EPA running parallel to a section of the grid connection within at the wind farm site conifer woodland is also noted.

Plate 21: Eroding/upland rivers FW1

The remainder of habitats along the grid connection route are common low-value habitats and/or are set back from the route and as such are not subject to potential effects and/or not of ecological value. These habitats comprised:

- *Conifer plantation WD4 (in footprint)*
- *Amenity grassland (improved) GA2 (adjacent)*
- *Dry meadows and grassy verges GS2 (adjacent)*
- *Buildings and artificial surfaces BL3 (adjacent)*
- *Stone walls and other stoneworks BL1 (adjacent)*
- *Improved agricultural grassland GA1 (adjacent)*
- *Hedgerows WL1 (adjacent)*
- *Treelines WL2 (adjacent)*
- *Scrub WS1 (adjacent)*

- *Wet grassland GS4 (adjacent)*

7.5.5.3 Turbine Delivery Pinch Points

Pinch point 3

Habitats here consisted of buildings and artificial surfaces (BL3) and recolonising bare ground (ED3). The area that will be affected is recolonising bare ground (ED3). Mainly consisting of small *Epilobium* spp, *Taraxacum* spp and ragwort. No invasive species were present. Note a 25 m tall treeline (WL2) with beech *Fagus sylvatica,* bird cherry *Prunus avium* and ash *Fraxinus excelsior* was present near the road but it was located outside of the potential area for trimming.

Plate 22: Pinch point 3

Pinch point 4

This pinch point consisted of scattered trees and parkland (WD5), amenity grassland (improved) (GA2), hedgerows (WL1) and treelines (WL2). The only area affected is amenity grassland (improved) (GA2). The scattered trees included copper beech *Fagus sylvatica* and rowan *Sorbus aucuparia*. The hedge was a hawthorn *Crataegus monogyna* hedge. The treelines were of mature ash trees approximately 25 m tall of low-moderate bat roost potential owing to a lack of crevices and ivy coverage. No invasive species or other constraints were present.

Plate 23: Pinch point 4

Pinch point 5

Habitats included dry meadows and grassy verges (GS2), scrub (WS1) and improved agricultural grassland (GA1). Habitats affected will include dry meadows and grassy verges and improved agricultural grassland. No significant ecological constraints are present. Sparrowhawk was observed nearby but would not be nesting at this pinch point due to a lack of suitable habitat.

Plate 24: Pinch point 5

Pinch point 6

Habitats include buildings and artificial surfaces (BL3), hedgerows (WL1) and wet grassland (GS4). A tall ~20 m sycamore is present near this pinch point, which could require trimming. Low potential for bat roosts. Non-native redcurrant is present nearby and further away are fuchsia and Wilson's honeysuckle.

Plate 25: Pinch point 6

Pinch point 7

Near this pinch-point was a water crossing over the Dinin (South). There was a stone bridge of stone walls and other stoneworks BL1 type, >5 m tall and the FW1 river was 3-4 m wide and approximately 20 cm deep. The bridge did not appear to have any obvious crevices and was of low bat roosting potential. At the point near the crossing, the river could have some potential for foraging Daubenton's bat, kingfisher and dipper owing to its width, which was unobstructed by overhanging vegetation. The bed was rocky and the flow moderate. There was a patch of riparian woodland WN5 that may require trimming. This consists largely of willow trees, with ~10 m tall ash and sycamore trees closest to the road and most likely to be affected. These trees had low bat roost potential. No invasive species are present nearby.

Plate 26: Pinch point 7

Additional section

This section consisted of amenity grassland (improved) (GA2) and treelines (WL2). The only area affected will be amenity grassland. No invasive species or other constraints identified. A 20 m tall ash was recorded nearby but considered to be away from zone of influence.

Plate 27: Additional section

Grid Connection Crossing (Rossmore Stream)

The 1st order Rossmore Stream is a small watercourse of limited ecological value. The proposed crossing is at an existing crossing at the source of the stream where there is limited habitat for aquatic species.

Part of this stream (upstream of mapped source) had been canalised, where it borders a residential dwelling. The stream is c. 30 cm wide and only several centimetres deep. The bed is rocky and carried a moderate flow when observed in July 2020.

Plate 28: Canalised section of Rossmore stream viewed from Grid connection crossing point

7.5.6 Terrestrial Mammals

7.5.6.1 Rare and Protected Mammals (Desktop Study)

Records of Irish hare, red squirrel, sika deer, hedgehog, pine martin, otter, Irish stoat, red deer, pygmy shrew and badger are present in NBDC datasets covering the two 10km squares (S67 & S66) overlapping and adjacent to the Site. All of these species could potentially use the habitats within and bounding the Site study area.

NPWS rare/protected species datasets included no additional protected mammal species to those in the NBDC datasets recorded within the 10 km Grid Squares S66 and S67.

Table 7-30 below lists the protected mammal species for which historical records exist within grid squares S66 and S67 and also details their conservation status.

Table 7-30: Protected mammal species records within 10 km Grid squares S66 & S76

Common Name	Scientific Name	Irish Red List	EU Habitat Directive Annex Listing	Wildlife Act
Pine Marten	*Martes martes*	Least Concern	V	√
Irish Hare	*Lepus timidus* subsp. *hibernicus*	Least Concern	V	√
Eurasian Badger	*Meles meles*	Least Concern	-	√
Red Squirrel	*Sciurus vulgaris*	Least Concern	-	√
Irish Stoat	*Mustela erminea hibernica*	Least Concern	-	√
Hedgehog	*Erinaceus europaeus*	Least Concern	-	√
Otter	*Lutra lutra*	Least Concern	II & IV	√
Pygmy shrew	*Sorex minutus*	Least Concern	-	√

7.5.6.2 Invasive Mammals (Desktop Study)

A desktop study was carried out to identify any invasive mammal species historically recorded in NBDC and NPWS datasets covering the two 10km squares (S67 & S66) overlapping and adjacent to the Site.

A total of five invasive mammal species for which records exist within this search area were identified; these are listed below in Table 7-31 along with their invasiveness impact level and legal status.

Table 7-31: Invasive mammal species recorded within grid squares S66 & S67

Common Name	Scientific Name	Latest record date	Impact level	Legal Status
American Mink	*Mustela vison*	13/10/1991	High Risk	Schedule III
Brown Rat	*Rattus norvegicus*	24/11/17	High Risk	Schedule III
Eastern Grey Squirrel	*Sciurus carolinensis*	31/12/2007	High Risk	Schedule III
Greater White Toothed Shrew	*Crocidura russula*	15/07/2020	Medium Risk	None
European Rabbit	*Oryctolagus cuniculus*	14/07/2015	Medium Risk	None

7.5.6.3 Terrestrial Mammals Survey Results

Signs and sightings indicating or confirming the presence of five mammal species were recorded within the Site study area. In addition, deer tracks which were not identified to species level were recorded in the Site study area. It is noted that the range of both Sika and Red Deer is considered to extend to the adjacent 10 km grid square (S77)[75].

See Table 7-32 below for more information. Figure 7.8 shows the location of mammal field signs, and direct observations of live mammals. This data was obtained during the mammal survey walkovers as well as records gathered during other ecological surveys. Four of these species are considered to be of 'Least Concern', namely badger, red fox, red squirrel and pine marten. The other species, American mink, is introduced and not provided a conservation status. As discussed in section 7.5.6.2, American mink is an invasive species.

Other mammal species previously recorded in the desktop study area (see section 7.5.6.1) but not observed during surveys may also occur; Irish hare, red deer, sika, Irish stoat, hedgehog, brown rat, grey squirrel, greater white toothed shrew and European rabbit. The treelines, as well as the edge of the woodland and scrub habitats, and adjacent field edges are suitable for Irish stoat; utilising habitat edges to hunt. Species are subject to seasonal fluctuations in population as the availability of food changes throughout the year[76].

[75] Carden, R.F. et al. (2010) Distribution and range expansion of deer in Ireland. Mammal Review.

[76] Couzens, D., Swash, A., Still, R., Dunn, L.,(2017) Britains Mammals; A field guide to the mammals of Britain and Ireland. Princeton University Press

Table 7-32: Mammals recorded onsite during surveys

Name	Conservation Status
Badger *Meles meles*	Least Concern
Red Fox *Vulpes vulpes*	Least Concern
Red Squirrel *Sciurus vulgaris*	Least Concern
Pine Marten *Martes martes*	Least Concern
American Mink *Neovison vison*	Invasive Species

Badger

Soil disturbance considered to have been caused by Badger was recorded within cutover raised bog between T2 and T3. No setts or other evidence confirming the presence of badger was recorded. Badger are not recorded within any 2 km grid squares overlapping the Site but are recorded in an adjacent 2 km grid square (S6671).

Red Fox

The remains of a fox (skull and bones) were found during mammal surveys. These were found in the same habitat and general area (cutover bog between T2 and T3) as the potential badger sign detailed above. Foxes are common and often abundant throughout the country. They are not legally protected, are considered vermin by many land users and in certain situations can negatively affect ground-nesting bird populations. However, they also form an important element in the depauperate remnant ecosystems left behind after centuries of human exploitation.

Red Squirrel

Two live sightings of red squirrel were recorded. One was along the L3041, a road bounded by conifer plantations to the north-east of the Site, while the second was along an existing access track (Grid Application northern access route) within conifer plantation. The conifer plantations at the Site and in the surrounding landscape provide suitable foraging and breeding habitat for red squirrel.

Pine Marten

A pine marten scat was recorded along an existing access track to the south of T1 during mammal surveys. Pine marten may use the conifer plantations at the Site study area and also the surrounding farmland to forage. This species could also potentially use the conifer plantations onsite to breed (pine marten use 'dens' to breed, which include a variety of structures and locations including rot-holes, piles of wood, rock services, and dwellings abandoned by other mammals). However, no pine marten dens were found onsite.

American Mink

Evidence of this species in the form of scat (droppings) was found on an existing forestry track to the south of T4.

American mink is a non-native mustelid introduced into the wild in Ireland as a result of fur farming (through escape or deliberate release). It is a predatory mustelid often associated with river networks but may also venture overland in search of prey. As a non-native invasive mammal, mink have negative effects on native species through competition and predation.

7.5.6.4 Otter Survey Results

No otter holts or evidence of otter was recorded within the study area during the otter survey. The small streams in the study area could potentially be used as commuting corridors by otters travelling between catchments, while the Dinin in the vicinity of the Development may also be of low-moderate value to foraging Otter.

7.5.7 Bats

7.5.7.1 Desktop Study

The review of existing records of bat species within the chosen radii of the Development (outlined in section 3.2 of the accompanying bat report in Appendix 7.1), indicates that four of the nine known Irish species of bat have been recorded in the study area. The NBDC and BCI results are shown in Table 7-33 and Table 7-34 respectively.

Review of the NPWS lesser horseshoe bat database indicates that there are no records of lesser horseshoe bat roosts within a 2.5 km search radius.

The rare and protected species records from NPWS did not include any bat species.

The Cave Database for the Republic of Ireland does not hold any records of caves within a 4 km search radius.

Table 7-33: Desktop Results of NBDC Bat Records within 10km radius (2022)

Bat Species	**Legal Protection**	**Conservation Status (Marnell et al. 2019)**	**Date of Last Record**
Common pipistrelle (*Pipistrellus Pipistrellus*)	EU Habitats Directive Annex IV, Wildlife Acts	Least Concern	11/08/2010
Daubenton's bat (*Myotis daubentonii*)	EU Habitats Directive Annex IV, Wildlife Acts	Least Concern	25/08/2013
Soprano pipistrelle (*Pipistrellus pygmaeus*)	EU Habitats Directive Annex IV, Wildlife Acts	Least Concern	11/08/2010
Brown Long-eared Bat (*Plecotus auritus*)	EU Habitats Directive Annex IV, Wildlife Acts	Least Concern	18/08/2009

Table 7-34: Bat roosts recorded within 10km (BCI, 2020)

Bat Species	**Legal Protection**	**Conservation Status (Marnell et al. 2019)**	**Distance from site (km)**
Daubenton's bat (*Myotis daubentonii*)	EU Habitats Directive Annex IV, Wildlife Acts	Least Concern	4.37km
Natterer's bat (*Myotis nattereri*)	EU Habitats Directive Annex IV, Wildlife Acts	Least Concern	6.10km
Daubenton's bat (*Myotis daubentoniid*)	EU Habitats Directive Annex IV, Wildlife Acts	Least Concern	7.08km

Bat Landscapes

The bat landscape association model[77] suggests that the Development site is part of a landscape that is of low to moderate suitability for Daubenton's bat, whiskered bat, brown long-eared, common pipistrelle, soprano pipistrelle, Leisler's bat and Natterer's bat. The Development site and its environs are of low suitability for lesser horseshoe bat and Nathusius' pipistrelle.

Table 7-35: Bat landscapes (NBDC, 2020)

Bat Species		**Suitability Index**	
All Bats		22.44	
Pipistrellus pygmaeus	Soprano pipistrelle	28	
Plecotus auritus	Brown long-eared bat	34	
Pipistrellus pipistrellus	Common pipistrelle	38	
Rhinolophus hipposideros	Lesser horseshoe bat	0	
Nyctalus leisleri	Leisler's bat	24	
Myotis mystacinus	Whiskered bat	36	
Myotis daubentonii	Daubenton's bat	14	
Pipistrellus nathusii	Nathusius' pipistrelle	0	
Myotis nattereri	Natterer's bat	28	

0 - 13
14 - 26
27 - 36
37 - 48
49 - 75

Designated Sites

Designated sites have already been detailed above in section 7.4.6.1. As such only designated sites which are relevant specifically to bats are considered here.

European Sites

No European site designated for bats is located within 15 km of the Development site.

National Sites

One of the pNHAs present within 10 km of the Development site has been selected for bats.

Mothel Church, Coolcullen pNHA (000408) which is situated 4.65km south-west of the Development site is designated for a nursery colony of Natterer's bats which use the loft and bell tower of the church. Over 100 bats were counted at this site in 1993 (NPWS Site Synopsis).

7.5.7.2 Bat Activity Surveys 2020

The results of the four no. bat activity surveys carried out at the Development site in 2020 are presented below in Table 7-37 to Table 7-40.

[77] Lundy MG, Aughney T, Montgomery WI, Roche N (2011). *Landscape conservation for Irish bats & species specific roosting characteristics*. Bat Conservation Ireland.

Table 7-36: Bat activity survey conditions

Conditions	**Sunset**	**Cloud cover**	**Wind**	**Precipitation**	**Temperature**
Survey					
Survey Visit 1 (30-06-2020)	21:55	5/8	F1	None	14ºC
Survey Visit 2 (23-07-2020)	21:34	4/8	F2	None	17ºC
Survey Visit 3 (04-09-2020)	20:08	2/8	F3	None	13 ºC
Survey Visit 4 (05-10-2020)	18:54	3/8	F2	None	9 ºC

Table 7-37: Analysis EM2 pro Data - Survey 1 Results 30-06-2020

Species	**No. of Recordings**	**% Total Recordings**
Common pipistrelle	4	100
Total	**4**	

Table 7-38: Analysis EM2 pro Data - Survey 2 Results 23-07-2020

Species	**No. of Recordings**	**% Total Recordings**
Common pipistrelle	14	56%
Soprano pipistrelle	2	8%
Leisler's bat	5	20%
Brown long-eared	1	4%
Daubenton's bat	1	4%
Natterer's bat	2	8%
Total	**25**	

Table 7-39: Analysis EM2 pro Data - Survey 3 Results 04-09-2020

Species	**No. of Recordings**	**% Total Recordings**
Common pipistrelle	8	80%
Soprano pipistrelle	2	20%
Total	**10**	

Table 7-40: Analysis EM2 pro Data - Survey 4 Results 05-10-2020

Species	**No. of Recordings**	**% Total Recordings**
Common pipistrelle	6	100%
Total	**6**	

7.5.7.3 Static Bat Detector Surveys 2020

Table 7-41 below summarises the results, in relation to bat species, recorded on the static detectors deployed in 2020. Five static units were deployed during each survey period. Overall, eight bat species were recorded (common pipistrelle, soprano pipistrelle, nathusius' pipistrelle, leisler's bat, brown long-eared bat, natterer's bat, daubenton's bat and whiskered bat).

Table 7-41: Summary results of Static Bat Detectors deployed during survey periods 1 to 3

Static Detector No. and location habitats	Species detected during Period 1 14th to 26th June 2020 (Night 1 – 13)	Species detected during Period 2 8th to 18th July 2020 (Night 14 – 24)	Species detected during Period 3 4th to 14th September 2020 (Night 25 – 35)
BB1 Conifer Plantation	Daubenton's bat Whiskered bat Leisler's bat Nathusius' pipistrelle Common pipistrelle Soprano pipistrelle Brown long-eared bat	Leisler's bat Common pipistrelle	Daubenton's bat Whiskered bat Natterer's bat Leisler's bat Nathusius' pipistrelle Common pipistrelle Soprano pipistrelle Brown long-eared bat
BB2 Conifer Plantation	Daubenton's bat Leisler's bat Nathusius' pipistrelle Common pipistrelle Soprano pipistrelle	Daubenton's bat Leisler's bat Nathusius' pipistrelle Common pipistrelle Soprano pipistrelle Brown long-eared bat	Whiskered bat Leisler's bat Nathusius' pipistrelle Common pipistrelle Soprano pipistrelle Brown long-eared bat
BB3 Conifer Plantation	Daubenton's bat Whiskered bat Natterer's bat Leisler's bat Nathusius' pipistrelle Common pipistrelle Soprano pipistrelle Brown long-eared bat	Daubenton's bat Whiskered bat Natterer's bat Leisler's bat Nathusius' pipistrelle Common pipistrelle Soprano pipistrelle Brown long-eared bat	Daubenton's bat Whiskered bat Natterer's bat Leisler's bat Nathusius' pipistrelle Common pipistrelle Soprano pipistrelle Brown long-eared bat
BB4 Conifer Plantation	Daubenton's bat Leisler's bat Nathusius' pipistrelle Common pipistrelle Brown long-eared bat	Natterer's bat Leisler's bat	Daubenton's bat Whiskered bat Natterer's bat Leisler's bat Nathusius' pipistrelle Common pipistrelle Soprano pipistrelle
BB5 Conifer Plantation	Daubenton's bat Whiskered bat Natterer's bat Leisler's bat Common pipistrelle Soprano pipistrelle	Daubenton's bat Leisler's bat	Daubenton's bat Whiskered bat Leisler's bat Nathusius' pipistrelle Common pipistrelle Soprano pipistrelle

Common Pipistrelle

The total number of recordings for common pipistrelle at the development was 9,732 no. recordings; 54.09% of total recordings. These were recorded over 32 no. nights which gives an average of 304.13 no. recordings per night.

Leisler's Bat

The total number of recordings for Leisler's bat at the development was 3,666 no. recordings; 20.38% of total recordings. These were recorded over 32 no. nights which gives an average of 114.56 no. recordings per night.

Soprano Pipistrelle

The total number of recordings of soprano pipistrelle recorded at the development was 2,251 no. recordings; 12.51% of total recordings. These were recorded over 32 no. nights. This gives an average of 70.34 no. recordings per night.

Nathusius' Pipistrelle

The total number of recordings for Nathusius' Bat at the development was 2,072 no. recordings; 11.52% of total recordings. These were recorded over 32 no. nights which gives an average of 64.75 no. recordings per night.

Whiskered Bat

The total number of recordings for whiskered bat at the development was 79 no. recordings; 0.44% of total recordings. These were recorded over 32 no. nights which gives an average of 2.47 no. recordings per night.

Brown Long-Eared Bat

The total number of recordings for brown long-eared bat at the development was 74 no. recordings; 0.41% of total recordings. These were recorded over 32 no. nights which gives an average of 2.31 no. recordings per night.

Daubenton's Bat

The total number of recordings for Daubenton's bat at the development was 71 no. recordings; 0.39% of total recordings. These were recorded over 32 no. nights which gives an average of 2.22 no. recordings per night.

Natterer's Bat

The total number of recordings for Natterer's bat at the development was 46 no. recordings; 0.26% of total recordings. These were recorded over 32 no. nights which gives an average of 1.44 no. recordings per night.

7.5.7.4 Ecobat

The Ecobat tool provides are series of summary tables to enable analysis of the bat activity level at each static location. These are presented below.

Survey Period 1

A summary table provided by EcoBat results, showing the number of nights recorded bat activity fell into each activity band for each species is presented below.

None of the five static locations had at least one night of High Activity during the survey period.

Bat surveys were conducted at BB1, BB2, BB3, BB4, BB5, for 12 nights between 2020-05-14 and 2020-05-26, using Song Meter SM4BAT bat detectors. The maximum of passes recorded in a single night was 204 passes, and 8 species were recorded.

None of the five static locations had at least High Activity during the survey period.

Table 7-42: Summary table showing the number of nights recorded bat activity which fell into each activity band for each species during Survey Period 1.

Location	Species/Species Group	Nights of High Activity	Nights of Moderate/ High Activity	Nights of Moderate Activity	Nights of Low/ Moderate Activity	Nights of Low Activity
BB1	*Myotis daubentonii*	0	0	0	0	1
BB1	*Myotis mystacinus*	0	0	0	0	3
BB1	*Nyctalus leisleri*	0	0	1	0	10
BB1	*Pipistrellus nathusii*	0	0	1	0	11
BB1	*Pipistrellus pipistrellus*	0	0	0	11	0
BB1	*Pipistrellus pygmaeus*	0	0	11	0	0
BB1	*Plecotus auritus*	0	0	0	3	1
BB2	*Myotis daubentonii*	0	0	0	0	2
BB2	*Nyctalus leisleri*	0	0	11	2	0
BB2	*Pipistrellus nathusii*	0	0	1	2	1
BB2	*Pipistrellus pipistrellus*	0	0	2	8	0
BB2	*Pipistrellus pygmaeus*	0	0	0	0	3
BB3	*Myotis daubentonii*	0	1	1	0	3
BB3	*Myotis mystacinus*	0	0	5	4	0
BB3	*Myotis nattereri*	0	0	3	2	0
BB3	*Nyctalus leisleri*	0	9	2	0	0
BB3	*Pipistrellus nathusii*	0	10	0	0	0
BB3	*Pipistrellus pipistrellus*	0	11	0	1	0
BB3	*Pipistrellus pygmaeus*	0	11	0	0	0
BB3	*Plecotus auritus*	0	0	1	2	0
BB4	*Myotis daubentonii*	0	0	0	0	1
BB4	*Nyctalus leisleri*	0	0	11	1	0
BB4	*Pipistrellus nathusii*	0	0	0	1	0
BB4	*Pipistrellus pipistrellus*	0	0	1	5	3
BB4	*Plecotus auritus*	0	0	0	0	1
BB5	*Myotis daubentonii*	0	0	0	0	2
BB5	*Myotis mystacinus*	0	0	0	0	2
BB5	*Myotis nattereri*	0	0	0	1	1
BB5	*Nyctalus leisleri*	0	0	8	3	0
BB5	*Pipistrellus pipistrellus*	0	0	0	5	3
BB5	*Pipistrellus pygmaeus*	0	0	0	1	1

BB = Bilboa, and number = Turbine Location, so BB1 = Turbine 1 at Bilboa

<u>*Survey Period 2*</u>

A summary table showing the number of nights recorded bat activity fell into each activity band for each species is presented below.

Bat surveys were conducted at BB5, BB3, BB2, BB4, BB1, for 10 nights between 2020-07-08 and 2020-07-18, using Wildlife Acoustics static bat detectors. The maximum of passes recorded in a single night was 104 passes, and 8 species were recorded.

One of the five static locations had at least one night of High Activity during the survey period (BB3).

The following Turbine locations are deemed to have a High Bat Activity (for specific bat species) level based on the Percentile Median value (i.e. a median percentile ≥81): BB3 (common pipistrelle, Nathusius' pipistrelle).

Table 7-43: Summary of Ecobat Analysis Tool for static detectors deployed at the Site during survey period 2.

Location	Species/Species Group	Nights of High Activity	Nights of Moderate/ High Activity	Nights of Moderate Activity	Nights of Low/ Moderate Activity	Nights of Low Activity
BB1	*Nyctalus leisleri*	0	0	1	1	0
BB1	*Pipistrellus pipistrellus*	0	0	0	1	1
BB2	*Myotis daubentonii*	0	0	0	0	2
BB2	*Nyctalus leisleri*	0	0	5	3	1
BB2	*Pipistrellus nathusii*	0	0	0	0	1
BB2	*Pipistrellus pipistrellus*	0	0	2	1	1
BB2	*Pipistrellus pygmaeus*	0	0	1	0	1
BB2	*Plecotus auritus*	0	0	0	1	2
BB4	*Myotis nattereri*	0	0	0	0	2
BB4	*Nyctalus leisleri*	0	1	0	5	1
BB5	*Myotis daubentonii*	0	0	0	0	5
BB5	*Nyctalus leisleri*	0	0	0	4	4
BB3	*Myotis daubentonii*	0	2	0	0	2
BB3	*Myotis mystacinus*	0	1	0	0	0
BB3	*Myotis nattereri*	0	1	1	0	1
BB3	*Nyctalus leisleri*	1	3	2	2	0
BB3	*Pipistrellus nathusii*	3	0	0	0	0
BB3	*Pipistrellus pipistrellus*	5	3	0	0	1
BB3	*Pipistrellus pygmaeus*	4	5	0	1	0
BB3	*Plecotus auritus*	0	1	2	0	1

Survey Period 3

A summary table showing the number of nights recorded bat activity fell into each activity band for each species is presented below.

Bat surveys were conducted at BB3, BB4, BB1, BB5, BB2, BB3, for 10 nights between 2020-09-04 and 2020-09-14, using Wildlife Acoustics static bat detectors. The maximum of passes recorded in a single night was 224 passes, and 8 species were recorded.

Three of the five static locations had at least one night of High Activity during the survey period.

The following Turbine locations are deemed to have a High Bat Activity (for specific bat species) level based on the Percentile Median value (i.e. a median percentile ≥81): BB1 (Leisler's, soprano pipistrelle), BB3 (common pipistrelle, soprano pipistrelle).

Table 7-44: Summary of Ecobat Analysis Tool for static detectors deployed at the Site during survey period 3

Location	Species/Species Group	Nights of High Activity	Nights of Moderate/ High Activity	Nights of Moderate Activity	Nights of Low/ Moderate Activity	Nights of Low Activity
BB1	*Myotis daubentonii*	1	1	0	0	0
BB1	*Myotis mystacinus*	0	1	0	0	0
BB1	*Myotis nattereri*	0	1	0	0	0
BB1	*Nyctalus leisleri*	6	2	0	0	0
BB1	*Pipistrellus nathusii*	5	2	0	0	0
BB1	*Pipistrellus pipistrellus*	8	2	0	0	0
BB1	*Pipistrellus pygmaeus*	9	1	0	0	0
BB1	*Plecotus auritus*	0	1	1	1	3
BB2	*Myotis mystacinus*	0	0	0	0	1
BB2	*Nyctalus leisleri*	0	3	4	0	0
BB2	*Pipistrellus nathusii*	0	0	3	0	0
BB2	*Pipistrellus pipistrellus*	0	4	0	0	1
BB2	*Pipistrellus pygmaeus*	0	0	4	0	1
BB3	*Myotis daubentonii*	0	5	2	0	0
BB3	*Myotis mystacinus*	0	6	0	1	1
BB3	*Myotis nattereri*	0	6	2	2	0
BB3	*Nyctalus leisleri*	1	8	0	0	1
BB3	*Pipistrellus nathusii*	1	2	1	0	0
BB3	*Pipistrellus pipistrellus*	9	1	1	0	0
BB3	*Pipistrellus pygmaeus*	9	2	0	0	0

Location	Species/Species Group	Nights of High Activity	Nights of Moderate/ High Activity	Nights of Moderate Activity	Nights of Low/ Moderate Activity	Nights of Low Activity
BB3	*Plecotus auritus*	0	3	3	1	0
BB3	*Pipistrellus pygmaeus*	4	4	0	0	0
BB3	*Plecotus auritus*	0	0	3	3	0
BB3	*Myotis daubentonii*	0	3	1	0	0
BB3	*Myotis mystacinus*	0	2	3	2	0
BB3	*Myotis nattereri*	0	0	5	0	0
BB3	*Nyctalus leisleri*	2	5	1	1	0
BB3	*Pipistrellus nathusii*	2	5	0	0	0
BB3	*Pipistrellus pipistrellus*	8	2	1	0	0
BB3	*Pipistrellus pygmaeus*	2	8	1	0	0
BB4	*Myotis daubentonii*	0	0	0	0	2
BB4	*Myotis mystacinus*	0	0	0	0	1
BB4	*Myotis nattereri*	0	0	0	1	0
BB4	*Nyctalus leisleri*	0	3	2	3	0
BB4	*Pipistrellus nathusii*	0	0	4	0	0
BB4	*Pipistrellus pipistrellus*	0	4	1	1	0
BB4	*Pipistrellus pygmaeus*	0	1	3	1	0
BB4	*Plecotus auritus*	0	0	0	1	0
BB5	*Myotis daubentonii*	0	0	0	0	2
BB5	*Myotis mystacinus*	0	0	0	0	2
BB5	*Nyctalus leisleri*	0	3	2	3	0
BB5	*Pipistrellus nathusii*	0	0	3	0	0
BB5	*Pipistrellus pipistrellus*	0	2	1	1	0
BB5	*Pipistrellus pygmaeus*	0	0	0	3	0

7.5.7.5 Summary of 2020 Bat Survey Results

Table 7-45 provides a summary of the bat assessment. It outlines whether a bat species identified for the desktop study was subsequently recorded within the Development study area during the bat surveys that took place in 2020.

Table 7-45: Bat Survey Summary Results

Bat Species	Desktop Study (NBDC & NPWS)	2020 Activity Surveys	2020 Static Detector Surveys
Brown long-eared bat	X	✓	✓
Common pipistrelle	✓	✓	✓
Daubenton's bat	✓	✓	✓
Leisler's bat	X	✓	✓
Lesser horseshoe bat	X	X	X
Nathusius' bat	X	X	✓
Natterer's bat	✓	✓	✓
Soprano pipistrelle	✓	✓	✓
Whiskered bat	X	X	✓

7.5.8 Avifauna

A desktop study was undertaken to locate any records of rare or protected avian species that have previously been recorded for the study site and the surrounding area. Examination of NPWS and NBDC records indicates that there is a total of 52 species of ecological importance recorded historically in the 10 km grid squares (S66 and S67) which overlap and abut the core study area. These are listed in Table 7-46 below. These species are comprised of 12 that are on the current Birds of Conservation Concern in Ireland (BoCCI) red list[28] and [33] are on the BoCCI amber list[28]. Five of the species are Annex I species of the EU Birds Directive[78]. Five are species which are not rare (Red or Amber listed) or protected under Annex I (Habitats Directive) but have been included as they are indicator/keystone species and/or may be sensitive to wind farm development; namely common buzzard (*Buteo buteo*), Eurasian sparrowhawk (*Accipiter nisus*), long-eared owl (*Asio otus*), white-throated dipper (*Cinclus cinclus*) and heron (*Ardea cinerea*).

The NPWS data request included records of peregrine falcon breeding sites (2017) in the areas surrounding the Site.

Seven of the avian species are historical records dating from 1972 for rare/protected species, namely corncrake (*Crex crex*), grey partridge (*Perdix perdix*), hen harrier (*Circus cyaneus*), northern wheatear (*Oenanthe Oenanthe*), common sandpiper (*Actitis hypoleucos*) and stock pigeon (*Columba oenas*). The record for barn owl (*Tyto alba*) from 1984 is also somewhat dated. No invasive avian species were recorded within the grid squares (S66 and S67) overlapping the core study area.

[78] DIRECTIVE 2009/147/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 30 November 2009 on the conservation of wild birds

Table 7-46: Rare and Protected species of avifauna recorded historically within the 10km squares (S66 and S67) overlapping the core study area for avifauna [Note – historical/dated records are in bold.]

Species	Year of last record	BoCCI status	Annex I status
Barn Swallow *Hirundo rustica*	21/05/2016	Amber	No
Barn Owl *Tyto alba*	24/05/2021	Red	No
Black-headed Gull *Larus ridibundus*	23/03/2014	Amber	No
Blackcap *Sylvia atricapilla*	22/06/2021	Green	No
Common Buzzard *Buteo buteo*	18/08/2021	Green	No
Common Chiffchaff *Phylloscopus collybita*	25/06/2020	Green	No
Common Coot *Fulica atra*	31/12/2011	Amber	No
Common Crossbill *Loxia curvirostra*	22/06/2021	Green	No
Common Cuckoo *Cuculus canorus*	17/05/2021	Green	No
Common Grasshopper Warbler *Locustella naevia*	20/06/2021	Green	No
Common Goldeneye *Bucephala clangula*	31/12/2011	Red	No
Common Kestrel *Falco tinnunculus*	15/07/2020	Red	No
Common Kingfisher *Alcedo atthis*	18/10/2020	Amber	Yes
Common Linnet *Carduelis cannabina*	31/12/2011	Amber	No
Common Pochard *Aythya ferina*	**29/02/1984**	**Red**	**No**
Common Raven *Corvus corax*	25/06/2020	Green	No
Common Sandpiper *Actitis hypoleucos*	31/07/1972	Amber	No
Common Snipe *Gallinago gallinago*	31/12/2011	Red	No
Common Starling *Sturnus vulgaris*	31/01/2015	Amber	No
Common Swift *Apus apus*	24/06/2017	Red	No
Corncrake *Crex crex*	**31/07/1972**	**Red**	**Yes**
Eurasian Curlew *Numenius arquata*	07/11/2020	Red	No
Eurasian Sparrowhawk *Accipiter nisus*	29/10/12	Green	No
Eurasian Teal *Anas crecca*	31/12/2011	Amber	No
Eurasian Tree Sparrow *Passer montanus*	31/12/2011	Amber	No
Eurasian Wigeon *Anas penelope*	31/12/2011	Amber	No
Eurasian Woodcock *Scolopax rusticola*	06/05/2020	Red	No
European Golden Plover *Pluvialis apricaria*	20/04/2021	Red	No
Great Cormorant *Phalacrocorax carbo*	28/01/2017	Amber	No

Species	**Year of last record**	**BoCCI status**	**Annex I status**
Grey Patridge *Perdix perdix*	**31/07/1972**	**Red**	**No**
Great Crested *Grebe Podiceps cristatus*	31/12/2011	Amber	No
Great Spotted Woodpecker *Dendrocopos major*	20/06/2021	Green	No
Hen Harrier *Circus cyaneus*	**31/07/1972**	**Amber**	**Yes**
Herring Gull *Larus argentatus*	07/05/10	Amber	No
Heron *Ardea cinerea*	23/06/2017	Green	No
House Martin *Delichon urbicum*	31/12/2011	Amber	No
House Sparrow *Passer domesticus*	21/05/2016	Amber	No
Lesser Black-blacked Gull Larus fuscus	31/12/11	Amber	No
Lesser Redpoll *Carduelis cabaret*	05/05/2021	Green	No
Little Egret *Egretta garzetta*	31/12/2011	Green	Yes
Little Grebe *Tachybaptus ruficollis*	31/12/2011	Green	No
Long Eared Owl *Atio otus*	25/03/2021	Green	No
Merlin *Falco columbarius*	**31/07/1972**	**Amber**	**No**
Mute Swan *Cygnus olor*	28/01/2018	Amber	No
Moorhen *Gallinula chloropus*	2010	Amber	No
Northern Lapwing *Vanellus vanellus*	31/12/2011	Red	No
Northern Shoveler *Anas clypeata*	31/12/2011	Red	No
Northern Wheatear *Oenanthe oenanthe*	**31/07/1972**	**Amber**	**No**
Peregrine Falcon *Falco peregrinus*	2017	Green	Yes
Sand Martin *Riparia riparia*	31/12/2011	Amber	No
Sedge Warbler *Acrocephalus schoenobaenus*	25/06/2020	Green	No
Skylark *Alauda arvensis*	31/12/2011	Amber	No
Spotted Flycatcher *Muscicapa striata*	31/12/2011	Amber	No
Stock Pigeon *Columba oenas*	**31/07/1972**	**Red**	**No**
Stonechat *Saxicola torquata*	20/06/2021	Green	No
Twite *Carduelis flavirostris*	**31/07/1972**	**Red**	**No**
Water rail *Rallus aquaticus*	23/06/17	Green	No
White Throated Dipper *Cinclus cinclus*	31/12/11	Green	No
Whooper Swan *Cygnus cygnus*	12/04/2021	Amber	No
Willow Warbler *Phylloscopus trochilus*	14/04/2021	Amber	No
Yellowhammer *Emberiza citrinella*	30/05/2021	Red	No

7.5.8.1 Target Species Observations (Flight Activity Surveys)

Descriptive accounts of the flight activity recorded for each target species recorded are given here. The full set of survey data is tabulated in Appendices 7.3 and 7.4.

Buzzard

Vantage Point Surveys (Winter Season 2019/2020)

Buzzard were observed regularly in the study area during the 2019/2020 season, with a total of 26 individual records. A total of 16 observations were of birds flying outside the flight activity area, while five were of birds flying inside this buffer. Three observations were of flights which extended both inside and outside the flight activity area. A single record of a buzzard heard calling but not seen (inside the flight activity area) was made on 19th December 2020. On a single occasion (8th March 2020) a pair of buzzards were observed flying over coniferous forestry, scrub and farmland. All other observations were of single birds. The duration of flights observed ranged from short flights lasting 10 seconds to longer flights up to 480 seconds. The long meandering/soaring flights characteristic of this species accounted for a large proportion of the observations made during winter 2019/2020. The flight lines recorded for buzzard during this period were predominantly over coniferous forestry or farmland (improved agricultural grassland) which are the two dominant habitat types in the study area.

Vantage Point Surveys (Winter Season 2020/2021)

Green-listed buzzard was observed on nine occasions during the winter season 2020/21. One observation of buzzard was from February 2021 and the remaining eight observations were from March 2021. Buzzard were seen from VP1 and VP2. Three observations were of individual birds flying within the SNH buffer zone. One buzzard was noted as flying slowly and occasionally hovering over sitka spruce forestry within the buffer and veering off in a north-western direction on the 16th of February 2021. Buzzard were seen flying both within and outside the buffer zone on three occasions, which includes one individual and to occasions of two Buzzards flying together. The three remaining flight lines were entirely outside the buffer zone. Notable observations were of two buzzards hunting together and another of three buzzards flying together outside of the buffer zone, both observations were from the 17th of March 2021

Vantage Point Surveys (Breeding Season 2020)

A total of two buzzard observations were recorded during this period. The first observation recorded on 6th May 2020 was of a buzzard being mobbed by a hooded crow outside the flight activity area. This bird was observed briefly over improved agricultural grassland, flying low (< 10m) in a north-easterly direction.

The second observation recorded on 20th September 2020 was of a pair of buzzards circling at treetop height over the Site land ownership boundary and adjacent fields to the south-west of T1 (within the flight activity area). The surveyor observed these birds while travelling between VP1 and VP2.

Vantage Point Surveys (Breeding Season 2021)

This Green-listed species was observed on 21 occasions over the summer season across VPs 1, 2 and 3.

The majority of the observations were of single birds, while only three observations were of 2 birds flying together. Six flight lines were within the flight activity area, eight flight lines inside and outside the buffer and the remaining seven outside the buffer zone.

Hen Harrier

Vantage Point Surveys (Winter Season 2019/2020)

A total of five observations of hen harrier were made during VP surveys within this period. All birds observed were lone 'ringtails' (either juveniles or females; not distinguished due to similar colouring). One observation (20th December 2019) was of a ringtail hunting near VP2. This bird flew over agricultural grassland, skirting a coniferous forestry plantation before turning to fly north-west into the conifer plantations covering the hilltop on which the Development is located. This flight began outside the flight activity area and then entered the buffer. Two hen harrier flight lines were recorded on 25th January 2020. One skirted conifer plantation to the west of the Development before crossing over the conifer plantation north-west of turbine T4, beginning outside the flight activity area and then entering the buffer. The second hen harrier flight recorded on this date proceeded north-west over conifer plantation before looping back south-east past T4, all within the 450 m buffer. The surveyor noted both records were of the same bird.

The fourth hen harrier observation was of a single bird flying over coniferous forestry north of VP1, within the flight activity area on 16th February 2020. The fifth observation was of a single bird flying south-east over improved agricultural grassland on 22nd February 2020 (outside the flight activity area).

A sixth observation was recorded during winter transects surveys on 25th January 2020. This record was of a ringtail hunting low (under 10 m) over heather bog within the flight activity area).

Vantage Point Surveys (Winter Season 2020/2021)

Hen harrier was not observed during this survey period.

Vantage Point Surveys (Breeding Season 2020)

Hen harrier was not recorded during summer VP surveys and there is no evidence of the species breeding within the Site.

Vantage Point Surveys (Breeding Season 2021)

Hen harrier was not observed during this survey period.

Kestrel

Vantage Point Surveys (Winter Season 2019/2020)

This species was recorded on only three occasions during winter 2019/2020. All observations were of birds flying outside the flight activity area. One of these was a brief observation of a kestrel flying over improved agricultural grassland in the immediate vicinity of VP2 on 7th March 2020. Another (8th March 2020) was of a kestrel flying over agricultural land north of VP1 which then flew towards conifer plantation to the south-west of the Development. The third kestrel observation (22nd March 2020) was of a bird flying over improved agricultural grassland to the south-east of VP4, heading in a south-westerly direction before crossing a narrow strip of conifer plantation.

Vantage Point Surveys (Winter Season 2020/2021)

This Red-listed species was noted six times during the winter season with all observations being from March 2021. All observations were of single birds, two observations were of Kestrel flying inside the buffer zone, one observation of a kestrel flying both within and outside the buffer zone and the remaining three flight lines being entirely outside of the flight activity area. One kestrel was circling between turbine locations 4 and 5 at 100-185m height on the 17th of March 2021.

Three instances of hunting were noted, one was entirely inside the SNH buffer near turbine location 3 and flying at between 30-100m height on the 19th of March 2021.

A female kestrel was observed on the 19th of March 2021 hunting while flying at height of 50-100 m and entering the buffer zone from the east.

Vantage Point Surveys (Breeding Season 2020)

Kestrel were recorded on three occasions during VP surveys in summer 2020. The first observation on 5th June was of a bird which flew in swiftly from the north-west, paused hovering briefly in front of VP1 and then continued south-east. The second, recorded on 1st August involved an adult kestrel observed from VP2 flying low across a field carrying medium-sized prey (possibly a rat) towards a Sitka spruce plantation north-east of the Site (outside the flight activity area). Calls were heard afterwards, potentially indicating the feeding of young, although only one adult was observed. The third kestrel observation was on 20th September from VP4 and involved a 1st-year bird commuting over farmland at c.15m altitude, flying towards the northern part of the Site (outside the 450m buffer).

A fourth breeding-season record of kestrel was made during breeding bird transect surveys on 20th May 2020. This bird was observed flying in an easterly direction within the flight activity area buffer, parallel to the L7130 to the south of the Site.

Vantage Point Surveys (Breeding Season 2021)

A total of seventeen observations for kestrel were noted over the summer season 2021, fifteen of which were of individual birds. Eight observations of Kestrel were within the buffer zone, six of which were within the rotor-swept height band (between 19.5 - 136.5 m). Three observations of Kestrel were both inside and outside the buffer zone and the remaining six flight lines were entirely outside of the flight activity area. Nine observations of hunting behaviour were noted, four of which were inside the flight activity area. One hunting event was of two Kestrels flying together on the 21st of August 2021 both inside and outside of the flight activity area. Of note was a sighting from VP2, of two adult Kestrels with a juvenile on the 22nd of July 2021, flying outside of the buffer zone. A juvenile male was seen flying low (at 10-20m height) inside of the SNH buffer zone on the 15th of August 2021.

<u>Peregrine</u>

Vantage Point Surveys (Winter Season 2019/2020)

This falcon species was recorded on four occasions during winter 2019/2020. Observations were all lone peregrines and included both male and female birds. The flight lines were recorded on three separate dates: 25th and 28th January, and 21st March 2020. Three of the flight lines recorded traversed areas both inside and outside the flight activity area, while one was outside the flight activity area. All flight lines recorded were clustered in roughly the same area, north of VP1 and primarily associated with conifer plantation. The general direction of travel was either east or west (towards or away from the Development which is east of VP1).

Vantage Point Surveys (Winter Season 2020/2021)

Peregrine was not observed during this survey period.

Vantage Point Surveys (Breeding Season 2020)

Peregrine was not recorded during summer VP surveys.

Vantage Point Surveys (Breeding Season 2021)

Peregrine, an Annex 1 species, were observed three times in the summer season 2021. Each observation was of an individual flying alone, one of which was identified as a male flying at 30-50 m height near turbine location 5 on the 27th of August 2021.

The other two peregrine falcon were flying at heights between 20-30m and their sex was not identified, one of these Peregrines flew close to turbine location 4 and along the centre of the site on the 28th of July 2021, the other flew into the south-western corner of the site boundary from a northern direction on the 27th of August 2021.

Sparrowhawk

Vantage Point Surveys (Winter Season 2019/2020)

Sparrowhawk were recorded frequently during the 2019/2020 season, with a total of 18 individual observations. A total of 11 observations were of birds flying outside the flight activity area, while four were of birds flying inside the buffer. A total of three observations recorded flight lines which extended both in and outside the flight activity area. All observations were of single birds. On one occasion (16th February 2020) a female was identified. The sex of birds was not determined for any other observations. Short (3-12 seconds), low (0-10 m) flights characteristic of this species were observed. Longer flights (up to 240 seconds) at higher altitudes (30-185 m) were also observed, as were flights of intermediate height and duration. Flight lines traversed confer plantations, open (agricultural) habitats or both.

Vantage Point Surveys (Winter Season 2020/2021)

Amber-listed sparrowhawk was observed six times during the winter season 2020/21 with all observations being of individual birds. Three observations were of sparrowhawk flying within the buffer zone, two were both inside and outside the buffer zone and one bird was exclusively outside of the buffer zone. On the 17th of March 2021 one sparrowhawk was mobbed by a hooded crow while flying at heights between 30-185 m inside the SNH buffer zone.

On the 23rd of December 2020 one sparrowhawk was observed flying very low at 0-10m; it was chasing and being chased by a Hooded Crow over improved agricultural grassland, very low over ground drifting in a westerly direction outside of the buffer zone. Sparrowhawk flight activity was concentrated to the north-west of the site.

Vantage Point Surveys (Breeding Season 2020)

Sparrowhawk was not recorded during summer VP surveys.

Vantage Point Surveys (Breeding Season 2021)

Sparrowhawk were observed nine times in the summer of 2021. All observations were of individuals, with two observations being of sparrowhawk flying inside of the buffer zone at heights between 20-50m to the north-west of the site boundary, one was a female recorded on the 22nd of July 2021, the other an individual of undetermined sex that was seen on the 28th of July 2021. One sparrowhawk was flying both inside and outside the buffer zone at heights between 20-50 m and exited the site at the north-eastern corner on the 31st of July 2021. The remaining six flight lines were outside of the buffer zone and to the west of the site. Of note was a territorial display flight on the 9th of June 2021 outside of the flight activity area.

Golden Plover

Vantage Point Surveys (Winter Season 2019/2020)

This migratory wader species was recorded on three occasions during the 2019/2020 season. On 16th February 2020, a flock of 120 golden plover was observed flying between 50-185 m for 480 seconds. This flight line began over conifer plantation within the flight activity area before exiting the buffer and travelling north-west and then northeast over farmland, during which time the flock made one large loop.

On 17th March 2020, a flock of approximately 100 golden plover was observed flying between 100-185 m for 60 seconds over farmland outside the flight activity area (c. 1.6

km northwest of the Development). A flock of approximately 30 golden plover was observed flying between 50-185 m for 90 seconds on 21st March 2020. This flock flew west and then north-west outside the flight activity area over farmland north-west of the Development.

Vantage Point Surveys (Winter Season 2020/2021)

There were no observations of golden plover in the winter season 2020/21.

Vantage Point Surveys (Breeding Season 2020)

Golden plover was not recorded during summer VP surveys.

Vantage Point Surveys (Breeding Season 2021)

This Annex 1 species was noted once on the 20th of April 2021. It was heard calling at 14:49 by the surveyor from VP2 and was estimated to be located a few hundred metres from the site boundary, it was not seen. This golden plover was likely a late wintering bird or a migrant bird, as no other golden plover observations were made in the summer season of 2021.

Snipe

Vantage Point Surveys (Winter Season 2019/2020)

Snipe were recorded incidentally on four occasions during winter 2019-20 VP surveys. A bird was heard calling from VP2 on 20th December 2019. The remainder of observations were of birds flying outside the flight activity area (19th December and 25th January from VP1; 23rd January from VP2).

Vantage Point Surveys (Winter Season 2020/2021)

Red-listed snipe were observed once in the winter season 2020/21 on the 23rd of December 2020. Four snipe were flushed from a field to the north east and outside of the buffer zone by horses. They flew off quickly and climbed gradually in a north-easterly direction. Their flight path was entirely outside of the flight activity area.

Vantage Point Surveys (Breeding Season 2020)

Snipe were not recorded during summer VP surveys.

Vantage Point Surveys (Breeding Season 2021)

Snipe were noted once in summer 2021 on the 21st of August. A flock of 30 snipe were observed flying across the flight activity area to the east of the site boundary. They were flying at heights between 30-50 m.

Grey Heron

Vantage Point Surveys (Winter Season 2019/2020)

This secondary species was recorded on two occasions during the winter season. On one occasion (23rd January 2020) a grey heron was observed flying within the flight activity area. On the second occasion a grey heron flight line which extended both inside and outside the flight activity area was recorded.

Vantage Point Surveys (Winter Season 2020/2021)

Green-listed grey heron was observed once in the winter season on March 17th 2021 from VP1, flying outside the flight activity area.

Vantage Point Surveys (Breeding Season 2020)

Grey heron was not recorded during summer VP surveys.

Vantage Point Surveys (Breeding Season 2021)

Grey heron was observed once in the summer season 2021 from VP2. It was flying to the north-west of the site outside the flight activity area.

Lesser Black-backed Gull

Vantage Point Surveys (Winter Season 2019/2020)

Lesser black-backed gull was not recorded during summer VP surveys.

Vantage Point Surveys (Winter Season 2020/2021)

Lesser black-backed gull was not recorded during winter VP surveys.

Vantage Point Surveys (Breeding Season 2020)

Lesser black-backed gull was not recorded during summer VP surveys.

Vantage Point Surveys (Breeding Season 2021)

Lesser black-backed gull was observed four times in the summer season 2021. Flights of this species were observed in June and July 2021 only and across all VP's. On three occasions three birds were seen flying together, two observations were of gulls flying outside of the flight activity area and one was of gulls flying both inside and outside the flight activity area. A flock of 14 was sighted crossing the flight activity area on the 9th of June 2021, flying at heights between 100 - 185 m.

7.5.8.2 Hinterland Surveys

Hinterland surveys to establish breeding occupancy and census wetland sites within c. 10 km of the site were carried out between December 2019 and September 2021 inclusive (see Table 7-10). The locations of the Hinterland survey sites are shown in Figure 7.3. A total of 67 bird species were identified during Hinterland surveys within this period.

Two Annex I species were recorded during hinterland surveys: little egret and peregrine. a total of seven red-listed species were observed: grey wagtail, kestrel, lapwing, meadow pipit, redwing, snipe and woodcock. A further 17 Amber-listed species were observed with the remaining 43 species being Green-listed.

Species recorded during Hinterland surveys included four raptor species, two gull species, four wader species, one duck species, six goose species and one swan species.

The full list of species recorded during hinterland surveys is included in Table 7-47. Species of conservation concern that were recorded are discussed in more detail in this section. Species have been selected for detailed discussion based on conservation status, vulnerability to wind farm developments and species sightings recorded on or near the proposed Wind Farm site, which will indicate potential links between species recorded at the proposed site and the surrounding environment. Distances of Hinterland sites from the proposed Wind Farm are included in Table 7-10.

Dipper

Green-listed dipper was observed six times during Hinterland surveys. One record was from January 2020, involving an individual observed at Hinterland site 11: River Barrow/Nore SAC 3. Two records were from February 2020; these involved an individual at Hinterland site 8: River Barrow and River Nore SAC 1, and a pair at Hinterland site 11: River Barrow/Nore SAC 3, one of which was carrying nesting material. Dipper was also recorded in March 2020, again at Hinterland site 11: River Barrow/Nore SAC 3 where an individual was observed.

This species was also observed once in December 2020 at Hinterland site 11: River Barrow/Nore SAC 3 and once in January 2021 at Hinterland site 12: River Barrow/Nore

SAC 4. These sites are between 2.6 km – 4.6 km from the wind farm (closest turbine location).

Grey Wagtail

This Red-listed species was observed three times in the winter period of 2020. One bird was observed at Hinterland site 8: River Barrow and River Nore SAC 1 (approximate distance to site 4.4 km) in March 2020. The remaining two observations were recorded at Cloghristick Wood pNHA (distance to closest turbine: 4.8 km). These involved a single bird recorded in February 2020, and a group of five birds seen on the riverbank in March 2020.

Great Spotted Woodpecker

This Green-listed species was observed three times in the winter period of 2021 with all observations being of single birds. One observation was in January 2021 at Hinterland site 8: River Barrow/Nore SAC 1 (approximate distance to site 4.4 km), one in February 2021 at Hinterland site 11: River Barrow/Nore SAC 3 (distance to closest turbine: 2.6 km), and one in March 2021 at Hinterland site 10: Quarries (Rossmore/Clongrennan) (distance to closest turbine location: 3 km).

Lapwing

Red-listed lapwing was noted on one occasion on the 21st of March 2021, where nine birds were seen at Hinterland site 6: Coan Bog NHA 2. This site is approximately 7 km from the closest turbine location.

Lesser Black-backed Gull

Amber-listed lesser black-backed gull was observed in February 2020 at Hinterland site 16: Ballymoon Esker pNHA; one bird was recorded on this occasion.

On 28th June 2021, 27 lesser black-backed gulls were observed at Breeding Wader site E, which is approximately 2.7 km from the closest turbine location.

Little Egret

Little egret, an Annex 1 species, was noted once in January 2021 at Hinterland site 13: River Barrow and River Nore SAC 5 (distance to closest turbine: 5.2 km) where an individual was observed. Two further observations were made in February 2021; one at Hinterland site 12: River Barrow and River Nore SAC 4 (distance to closest turbine: 3 km) and one at Hinterland site 15: Cloghristick Wood pNHA (distance to closest turbine: 4.8 km). Both observations were of individual birds.

Mallard

Mallard was recorded on 11 occasions during hinterland surveys. The majority (nine observations) were at Hinterland site 15: Cloghristick Wood pNHA (distance to closest turbine: 4.8 km).

An individual was recorded at this site in January 2020. A group of six was recorded at this site in February 2020. Groups of six and nine birds were recorded on two occasions during March 2020.

During the second year of surveys, one observation at this site was in November 2020 where nine mallards were observed. During visits to Hinterland site 15 in December 2020, January, February and March 2021, six mallards were noted on each occasion.

The remaining two records are from Hinterland site 10: Quarries (Rossmore/Clongrennan) (distance to closest turbine location: 3 km).

These involved three mallard flying around small pool in quarry, and a male flushed from a small pool. Both observations were recorded during March 2020.

Mute Swan

Amber-listed mute swan was observed on four occasions at Hinterland site 15: Cloghristick Wood pNHA (distance to closest turbine: 4.8 km). Individuals were observed here on 26th January and 25th March 2020.

On December 16th 2020 two mute swan were noted, and on the 21st of March 2021 two mute swans were again observed.

Peregrine

This Annex 1 species was observed on one occasion, flying over Hinterland site 14: Whitehall Quarries pNHA (distance to closest turbine: 8.9 km) on 29th February 2020.

Snipe

Red-listed snipe was observed on two occasions, both at Hinterland site 6: Coan Bogs NHA 2 (distance to closest turbine: 7 km), during January and March 2020.

Woodcock

Red-listed woodcock was recorded on the 13th of February 2021 in Hinterland site 9: River Barrow and River Nore SAC 2 (distance to closest turbine: 3.7 km), where one woodcock was observed.

Table 7-47: Species recorded during hinterland surveys

Common Name	Scientific Name	Conservation Status	
		BoCCI*	Annex I**
Blackbird	*Turdus merula*	Green	No
Blackcap	*Sylvia atricapilla*	Green	No
Black-headed Gull	*Larus ridibundus*	Amber	No
Blue Tit	*Cyanistes caeruleus*	Green	No
Bullfinch	*Pyrrhula pyrrhula*	Green	No
Buzzard	*Buteo buteo*	Green	No
Chaffinch	*Fringilla coelebs*	Green	No
Coal Tit	*Periparus ater*	Green	No
Collared Dove	*Streptopelia decaocto*	Green	No
Common Crossbill	*Loxia curvirostra*	Green	No
Common Redpoll	*Carduelis flammea*	Green	No
Cormorant	*Phalacrocorax carbo*	Amber	No
Cuckoo	*Cuculus canorus*	Green	No
Dipper	*Cinclus cinclus*	Green	No
Dunnock	*Prunella modularis*	Green	No

Common Name	Scientific Name	Conservation Status	
		BoCCI*	Annex I**
Fieldfare	*Turdus pilaris*	Green	No
Goldcrest	*Regulus regulus*	Amber	No
Goldfinch	*Carduelis carduelis*	Green	No
Great Spotted Woodpecker	*Dendrocopos major*	Green	No
Great Tit	*Parus major*	Green	No
Greenfinch	*Carduelis chloris*	Amber	No
Grey Heron	*Ardea cinerea*	Green	No
Grey Wagtail	*Motacilla cinerea*	Red	No
Hooded Crow	*Corvus cornix*	Green	No
House Martin	*Delichon urbicum*	Amber	No
House Sparrow	*Passer domesticus*	Amber	No
Jackdaw	*Corvus monedula*	Green	No
Jack Snipe	*Lymnocryptes minimus*	Green	No
Jay	*Garrulus glandarius*	Green	No
Kestrel	*Falco tinnunculus*	Red	No
Lapwing	*Vanellus vanellus*	Red	No
Lesser Black-backed Gull	*Larus fuscus*	Amber	No
Lesser Redpoll	*Carduelis cabaret*	Green	No
Linnet	*Carduelis cannabina*	Amber	No
Little Egret	***Egretta garzetta***	**Green**	**Yes**
Long-tailed Tit	*Aegithalos caudatus*	Green	No
Magpie	*Pica pica*	Green	No
Mallard	*Anas platyrhynchos*	Amber	No
Meadow Pipit	*Anthus pratensis*	Red	No
Mistle Thrush	*Turdus viscivorus*	Green	No
Moorhen	*Gallinula chloropus*	Green	No
Mute Swan	*Cygnus olor*	Amber	No
Peregrine	***Falco peregrinus***	**Green**	**Yes**

Common Name	Scientific Name	Conservation Status	
		BoCCI*	Annex I**
Pheasant	*Phasianus colchicus*	Green	No
Pied/White Wagtail	*Motacilla alba*	Green	No
Raven	*Corvus corax*	Green	No
Redwing	*Turdus iliacus*	Red	No
Reed Bunting	*Emberiza schoeniclus*	Green	No
Robin	*Erithacus rubecula*	Amber	No
Rook	*Corvus frugilegus*	Green	No
Sand Martin	*Riparia riparia*	Amber	No
Sedge Warbler	*Acrocephalus schoenobaenus*	Green	No
Siskin	*Carduelis spinus*	Green	No
Skylark	*Alauda arvensis*	Amber	No
Snipe	*Gallinago gallinago*	Red	No
Song Thrush	*Turdus philomelos*	Green	No
Sparrowhawk	*Accipiter nisus*	Green	No
Spotted Flycatcher	*Muscicapa striata*	Amber	No
Starling	*Sturnus vulgaris*	Amber	No
Stonechat	*Saxicola torquatus*	Amber	No
Swallow	*Hirundo rustica*	Amber	No
Whitethroat	*Sylvia communis*	Green	No
Willow Warbler	*Phylloscopus trochilus*	Amber	No
Woodcock	*Scolopax rusticola*	Red	No
Wood Pidgeon	*Columba palumbus*	Green	No
Wren	*Troglodytes troglodytes*	Green	No

7.5.8.3 Barn Owl Surveys

Summer 2020

Two disused buildings with potential to host barn owl were identified in the vicinity of the Site during the preliminary roost survey on 12th May 2020 (see Figure 7.3 for locations).

These were assessed for their potential to support barn owl and for any evidence of nesting barn owl on 12th may and 22nd July 2020.

Summer 2021

Barn owl surveys were conducted at the same survey locations detailed above on the 11th of June and 16th of July 2021. During these surveys no barn owl or signs thereof were found.

7.5.8.4 One of the buildings identified during summer 2020 surveys (Site 5; see Figure 7.3) was found to have been renovated prior to summer 2021, and as such no longer had potential to host nesting or roosting barn owl. Woodcock Surveys

Woodcock dusk surveys were conducted three times during summer 2021. On 23rd April 2021 a woodcock was heard and seen flying over forestry on site at 21:11 and again at 21:14. A woodcock was seen and heard roding from the survey location at the centre of the site on 14th May 2021 at 21:12. A woodcock was also heard and seen during the final survey on the 11th of June 2021 at 22:23. It is estimated that 1-2 pairs of woodcock are breeding on site.

7.5.8.5 Kingfisher Surveys

7.5.8.6 This species was not recorded within the Site or surrounding area (kingfisher survey study area). No appropriate habitat is available at or near the wind farm site but is potentially available downstream of Development. Transects/Point Counts

Transect and Point Count Surveys for all species were recorded during monthly surveys of the Site study area over two winters and two summers. This survey captured the baseline of avian species using the Site as well as their abundance and includes seasonal visitors of the winter (i.e. fieldfare, redwing) and summer months i.e. blackcap, chiffchaff, spotted flycatcher, whitethroat, willow warbler). Over the survey period a total of 37 bird species were recorded.

Winter 2019/2020

The results of the winter transect survey at Bilboa are shown below, in Table 7-48.

A total of 31 species were recorded along the transects. One Annex I species, hen harrier, was recorded during winter surveys. Three Red-listed species were recorded: meadow pipit, snipe and redwing. Three Amber-listed species were recorded: goldcrest, hen harrier and starling. The remaining 27 species are Green-listed. The Hen harrier observation was recorded on 25th January 2020 and involved a ringtail hunting low (under 10 m) over heather bog within the 450 m site buffer.

Table 7-48: Winter 2019-20 Transect and Point count survey results

Species	January						February						March					
	TR1			TR2			TR1			TR2			TR1			TR2		
	0-25m	25-100m	>100m/FO	0-25m	25-100m	>100m/FO	0-25m	25-100m	>100m/FO	0-25m	25-100m	>100m/FO	0-25m	25-100m	>100m/FO	0-25m	25-100m	>100m/FO
Blackbird *Turdus merula*	2	3			2		1			1	1			2		2		
Blue Tit *Cyanistes caeruleus*	3	1					1			1			3			2		
Bullfinch *Pyrrhula pyrrhula*							1											
Buzzard *Buteo buteo*																		3
Chaffinch *Fringilla coelebs*	4	6		1			3			2	1	1	4	6		4	3	
Coal Tit *Periparus ater*	2						2			1	3		1	1		2	2	
Crossbill *Loxia curvirostra*																1		
Dunnock *Prunella modularis*							1							1				
Fieldfare *Turdus pilaris*		30																
Goldcrest *Regulus regulus*				1														
Goldfinch *Carduelis carduelis*										1								
Great Tit *Parus major*	1	1								1								
Hen Harrier *Circus cyaneus*						1												
Hooded *Crow Corvus cornix*		1						2				1	1	5			2	3
Jackdaw *Corvus monedula*		2		2					8	3					8			1
Jay *Garrulus glandarius*	1																	
Lesser Redpoll *Acanthis cabaret*					1			1										
Magpie *Pica pica*	2							1		2					1	1		

	January						February						March					
Species	**TR1**			**TR2**			**TR1**			**TR2**			**TR1**			**TR2**		
	0-25m	**25-100m**	**>100m/FO**	**0-25m**	**25-100m**	**>100m/FO**	**0-25m**	**25-100m**	**>100m/FO**	**0-25m**	**25-100m**	**>100m/FO**	**0-25m**	**25-100m**	**>100m/FO**	**0-25m**	**25-100m**	**>100m/FO**
Meadow Pipit *Anthus pratensis*																	4	
Mistle Thrush *Turdus viscivorus*																1		
Pied Wagtail *Motacilla alba*								1										
Raven *Corvus corax*									2					2				
Redwing *Turdus iliacus*													30					
Robin *Erithacus rubecula*	6	3		1			1			2			4	1		2	1	
Rook *Corvus frugilegus*								1										
Siskin *Spinus spinus*		3																
Snipe *Gallinago gallinago*				2						1								
Song *Thrush Turdus philomelos*		1												1				
Starling *Sturnus vulgaris*		2										30			1			30
Wood Pigeon *Columba palumbus*	3				1			1		1					2		3	
Wren *Troglodytes troglodytes*	2			1			2			2				3		1	1	
No. of species	31																	

Winter 2020/2021

The results of the winter transect survey at Bilboa are shown below, in Table 7-49.

A total of 12 species were recorded along the transects. No Annex I species was recorded during winter surveys. One Red-listed species was recorded: woodcock, where an individual was seen from TR 2 in December 2020. One Amber-listed species was recorded: goldcrest. The remaining ten species are Green-listed.

Table 7-49: Winter 2020-21 Transect and Point count survey results

Species	**October**						**December**					
	TR1			**TR2**			**TR1**			**TR2**		
	0-25m	**25-100m**	**>100/FO**	**0-25m**	**25-100m**	**>100/FO**	**0-25m**	**25-100m**	**>100/FO**	**0-25m**	**25-100m**	**>100/FO**
Blackbird *Turdus merula*					1		1					
Chaffinch *Fringilla coelebs*							1					
Coal Tit *Periparus ater*	1									7		
Common Redpoll *Carduelis flammea*	6											
Dunnock *Prunella modularis*	1			1			4					
Goldcrest *Regulus regulus*	2			3			1					
Hooded Crow *Corvus cornix*								1				
Jay *Garrulus glandarius*		1								1		
Robin *Erithacus rubecula*	4			5			1			2		
Rook *Corvus frugilegus*		2										
Woodcock *Scolopax rusticola*							1					
Wren *Troglodytes troglodytes*	5			5						2		
Number of Species:	12											

Summer 2020

The results of the 2020 breeding bird transect survey at Bilboa are shown below in Table 7-50.

A total of 15 species were recorded along the transects. No Annex I species was recorded during breeding bird surveys. One Red-listed species was recorded: kestrel. Three Amber-listed species was recorded: goldcrest, linnet and willow warbler. The remaining 11 species are Green-listed.

Table 7-50: Summer 2020 Transect and Point count survey results

Species	May						June					
	TR1			TR2			TR1			TR2		
	0-25m	25-100m	>100/FO	0-25m	25-100m	>100/FO	0-25m	25-100m	>100/FO	0-25m	25-100m	>100/FO
Blackbird *Turdus merula*	3											
Blackcap *Sylvia atricapilla*	4			3			3			4		
Chaffinch *Fringilla coelebs*	6			6						2		
Chiffchaff *Phylloscopus collybita*	1						2					
Coal Tit *Periparus ater*				5						2		
Goldcrest *Regulus regulus*	3			4			3			3		
Goldfinch *Carduelis carduelis*	2											
Kestrel *Falco tinnunculus*			1									
Linnet *Carduelis cannabina*							2					
Magpie *Pica pica*	1											
Robin *Erithacus rubecula*	2			2			2			2		
Rook *Corvus frugilegus*												
Whitethroat *Sylvia communis*	1			1			2			1		
Willow Warbler *Phylloscopus trochilus*	4			4			5			3		
Wren *Troglodytes troglodytes*	2						1					
No. of Species	15											

Summer 2021

The results of the 2021 summer breeding bird transect survey at Bilboa are shown in Table 7-51. A total of 17 species were recorded along the transects. No Annex I or Red-listed species were recorded. Just one Amber-listed species was observed during the breeding bird transects: willow warbler. The remaining 16 species are Green-listed.

Table 7-51: Summer 2021 Transect and Point count survey results

Species		April						June					
		T1			T2			T1			T2		
		0-25m	25-100m	>100/FO	0-25m	25-100m	>100/FO	0-25m	25-100m	>100/FO	0-25m	25-100m	>100/FO
Blackbird	*Turdus merula*	1	2		1				3		1	3	
Blackcap	*Sylvia atricapilla*								1				
Blue Tit	*Cyanistes caeruleus*	1											
Chaffinch	*Fringilla coelebs*	4			3			4	2		1	2	
Chiffchaff	*Phylloscopus collybita*		1						1				
Coal Tit	*Periparus ater*	1	1		2								
Dunnock	*Prunella modularis*	1	1			1		1					
Hooded Crow	*Corvus cornix*			1									
Jackdaw	*Corvus monedula*				1					2			
Pheasant	*Phasianus colchicus*						1						
Robin	*Erithacus rubecula*	2	1		2			4			3		
Rook	*Corvus frugilegus*												1
Song Thrush	*Turdus philomelos*		1										
Siskin	*Carduelis spinus*				1								
Willow Warbler	*Phylloscopus trochilus*		2			1	1	1	2	1		1	

Species		April						June					
		T1			T2			T1			T2		
		0-25m	25-100m	>100/FO	0-25m	25-100m	>100/FO	0-25m	25-100m	>100/FO	0-25m	25-100m	>100/FO
Woodpigeon	*Columba palumbus*		1	1						3		1	
Wren	*Troglodytes troglodytes*				1			3			1	1	
Number of Species:		17											

7.5.8.7 Non-target Species recorded during Winter (2019/2020) and Summer (2020) VP surveys

During VP surveys a number of non-target species of conservation concern were also recorded. A total of 20 species of conservation concern were recorded. These included one Annex I species, golden plover, eight Red-listed species and 12 Amber-Listed species. These records are provided in Table 7-52.

Table 7-52: Non-Target Species of conservation concern recorded during Winter and Summer VP surveys

Species	**BoCCI status**	**Annex I Status**
Greenfinch *Carduelis chloris*	Amber	No
Goldcrest *Regulus regulus*	Amber	No
House Martin *Delichon urbicum*	Amber	No
House Sparrow *Passer domesticus*	Amber	No
Lesser Black-backed Gull *Larus fuscus*	Amber	No
Linnet *Carduelis cannabina*	Amber	No
Meadow Pipit *Anthus pratensis*	Red	No
Skylark *Alauda arvensis*	Amber	No
Starling *Sturnus vulgaris*	Amber	No
Swallow *Hirundo rustica*	Amber	No
Golden Plover *Pluvialis apricaria*	**Red**	**Yes**
Grey Wagtail *Motacilla cinerea*	Red	No
Kestrel *Falco tinnunculus*	Red	No
Meadow Pipit *Anthus pratensis*	Red	No
Redwing *Turdus iliacus*	Red	No
Sand Martin *Riparia riparia*	Amber	No
Snipe *Gallinago gallinago*	Red	No
Swift *Apus apus*	Red	No
Wheatear *Oenanthe oenanthe*	Amber	No
Willow Warbler *Phylloscopus trochilus*	Amber	No

7.5.8.8 Target Species Breeding Activity

No confirmed target species breeding activity was recorded within the core study area.

A breeding season observation of a pair of buzzard flying at treetop level to the south of the Development could potentially indicate breeding activity, however no further observations confirmed this. No observations of buzzard displaying or nesting within the Development Site or surrounding area (core study area) were recorded.

During breeding season VP surveys, a kestrel was observed carrying prey towards conifer woodland to north of the Site (outside the core study area) followed by calls indicating a potential nesting site. This species could potentially breed in conifer plantations and farmland within the core study area.

Sparrowhawk flight activity was recorded in and around the core study area during VP surveys in summer 2021. No evidence of sparrowhawk breeding within the Site was observed. As such, while this species is active in the study area, survey results do not indicate the presence of breeding birds onsite.

7.5.8.9 Great-spotted Woodpecker Records

Great-spotted woodpecker *Dendrocopos major* was recorded incidentally during vegetation surveys of peatland habitats on 27th September 2020. This species was recorded in the vicinity of the vegetation (quadrat) survey area between T2 and T3.

Great-spotted woodpecker was also recorded as an additional species during VP surveys when it was heard calling from VP1 on 22nd July 2021.

Great-spotted woodpecker are recent colonists in Ireland and as such are expanding their range and are Green-listed.

7.5.9 Aquatic Surveys

Desktop studies investigating water quality, fish status and the occurrence of freshwater pearl mussel and white-clawed crayfish in the Barrow and Nore catchments and the study area for the Development were undertaken. These indicated the Dinin is not known to host populations of either freshwater pearl mussel or white-clawed crayfish but is known as a salmonid river. Furthermore, the desk study indicated the main populations of freshwater pearl mussel known from the Barrow and Nore catchments are not downstream of the Site (located upstream along the Nore and in tributaries of the Barrow). See the accompanying aquatic ecology report in Appendix 7.2 and also Figure 6 within that report.

The results of aquatic ecology surveys at the ten sites selected within the aquatic survey study area are detailed below. The sites are in general of low-moderate value other than Site 6 at Black Bridge on the River Dinin which was confirmed to be an important salmonid spawning and nursery site and is within the River Barrow and River Nore SAC and Site 1 on the Rathornan River which also contained spawning and nursery habitat for salmonids. Site 6 also contained limited habitat for juvenile lamprey (none were recorded however); no other sites had potential for lamprey.

While some contained limited numbers of brown trout and other fish, the primary consideration relating to the other watercourses surveyed is their capacity to act as pathways for pollution to higher-value habitats and protected areas further downstream.

No white-clawed crayfish or freshwater pearl mussel were recorded.

The locations of aquatic survey sites are shown in Figure 3 in the accompanying aquatic ecology report contained in Appendix 7.2.

7.5.9.1 Site 1

Site 1 is located c. 3.7km to the south-east of the Development land ownership boundary. This site is situated at a road crossing (L7126 road) on the 3rd order Rathornan River (Segment: 14_82), approximately 285m west of the M9 motorway. Wind turbine location T1 is the nearest to this watercourse located 530m north-east of the source of the Rathornan River, upstream of Survey Site 1. The proposed site borrow pit is located 370m north-east of the watercourse and no Grid Application access tracks are within 200m of the river. The Rathornan River is within the Barrow catchment, the watercourse flows in a south-easterly direction away from the Development land ownership boundary towards its confluence with the Barrow which is c. 2.4rkm downstream of Site 1.

There is no EPA monitoring on the Rathornan River and no Q-ratings assigned to it. The nearest water quality monitoring on the watercourse is located nearly c. 3rkm downstream from Site 1, at Cardinal Moran Bridge (Station: 14B012680) on the River Barrow. A Q-score of Q3-4 was obtained at this monitoring station in 2020, indicating 'Moderate' water quality.

This watercourse has been assigned a River Waterbodies WFD Status 2013-2018 of 'Moderate' and the River Waterbodies Risk Assessment of the river is under review.

The electrofishing survey was undertaken at this site for 5 minutes and only two brown trout (1+) were recorded. Small numbers of three-spined stickleback were also recorded. This is a small watercourse and has limited potential to support fish. No potential lamprey habitat was recorded. The kick sample indicated that this site would achieve Q3-4 status. The most common macroinvertebrate species present were *Gammarus dubeni*, *Baetis rhodani* and Gerridae bugs. No Class A indicator species were recorded. This stream does not provide suitable habitat for white-clawed crayfish.

This stream is a spawning and nursery stream for salmonids and is identified as being a sensitive receptor.

7.5.9.2 Site 2

Site 2 is located c. 2km south-east of the Development land ownership boundary. This site is on the Boolyrathornan / Tomard watercourse (Segment: 14_1264), situated at a crossing point of the L7124 local road.

The Boolyrathornan / Tomard is 450m from the nearest wind turbine location, T1, which is situated to the northwest of the watercourse. It is 190m from the proposed onsite borrow pit and 120m from any Grid Application internal access tracks. This watercourse is a 1st order watercourse in the Barrow catchment. The watercourse flows in a south-easterly direction away from the Development land ownership boundary to the Rathornan River which then continues on to join the River Barrow c. 4.3rkm downstream of the survey site. There is no EPA monitoring on the Boolyrathornan / Tomard watercourse, and no Q-ratings assigned to it. This watercourse has been assigned a River Waterbodies WFD Status 2013-2018 of 'Moderate' and the River Waterbodies Risk Assessment of the river is under review.

This watercourse was very low during the site visit and no fish were present. It is expected that this stream dries up and it is not possible to provide it with a biotic index rating.

7.5.9.3 Site 3

Site 3 is located along the south-eastern part of the Development land ownership boundary. This survey site is on the Boolyrathornan / Tomard watercourse (Segment: 14_1264), situated at a crossing point of the L7130 local road. This watercourse is a 1st order watercourse in the Barrow catchment. Wind turbine location T1 is the nearest to this watercourse, located 450m north-west of the watercourse. It is 190m from the proposed onsite borrow pit and 120m from any Grid Application internal access tracks. The watercourse rises at Site 3 and flows in a south-easterly direction away from the Development land ownership boundary to the Rathornan River, which then continues on to join the River Barrow c. 6.3rkm downstream of the survey site. There is no EPA monitoring on the Boolyrathornan / Tomard watercourse and no Q-ratings assigned to it. This watercourse has been assigned a River Waterbodies WFD Status 2013-2018 of 'Moderate' and the River Waterbodies Risk Assessment of the river is under review.

This watercourse was dry during the site visit and no fish were present. It was not possible to provide it with a biotic index rating.

7.5.9.4 Site 4

Site 4 is located c. 2.2km to the south-east of the Development land ownership boundary and c. 1.9km north-west of the M9 motorway. This survey site is on the 2nd order Rathornan River (Segment: 14_1159) within the Barrow catchment. This site is located at the L7124 local road crossing of the watercourse. Wind turbine location T1 is the nearest to the Rathornan River, located 530m north-east of the watercourse. It is 370m from the proposed onsite borrow pit and 208m from any proposed internal access tracks. The river flows in a south-easterly direction away from the Development land ownership boundary and towards its confluence with the River Barrow, c. 4rkm downstream of Site 4. There is no EPA monitoring on the Rathornan River and no Q-ratings assigned to it. This watercourse has been assigned a River Waterbodies WFD Status 2013-2018 of 'Moderate' and the River Waterbodies Risk Assessment of the river is under review.

This watercourse was very low during the site visit and no fish were present. It is expected that this stream dries up and it is not possible to provide it with a biotic index rating.

7.5.9.5 Site 5

Site 5 is located along the southern part of the Development land ownership boundary. This site is situated at the L7130 road on the 1st order Rathornan River (Segment: 14_1105). Wind turbine location T1 is the nearest to the Rathornan River, located 530m north-east of the watercourse. It is 370m from the proposed onsite borrow pit and 208m from any Grid Application internal access tracks. The watercourse is within the Barrow catchment, it rises at Site 5 and flows in a south-easterly direction away from the Development land ownership boundary and towards its confluence with the River Barrow, c. 6.6rkm downstream of the survey site.

There is no EPA monitoring on the Rathornan River and no Q-ratings assigned to it. The nearest water quality monitoring on the watercourse is located nearly c. 7.2rkm downstream from Site 5, at Cardinal Moran Bridge (Station: 14B012680) on the River Barrow. A Q-score of Q3-4 was obtained at this monitoring station in 2020, indicating 'Moderate' water quality. This watercourse has been assigned a River Waterbodies WFD Status 2013-2018 of 'Moderate' and the River Waterbodies Risk Assessment of the river is under review.

This watercourse was dry during the site visit and no fish were present. It was not possible to provide it with a biotic index rating.

7.5.9.6 Site 6

Site 6 is located c. 2.7km west of the Development land ownership boundary. This survey site is situated on the Carlow / Kilkenny County border at the L3037 road crossing on the Dinin (South) River (Segment: 15_85), Black Bridge. Upstream of Survey Site 6 the Dinin (South) River comes within 597m of the nearest wind turbine location, T5, within 15m of the Grid Application cable route and within 8m of the permitted Grid Application access route to the north of the Development land ownership boundary. The Dinin (South) River is a 3rd order watercourse at this point, it is part of the Nore catchment. The river flows in a south-westerly direction away from the Development land ownership boundary and towards its confluence with the River Nore, c. 25rkm downstream of the survey site.

Black Bridge is a National Water Monitoring Station (Station: 15D080450). The most recent EPA monitoring carried out at this site was in 2019. A Q-rating of Q4, equivalent to 'Good' water quality was assigned to the river at this point. At the upstream side of the bridge (wind farm side) the River Waterbodies Risk is under review and the channel has a River Waterbodies WFD Status 2013-2018 of 'Moderate'. While on the downstream side of Black Bridge (River Nore side) the watercourse transitions to an 'not at risk' waterbody with a River Waterbodies WFD Status of 'Good'.

Reasonable numbers of juvenile Atlantic salmon (n=12) and brown trout (n=3) were recorded during the 5-minute electrical fishing survey. Stone loach were also common, and three-spined stickleback were also present. There was limited potential juvenile lamprey habitat present and no lampreys were detected. Two age groups (0+ and 1+) of both salmonid species were recorded. Juvenile salmon ranged in size from 8.1cm to 11.8cm. This is an important salmonid spawning and nursery site and is within the SAC. The CPUE for both species was considered to be low however. Just above this site there is a large cascade and this may be the upper the limit of salmon distribution in the Dinin River.

The kick sample taken at this site indicated that this site should be rated Q4 or 'Good Status'. The rating was based on the presence of two Class A indicators being present. However, there was siltation and some algae growth at this site. No crayfish were recorded. No freshwater pearl mussels are present at this site and there are no records from the Dinin River.

7.5.9.7 Site 7

Site 7 is on a 1st order tributary of the Dinin (South) River (Segment: 15_916) just east of the main Dinin channel. This river flows westerly alongside the Grid Application upgraded access tracks. The (access track upgrade) site boundary is c. 700m east of Survey Site 7 and the nearest wind turbine location to this watercourse is T4 which is 380m back from the channel. The watercourse comes within 30m of the Grid Application access route just upstream of site 7. The Dinin (South) River is within the Nore catchment. The watercourse flows in a westerly direction away from the Development land ownership boundary. The Dinin (South) River joins the River Nore c. 27.1rkm downstream from Site 7. This stream is not monitored by the EPA.

The stream was very low at the time of the survey and is too small to contain fish. Therefore, an adjoining site on the main Dinin River just downstream of the confluence of this stream was electro-fished as an alternative site. This site was fished for 5-minutes and the most common species recorded was stone loach. Reasonable numbers of brown trout were also present (n=15) ranging in size from 7.2cm to 16.9cm. Juvenile salmon were absent from this site.

A biological water quality rating of Q3-4 was assigned, and this site was silted and had extensive growth of algae present. No protected aquatic macroinvertebrates were recorded.

7.5.9.8 Site 8

Site 8 is situated c. 464m north-west of the Development land ownership site boundary. The survey site is located on the 1st order Boolyvannanan Stream (Segment: 15_915), within the Nore catchment. This site is beside a permitted upgraded access track (Grid Application) to the Site which crosses the stream.

The nearest wind turbine location to this stream is T5 which is 290m back from the watercourse. It is 190m from the onsite substation compound and 150m from the Grid Application cable route. The Boolyvannanan River flows northerly away from the Development land ownership boundary to join the Dinin (South) River c. 175rm downstream of Site 8. The watercourse connects to the River Nore c. 27.5rkm downstream of the survey site. The Dinin (South) River then flows south-west towards the River Nore.

This risk status of this watercourse is under review and it has been assigned a River Waterbody WFD Status 2013-2018 of 'Moderate'. There is no EPA monitoring carried out on the Boolyvannanan River. The nearest Q-rating available on the watercourse is c. 2.5rkm downstream on the Dinin (South) River (Segment: 15_85) at Black Bridge (Station: 15D080450). In 2019 a Q-rating of Q4 equivalent to 'Good' water quality was assigned to this watercourse.

The stream was also very low / partially dry at the time of the survey and is too small to contain fish. It was not possible to undertake an electrical fishing survey on this stream / drain. Therefore, again an adjoining site on the main Dinin River just downstream of the confluence of this stream was electro-fished as an alternative site. This site was fished for 5 minutes and the most common species recorded was again stone loach. Brown trout were also recorded (n=9) ranging in size from 8.2cm to 15.8 cm. Juvenile salmon were absent from this site.

A biological water quality rating of Q3-4 was assigned and the site was silted. This site was shaded by trees but growths of filamentous algae were recorded downstream of the site. No protected aquatic macroinvertebrates were recorded.

7.5.9.9 Site 9

Site 9 is located c. 880m north of the Development land ownership boundary, situated c. 437m south-west of Bilboa Crossroads on the Carlow / Laois County border. This survey site is at the L7129 road crossing on the 2nd order Dinin (South) River (Segment: 15_1), within the Nore catchment. At Site 9 the watercourse is within 15m of the Grid Application site access route. The Dinin (South) River comes within 597m of the nearest wind turbine location, T5, downstream of Site 9. The Dinin (South) River flows south-westerly to its confluence with the Nore which is c. 29.2rkm downstream of Site 9.

This risk status of this watercourse is under review and it has been assigned a River Waterbody WFD Status 2013-2018 of 'Moderate'. There is no EPA monitoring carried out upstream of this site on the Dinin (South) River. The nearest downstream monitoring station on the water course is located c. 4.2rkm downstream of Site 9, at Black Bridge (Station: 15D080450). In 2019 a Q-rating of Q4 equivalent to 'Good' water quality was assigned to the watercourse at Black Bridge.

The electrofishing survey was undertaken at this site for 5 minutes and only three brown trout (0+ and 1+) were recorded. Small numbers of three-spined stickleback and stone loach were also recorded. This is a small watercourse and has limited potential to support fish. No lampreys were recorded. The kick sample indicated that this site would achieve Q3-4 status but was too small to be rated. The site was silted but algae levels were normal. No Class A indicator species, or protected macroinvertebrates, were recorded.

7.5.9.10 Site 10

Site 10 is located c. 3.2km to the north of the Development land ownership boundary. This survey site is located on the 1st order Dinin (South) River (Segment: 15_711). This watercourse is in the Nore catchment. The Dinin (South) River rises upstream of this survey site and flows in a southerly direction, turning south-west before the Development land ownership boundary and flowing towards the River Nore. Downstream of Survey Site 10, the Dinin (South) River comes within 597m of the nearest wind turbine location, T5, within 15m of the Grid Application cable route and within 8m of the Grid Application proposed access route to the north of the Site. The Dinin (South) River's confluence with the River Nore is c. 31.6rkm downstream of Site 10.

This part of the Dinin (South) River is under review and has been assigned a River Waterbody WFD Status 2013-2018 of 'Moderate'.

There is no EPA water monitoring carried out at this part of the watercourse. The nearest EPA Q-rating was assigned c. 6.6rkm downstream at Black Bridge in 2019 when a Q4 rating, equivalent to 'Good' water quality was assigned.

This watercourse was very low during the site visit and only three-spined sticklebacks were present. It was not possible to provide it with a biotic index rating, but it appeared to be impacted from forestry / agricultural runoff. This stream had been deepened and modified.

7.5.10 Other Species

A desk study covering other fauna (amphibians, reptiles and terrestrial invertebrates) reviewed NPWS and NBDC data for 10km grid squares S66 and S67 abutting and overlapping the study area. Recent records for common frog *Rana temporaria* and smooth newt *Lissotriton vulgaris* within the overlapping grid square S67 were retrieved, while an older record (1972) for common lizard *Zootoca vivipara* was retrieved for the same grid square. It is noted common lizard was more recently recorded (2011) in the adjacent 10 km grid square S57.

7.5.10.1 Common Frog

Common frog was not observed during current ecological surveys of the study area, however the drains within the study area offer potential breeding habitat for frogs and this species was recorded onsite in 2011 EIS surveys. Frogspawn was also noted in ephemeral pools within conifer plantation during grid application surveys.

7.5.10.2 Smooth Newt

Smooth newt was not observed during ecological surveys of the study area, however the drains and artificial pond within the study area may offer some potential breeding habitat for smooth newt.

7.5.10.3 Common Lizard

Common lizard was not observed during ecological surveys of the study area, however the peatland and scrub habitats in and around the wind farm site may offer some suitable habitat for lizard.

7.5.10.4 Butterflies

A comma *Polygonia c-album* butterfly was observed incidentally during vegetation surveys of peatland habitats on 27th September 2020. This species was recorded in the vicinity of the vegetation (quadrat) survey area between T2 and T3. This species is a recent arrival in Ireland and is considered 'Likely to be resident, but not proven' and as such was not included in the red list assessment[79].

NBDC data includes a record of dingy skipper *Erynnis tages* from 2021 within 1 km grid square S6471 which overlaps the proposed development. This species is categorised Near Threatened[79]. This species was also recorded in the adjacent 1 km grid square S6571 (not overlapping the development).

Marsh fritillary *Euphydryas aurinia* (Annex II; Vulnerable) has been recorded within the adjacent 1 km grid square S6571 (not overlapping the development) (recorded in 2021). Aerial imagery indicates this grid square contains suitable habitat for this species (rough grassland) which is not present within the proposed site. This species requires more detailed assessment however due to the proximity of this record.

7.5.10.5 Damselflies and Dragonflies

A number of damselfly and dragonfly species (*Odonata*) were observed at the pond near the southern existing site entrance (see other artificial lakes and ponds on habitat map Figure 7.6a). These were the common hawker dragonfly *Aeshna juncea* and three damselfly species: large red damselfly *Pyrrhosoma nymphula*, blue-tailed damselfly *Ischnura elegans* and common blue damselfly *Enallagma cyathigerum.* All of these species are categorised as 'least concern' [80].

7.6 Receptor Evaluation

7.6.1 Habitat Evaluation

Table 7-53 below outlines the ecological resources in the form of habitat types found within the study area. Key receptors as per NRA guidance[40], for which impact assessment is to be carried out, are also indicated.

The habitats within the Development boundary are predominantly conifer plantation (WD4) and buildings and artificial surfaces (BL3). These habitats are species poor in terms of flora, have been modified and are subject to disturbance. As previously noted the presence of heath-spotted orchid increases the ecological interest of areas of existing access tracks in the south-west of the Site, although this common species is evaluated as 'least concern' [24].

The areas of Raised bog (PB1) and Cutaway bog/Wet heath (PB4/HH3) have also been subject to disturbance historically, having been drained and cut, however these habitats represent the most natural types present at the Site.

Habitats evaluated as Local Importance (Higher Value) and above which are within the Development footprint or zone of influence are classified as key receptors, while habitats outside the Development footprint or zone of influence or those within the Development footprint evaluated as Local Importance (Lower Value) are not classified as key receptors. See Figure 7.9 for the locations of habitats relative to the Development footprint.

[79] Regan, E.C., Nelson, B., Aldwell, B., Bertrand, C., Bond, K., Harding, J., Nash, D., Nixon, D., & Wilson, C.J. (2010) *Ireland Red List No. 4 – Butterflies*. National Parks and Wildlife Service, Department of the Environment, Heritage and Local Government, Ireland.

[80] Nelson, B., Ronayne, C. & Thompson, R. (2011) Ireland Red List No.6: Damselflies & Dragonflies (Odonata). National Parks and Wildlife Service, Department of the Environment, Heritage and Local Government, Dublin, Ireland.

Table 7-53: Habitat Evaluation

Fossitt Habitat Classification (Code)	Evaluation	Key Receptor
Conifer plantation (WD4)	Locally Important (Higher Value)	Yes
Buildings and artificial surfaces (BL3)	Locally Important (Lower Value)	No
Recolonising bare ground (ED3)	Locally Important (Higher Value)	No
Other artificial lakes and ponds (FL8)	Locally Important (Higher Value)	Yes
Drainage ditches (FW4)	Locally Important (Higher Value)	Yes
Scrub (WS1)	Locally Important (Higher Value)	Yes
Raised bog (PB1)	County Importance	Yes
Cutover bog PB4/Wet heath (HH3) mosaic	Locally Important (Higher Value)	Yes
Dense bracken (HD1)	Locally Important (Lower Value)	No
Eroding/upland rivers FW1	Locally Important (Higher Value)	Yes
Recently felled woodland (WS5)	Locally Important (Lower Value)	No
Wet grassland (GS4)	Locally Important (Higher Value)	No
Riparian Woodland (WN5)	Locally Important (Higher Value)	No

7.6.2 Fauna (Excluding Avifauna) Evaluation

The basis of impact assessment should be a determination of which ecological resources within the zone of influence of the Development and are of sufficient value to be material in decision making and therefore, included in the assessment[40]. Table 7-54 below outlines the key receptors selected for assessment and the rationale for same; taken from NRA guidance[40].

Table 7-54: Evaluation of Fauna

Common name	Conservation Status	NRA Evaluation	Rationale	Key Ecological Receptor
Bats	EU Habitats Directive Annex IV; Wildlife Act (Amendment) 2000	National Importance	Recent records of bat roosts and activity within 10 km of the wind farm site. Eight species recorded in the wind farm site during static detector surveys.	Yes
Badger	Wildlife Act (Amendment) 2000	County Importance	Recent 1 km NBDC records located east of the wind farm site. Field sign observed during mammal survey.	Yes
Irish Hare	EU Habitats Directive Annex V, Wildlife Act (Amendment) 2000	National Importance	Recent 100m NBDC record located south of the wind farm site. Could use open habitats onsite.	Yes

Common name	Conservation Status	NRA Evaluation	Rationale	Key Ecological Receptor
Pygmy Shrew	Wildlife Act (Amendment) 2000	National Importance	Recent 100m NBDC records located east and west of the wind farm site. Suitable habitat onsite.	Yes
Red Squirrel	Wildlife Act (Amendment) 2000	National Importance	Live sightings along the proposed access route and to east of the wind farm site. Conifer plantations onsite provide suitable foraging and breeding habitat.	Yes
Otter	EU Habitats Directive Annex II and Annex IV; Wildlife Act (Amendment) 2000	National Importance	Recent 100m NBDC records along the River Dinin located near the proposed grid connection route and downstream of the wind farm site. Foraging habitat along Dinin.	Yes
Irish Stoat	Wildlife Act (Amendment) 2000	National Importance	Recent 100m NBDC records south and west of the wind farm site. Suitable habitat present in the wind farm site.	Yes
Pine Marten	EU Habitats Directive Annex V, Wildlife Act (Amendment) 2000	National Importance	Recent 100m NBDC record overlaps proposed access route north-west of the wind farm site. Not observed during surveys but record indicates this species can occur within the conifer woodland where the wind farm site is located.	Yes
Hedgehog	Wildlife Act (Amendment) 2000	National Importance	Closest NBDC records are from areas several kilometers to the south and east, however this species could potentially occur at the wind farm site.	Yes
Red Deer	Wildlife Act (Amendment) 2000	National Importance	Deer tracks recorded in the wind farm site. Species not confirmed however the range of this species is considered to extend to the adjacent 10 km grid square (S77) (Carden. et al. 2010). As such there is potential for this species to occur in the wind farm site.	Yes
Red Fox	None	Local Importance (lower Value)	Widespread and resilient species, not sensitive to disturbance at population scale.	No
Sika Deer	Wildlife Act (Amendment) 2000/ Invasive non-native species	Not of conservation importance	Invasive non-native species – not of conservation concern (Sika are included in the Wildlife Act for the purpose of regulating hunting). The range of this species is considered to extend to the adjacent 10 km grid square (S77) (Carden. et al. 2010).	No

Common name	Conservation Status	NRA Evaluation	Rationale	Key Ecological Receptor
American Mink	Invasive non-native species	Not of conservation importance	Invasive non-native species – not of conservation concern. Scat recorded within the wind farm site.	No
Brown Rat	Invasive non-native species	Not of conservation importance	Invasive non-native species – not of conservation concern. Recent 100m NBDC record south-east of the wind farm site.	No
Grey Squirrel	Invasive non-native species	Not of conservation importance	Invasive non-native species – not of conservation concern. 100m NBDC record north-east of the wind farm site.	No
Rabbit	Invasive non-native species	Not of conservation importance	Invasive non-native species – not of conservation concern. 1 km NBDC record west of the wind farm site.	No
Greater White-toothed Shrew	Invasive non-native species	Not of conservation importance	Invasive non-native species – not of conservation concern. 100m NBDC records north, east and west of the wind farm site.	No
Common Frog	EU Habitats Directive Annex V, Wildlife Act (Amendment) 2000	National Importance	Common Frog was not observed during surveys, however the drains and pond (within borrow pit footprint) within the study area offer potential breeding habitat for frogs. Also recorded onsite during 2011 EIS surveys, grid application surveys and in NBDC 10 km grid square S67 records.	Yes
Smooth Newt	Wildlife Act (Amendment) 2000	National Importance	Not observed during surveys, however the drains within the study area offer potential breeding habitat for newts. 100m NBDC record c. 7 km north-east of the wind farm site.	Yes
Common Lizard	Wildlife Act (Amendment) 2000	National Importance	Not observed during surveys, however areas of peatland, wet grassland and scrub within the study area offer potential habitat for lizards. 1 km NBDC record north of the wind farm site (1972), more recent 100m record (2011) to east. Both c. 4km from the Site.	Yes
Dragonfly Species	Least Concern	Local Importance (Higher Value)	Recorded in artificial pond within borrow pit footprint	Yes

name	Status	Evaluation	Rationale	Ecological Receptor
Comma Butterfly	Not assessed	Local Importance (Higher Value)	Habitat generalist. Potentially uses habitats within the Development subject to disturbance only.	No
Dingy Skipper	Near Threatened	National Importance	Potentially uses access track margins, clearings or heath which could be subject to impacts from access track construction/upgrades.	Yes
Marsh fritillary	Annex II; Vulnerable	National Importance	Habitats onsite suboptimal. Potential for larval foodplant devil's bit scabious to occur onsite. Proximity of historical record.	Yes

7.6.3 Avifauna Evaluation

The basis of impact assessment should be a determination of which ecological resources within the zone of influence of the Development are of sufficient value to be material in decision making and therefore, included in the assessment[22 40]. Table 7-55 outlines the key receptors selected for assessment and the rationale for same based on NRA guidancce[40]; the overall importance or sensitivity evaluation for each key receptor, taken from guidance such as Percival 2007 is also illustrated.

Table 7-55: Avifauna Evaluation

Common name	Conservation Status	NRA Evaluation	Rationale	Key Receptor	Receptor Evaluation for Impact Assessment (Sensitivity)
Green-listed passerines	Green Listed	Local Importance (Low Value)	Common species occurring in association with widespread and abundant habitats such as conifer plantations and hedgerows	No	N/A
Buzzard	Green Listed	Local Importance (Higher Value)	Recorded during winter and summer VP surveys. However, no records of Buzzard displaying or nesting within the Development Site or surrounding area (core study area)	Yes	Low
Great Spotted Woodpecker	Green Listed	County Importance	Recorded in Development study area during surveys	Yes	Low
Grey Wagtail	Red Listed	National Importance	This species may forage in the wider river network near	Yes	High

Common name	Conservation Status	NRA Evaluation	Rationale	Key Receptor	Receptor Evaluation for Impact Assessment (Sensitivity)
			and downstream of the Development.		
Goldcrest	Amber Listed	County Importance	Recorded during transect/point count surveys	Yes	Medium
Golden Plover	Annex I Red Listed	International Importance	Recorded infrequently during vantage point surveys (three records during winter 2019/20; heard calling outside site boundary in April 2021). No breeding recorded within the study area or hinterland.	Yes	Very High
Greenfinch	Amber Listed	County Importance	Recorded during transect/count surveys	Yes	Medium
Grey Heron	Green Listed	Local Importance (Lower Value)	Recorded during VP surveys (4 observations)	Yes	Low
Hen Harrier	Annex I Amber Listed	International Importance	Recorded within the flight activity survey study area during winter 2019/20 (6 observations). Two flight lines entered the Development boundary. No observations during breeding season (2020/2021)	Yes	Very High
House Martin	Amber Listed	International Importance	Recorded during VP surveys	Yes	Medium

Common name	Conservation Status	NRA Evaluation	Rationale	Key Receptor	Evaluation for Impact Assessment (Sensitivity)
House Sparrow	Amber Listed	County Importance	Recorded during VP surveys	Yes	Medium
Kestrel	Red Listed	County Importance	Kestrel observed carrying prey towards conifer woodland to north of development site followed by calls indicating a potential nesting site. Active around core study area. Could potentially breed in conifer plantations and farmland within core study area.	Yes	High
Kingfisher	Annex I Amber Listed	International Importance	Not recorded within the Site or surrounding area. No appropriate available habitat on site but potentially available downstream of Development. Included as a precaution.	Yes	Very High
Lesser Black-backed Gull	Amber Listed	County Importance	Lesser Black-backed Gull observed during VP surveys.	Yes	Medium
Linnet	Amber Listed	County Importance	Recorded during transect/point count surveys	Yes	Medium
Meadow Pipit	Red Listed	National Importance	Recorded during winter transect/point count surveys	Yes	High
Peregrine Falcon	Annex I Green Listed	International Importance	Four Peregrine sightings during winter VP surveys 2019/20. Three sightings during breeding season 2021. No evidence of them breeding in core study area during surveys including	Yes	Very High

Common name	Conservation Status	NRA Evaluation	Rationale	Key Receptor	Receptor Evaluation for Impact Assessment (Sensitivity)
			summer breeding survey walkovers. However, NPWS hold records of three breeding sites (2017) within 5 km of the Development.		
Redwing	Red Listed	International Importance	Recorded during winter transect/point count surveys and VP surveys	Yes	High
Sand Martin	Amber Listed	International Importance	Recorded during VP surveys	Yes	Medium
Skylark	Amber Listed	County Importance	Recorded during VP surveys	Yes	Medium
Snipe	Red Listed	County Importance	Recorded infrequently during winter VP surveys and transects. No evidence of breeding snipe was recorded.	Yes	High
Sparrowhawk	Green Listed	County Importance	Sparrowhawk were observed frequently during VP surveys. Active around core study area, but no evidence of breeding within the site.	Yes	Low
Starling	Amber Listed	County Importance	Recorded during winter transect/count surveys.	Yes	Medium
Swallow	Amber Listed	International Importance	Recorded during VP surveys	Yes	Medium
Swift	Red Listed	International Importance	Recorded during VP surveys	Yes	High
Wheatear	Amber Listed	International Importance	Recorded during VP surveys	Yes	Medium
White Throated Dipper	Green Listed	Local Importance (Higher Value)	Breeding pair recorded downstream of the Site.	Yes	Low
Willow Warbler	Amber Listed	International Importance	Recorded during breeding transect/point count surveys and VP surveys	Yes	Medium

Common name	Conservation Status	NRA Evaluation	Rationale	Key Receptor	Receptor Evaluation for Impact Assessment (Sensitivity)
Woodcock	Red Listed	National Importance	Roding birds observed onsite during 2021 Woodcock surveys. Estimated 1-2 pairs breeding on site	Yes	High

The following Very High to Medium sensitivity species were recorded within the 10km grid squares overlapping and immediately south of the study area within the last 10 years (2012-2022) only and were not recorded within the study area over three years of dedicated field surveys. Consequently, they are not listed as key receptors. These species are:

- Barn owl, little egret, lapwing, whooper swan (Very High sensitivity)
- Long eared owl, black-headed gull, goldeneye, curlew, herring gull, northern shoveler, yellowhammer (High sensitivity)
- Common coot, grasshopper warbler, pochard, teal, tree sparrow, wigeon, cormorant, great crested grebe, little grebe, spotted flycatcher, mute swan, moorhen, water rail (Medium sensitivity).

Corncrake, grey partridge (Very High sensitivity species), merlin and stock pigeon (High sensitivity species) are historic records (1972-1984) from the 10km grid squares overlapping and immediately south of the study area and were not observed during surveys and consequently are not listed as key receptors.

7.6.4 Aquatic Ecology Evaluation

The basis of impact assessment should be a determination of which ecological resources within the zone of influence of the Development are of sufficient value to be material in decision making and therefore, included in the assessment[22 40]. Table 7-56 below, outlines the key receptors selected for assessment and the rationale for same; taken from NRA guidance[40]. All streams have been considered key receptors due to the downstream connectivity to high value watercourses. Note however site 10 on the Dinin is not a key receptor due to its location upstream of the Development catchment area.

Table 7-56: Aquatic Ecology Evaluation

Site	Waterbody name	EPA code	Evaluation of aquatic importance	Summary of features of conservation value	Key Receptor
1	Rathornan	14_82	Local importance (higher value)	Brown Trout and 3-spined Stickleaback present. Spawning and nursery habitat for salmonids present. Water quality Q3-4 (moderate status) but no other aquatic features of higher than local importance.	Yes
2	Boolyrathornan / Tomard	14_1264	Local importance (lower value)	No high value ecological attributes. Very low with no fish present at time of survey. Considered likely to dry up. Biotic index rating (Q value) not possible.	Yes
3	Boolyrathornan / Tomard	14_1264	Local importance (lower value)	No high value ecological attributes. Dry at time of survey. Biotic index rating (Q value) not possible.	Yes

Site	Waterbody name	EPA code	Evaluation of aquatic importance	Summary of features of conservation value	Key Receptor
4	Rathornan	14_1159	Local importance (lower value)	No high value ecological attributes. Dry at time of survey. Biotic index rating (Q value) not possible.	Yes
5	Rathornan	14_1105	Local importance (lower value)	No high value ecological attributes. Dry at time of survey. Biotic index rating (Q value) not possible.	Yes
6	Dinin	15_85	International importance (within SAC)	Atlantic salmon, Brown Trout, 3-spined stickleback, Stone Loach present. Spawning and nursery habitat for salmonids present. Limited potential juvenile lamprey habitat present. Water quality Q4 (good status).	Yes
7	Un-named	15_916	Local importance (lower value)	No high value ecological attributes. Very low at time of survey and too small to contain fish. Biotic index rating (Q value) not possible.	Yes
7a	Dinin	15_86	Local importance (higher value)	Brown Trout, Stone Loach and 3-spined stickleback present. Water quality Q3-4 (moderate status) but no other aquatic features of higher than local importance.	Yes
8	Boolyvannanan	15_915	Local importance (lower value)	No high value ecological attributes. Very low/partially dry at time of survey and too small to contain fish. Biotic index rating (Q value) not possible.	Yes
8a	Dinin	15_84	Local importance (higher value)	Brown Trout, Stone Loach and 3-spined stickleback present. Water quality Q3-4 (moderate status) but no other aquatic features of higher than local importance.	Yes
9	Dinin	15_1	Local importance (higher value)	Brown Trout and 3-spined stickleback present. Water quality (indicative) Q3-4 (moderate status) but no other aquatic features of higher than local importance.	Yes
10	Dinin	15_711	Local importance (lower value)	3-spined stickleback present. Biotic index rating not possible; appeared to be impacted by forestry / agricultural runoff. Stream had been deepened and modified.	No (upstream)

7.7 'DO-NOTHING' ALTERNATIVE

If the Development does not proceed, the 'do nothing' scenario is that the existing environment and key receptors identified in Section 7.6 are likely to remain as described previously. This includes the continuation of forestry operations.

7.8 POTENTIAL EFFECTS ON ECOLOGY

The potential effects of the project are addressed below in terms of potential effects arising in the construction, operational and decommissioning phases.

7.9 CONSTRUCTION PHASE

7.9.1 European sites

There are no designated European sites within the Development area, therefore no direct effects are predicted during construction. European sites hydrologically linked to the Development site have the potential for indirect effects due to hydrological changes and effects such as increased siltation, nutrient release and/or contaminated run-off through drainage channels and watercourses.

Hydrological effects are more likely to occur during the construction phase but could also occur during the operational phase e.g., run-off from hard-standing areas.

A Natura Impact Statement (NIS) has been prepared for the Development and has been submitted with the planning application. The NIS (Appendix A7.7) addresses potential effects on European Sites resulting from the Development.

7.9.2 Natural Heritage Areas and Proposed Natural Heritage Areas

There is one NHA within the 10 km of the Development:

- Coan Bogs NHA (002382)

There are three pNHAs within the 10km of the Development:

- Cloghristick Wood pNHA (000806)
- Mothel Church Coolcullen pNHA (000408)
- Whitehall Quarries pNHA (000855)

Cloghristick Wood pNHA is partly overlapped by the River Barrow and River Nore SAC (002162). However, it still forms a distinct site (its boundaries do not match those of the SAC) and therefore is assessed here.

Potential Direct Effects

As the Development does not overlap and is not in close proximity to any NHAs or pNHAs no direct effects are predicted in this regard.

Potential Indirect Effects

No effects arising from the Development will occur to Coan Bogs pNHA (located c. 2 km north-west) due to a lack of ecological connectivity and the NHA being designated for a non-mobile conservation interest (upland blanket bog).

Similarly, Cloghristick Wood pNHA will not be affected due to a lack of ecological connectivity (although located along the River Barrow, the pNHA is not downstream of the Development and is of interest for woodland which is non-mobile).

Mothel Church Coolcullen pNHA, located c. 5 km south-west of the Development is of interest due to the presence of a nursery colony of Natterer's bat. While this species may forage at the Development site and surrounding areas, work during night-time is not planned and as such disturbance of foraging bats arising from lighting is not predicted to occur regularly.

There may be occasional circumstances where night-time work is required and as such there is the possibility of limited disturbance to foraging Natterer's bats. However, the limited duration and infrequent occurrence of such works, combined with the infrequent recorded occurrence of Natterer's bat onsite (average of 1.44 recordings per night or 0.26% of all records during static detector surveys), distance between the Development and Mothel Church Coolcullen pNHA, in addition to the abundance of similar foraging habitats in the landscape means any such disturbance is not predicted to result in effects on the nursery colony at the pNHA.

Similarly, for Whitehall Quarries pNHA (c. 8.1 km south) which is of interest for peregrine falcon (a total of four peregrine observations were recorded during winter 2020; three observations were recorded during summer 2021), there may be infrequent instances where foraging peregrine could avoid hunting at the Development due to human presence during construction. However, as above this would not result in effects on the pNHA due to the abundance of similar habitats in the landscape. It is also noted the core range of breeding Peregrine is 2 km[81], making it unlikely that breeding birds from Whitehall Quarries pNHA would use the Site regularly.

7.9.3 Habitats and Flora

Potential Direct Effects

Table 7-57 below summarises the habitat loss which would result from the Development.

The loss of linear habitat - forestry tracks classified as buildings and artificial surfaces (BL3) will arise from the Development, however this artificial habitat will be replaced with similar habitat following construction. Approximately 802m of drainage ditches (FW4) run adjacent to proposed access tracks. These areas may be subject to disturbance and/or rerouting but will not be lost.

Table 7-58 summarises habitat disturbance arising from the clearing of trees within non-woodland habitats. Due to the nature of this habitat (Cutover bog /degraded wet heath mosaic) the removal of trees will not result in loss and will in fact enhance the habitat (invasive conifers will be removed). Felling and transport activities (access by felling and extraction machinery) are likely to result in temporary disturbance to vegetation, while localised soil compaction could potentially be a persistent effect.

Please see Figure 7.9 in conjunction with this section.

Table 7-57: Habitat loss within land ownership boundary [Note – ecology study area = land ownership boundary]

Habitat	Selected as key ecological receptor	Area in Hectares within the Ecology Study Area (ha)	Percentage of total Ecology Study Area (%)	Area of habitat to be lost (ha)	Percentage loss of each habitat type (%)
Conifer Plantation (WD4)	Yes	113.18	94.03 %	18.01*	15.9 %
Scrub (WS1)	Yes	1.18	0.98 %	0.54	45.8 %
Buildings and artificial surfaces (BL3)	No	0.53	0.1 %	0.46	86.8 %
Recolonising bare ground (ED3)	No	0.04	0.03 %	0.03	75.0 %
Other artificial lakes and ponds (FL8)	Yes	0.03	0.02 %	0.03	100 %

81 Scottish Natural Heritage (2016). *Assessing Connectivity with Special Protection Areas* V.3

Habitat	Selected as key ecological receptor	Area in Hectares within the Ecology Study Area (ha)	Percentage of total Ecology Study Area (%)	Area of habitat to be lost (ha)	Percentage loss of each habitat type (%)
Dense bracken (HD1)	No	0.08	0.07 %	0	0 %
Raised bog (degraded) (PB1)	Yes	2.28	1.9 %	0	0 %
Cutover bog / Wet heath (PB4/HH3) Mosaic**	Yes	3.45	2.87 %	0.09	2.6 %
Total		**120.36**	**100 %**	**19.16**	**N/A**

** 0.85 Ha of this total (4.7%) is consented under the grid application*
***This habitat loss is associated with a section of internal access track consented under the grid application.*

Table 7-58: Habitat disturbance associated with felling

Habitat	Selected as key ecological receptor	Area in Hectares within the Ecology Study Area (ha)	Percentage of total Ecology Study Area (%)	Area subject to disturbance (ha)	Percentage subject to disturbanc e (%)
Cutover bog / degraded wet heath (PB4/HH3) mosaic	Yes	3.45	2.87 %	0.07	2.0 %

The construction of Proposed Infrastructure and Proposed Felling will result in a degree of habitat damage and loss. As noted above, areas of peatland habitats within the Proposed Felling zones will be disturbed (access by felling and extraction machinery) but not lost.

The most abundant habitat type within the study area is conifer plantation (WD4) which on its own accounts for over 94% (113.18 Ha) of the study area. This is followed by cutover bog / degraded wet heath (PB4/HH3) mosaic (2.87 %/3.45 Ha) and raised bog (degraded) (PB1) (1.9 %/2.28 Ha).

The habitats which are considered key receptors are conifer plantation (WD4), scrub (WS1), other artificial lakes and ponds (FL8), cutover bog / wet heath (PB4/HH3) mosaic and (degraded) raised bog (PB1). The remainder of habitats within the study area: Buildings and artificial surfaces (BL3), recolonising bare ground (ED3) and dense bracken (HD1) are not considered Key ecological receptors in terms of direct effects due to having either negligible ecological value or not being subject to losses.

A total of 18.01 Ha or 15.9 % of conifer plantation within the study area shall be lost due to the Proposed Felling. It is noted that 0.85 Ha (4.7 %) of this total figure within the land ownership boundary is consented under the Grid Application. These felled areas shall be maintained as treeless areas for the life of the wind farm, but they shall form other semi-natural habitats as vegetation recolonises these areas. It is important to note that conifer plantation is a highly artificial habitat of recent origin and limited biodiversity value, managed primarily as a silvicultural crop for the production of timber. Considering this, a **Long-term Slight Reversible Effect** will result from the Proposed Felling of conifer woodland.

An area of scrub is present within the study area, representing a total area of 1.18 Ha (0.98 %). The total area of habitat loss for this habitat type is 0.54 Ha or 45.8 % of the total habitat type. Scrub is a successional habitat representing the early stages of woodland growth and as such is of recent origin. New areas of scrub are constantly developing in undisturbed areas.

It is considered highly likely that recolonisation would occur following construction of the proposed Wind Farm and any resultant habitat loss would be short-term (1-7 years) in nature. The loss of this habitat would result in a **Short-term Imperceptible Reversible Effect**.

An artificial pond measuring 0.3 Ha will be lost within the proposed borrow pit footprint. It is proposed to construct a new pond within the reinstated borrow pit area following construction (see Appendix A7.9).

An area of 3.45 Ha or (2.87 %) of cutover bog / degraded wet heath mosaic is also present within the study area. A total of 0.09 Ha or 2.6 % of this habitat will be lost within the section of access track between turbines T2 and T3 consented under the Grid Application. Measures to restore/rewet the surrounding this peatland habitat and minimise drainage arising from access track construction are detailed in Appendices A7.9 & A7.13.

Of the 3.45 Ha total present within the study area, 0.07 Ha (2 % of total) of this habitat is within the Proposed Felling buffer (eastern section) around T3. As previously stated, this habitat is likely to be disturbed by felling and timber extraction activities but will not be lost. Considering the temporary nature of disturbance (disturbed areas can be expected to recolonise within 1-7 years) and limited percentage of habitat affected (2 % of total within study area), a **Short-term Slight Reversible Effect** is predicted.

An area of 2.28 Ha or (1.9 %) of degraded raised bog is present within the study area. As previously noted this has been altered by historical drainage and peat cutting activities (the adjoining areas were cut away). This habitat is outside the Proposed Felling buffer.

Potential Indirect Effects

Indirect effects on habitats are limited to watercourses (eroding/upland rivers FW1 and drainage ditches FW4). These habitats could be subject to effects arising from transport of pollutants into the hydrological network. These effects are considered in detail in Section 0 Aquatic Ecology.

No peat drying will arise from the Development as this has already occurred historically when areas of bog were harvested and planted for forestry. Restoration (re-wetting) measures are proposed to allow the bog to regenerate (see Appendices A7.9 & A7.13).

7.9.4 Mammals (excluding Bats)

Potential Direct Effects

The Development will lead to a permanent loss of approximately 19.06 Ha or 15.8 % of habitats within the study area, most of which is conifer plantation a (94.03 %). In addition, the felling and maintenance of buffer zones surrounding turbines located in conifer plantation will result in habitat alteration (from conifers and heath/bog and other semi-natural natural habitats). This habitat is widespread in the general area and this small-scale loss of habitat will not result in a significant negative impact on the distribution of local protected mammal fauna including pygmy shrew, Irish hare, Irish stoat, and hedgehog.

Any unmitigated effects on these species will be **Short-term Imperceptible Reversible**.

Badger

While no Badger setts were noted within the study area, soil disturbance attributed to badger was recorded between T2 and T3. Badger have been historically recorded in an adjacent 1 km grid square (S6671) and as such are likely to inhabit the conifer plantations overlapping the Development or adjacent areas. If construction and/or felling were to be carried out in close proximity to an active sett particularly during the breeding season (December to June), this could result in a **Long-term Significant Reversible Effect** (prior to mitigation).

Red Squirrel

Two live sightings of red squirrel were recorded in the locality of the study area, indicating this species is likely to inhabit the conifer plantations overlapping the Development. The total loss of conifer plantation within the land ownership boundary is 18.01 Ha or 15.9 % of the total habitat type within the study area. There are however ample areas of conifer plantation in the greater surroundings. Conifer plantations are harvested and replanted as trees reach maturity and therefore the availability of this habitat is subject to transition as a resource for red squirrel under normal circumstances. As red squirrel are present in the area, a precautionary approach is required, and it is assumed that they may occur in any area of woodland where clear-felling is proposed.

There is therefore the possibility that red squirrel breeding or resting sites may be disturbed during any clear-felling operations. It is considered that prior to mitigation a **Short-term Significant Reversible Effect** on red squirrel could occur.

Pine Marten

Evidence of the presence of this species was found within the Site; however, no pine marten were found during the mammal survey within the footprint of the Development or the greater study area. As the presence of pine marten has been confirmed however, a precautionary approach is required, and it is assumed that they may occur in any area of woodland where clear-felling is proposed.

Dens are normally used only during the breeding season. Pine marten use refuge sites outside these periods which are less visible and more casual. Therefore, it is considered that the permanent loss of conifer plantation is unlikely to impact negatively on the local pine marten population. There is however still the possibility that pine marten breeding or resting sites may be disturbed during any clear-felling operations. It is considered that prior to mitigation a **Short-term Significant Reversible Effect** to pine marten could arise.

Otter

No holts were recorded during surveys at watercourses within 150m of any elements of the Development. Therefore, there shall be no direct effects on otter during construction.

Potential Indirect Effects

The construction phase of the Development may result in temporary disturbance to fauna, however as this will be temporary (< 1 year) in duration, and given the habitats present in the wider environment, affected mammals will be able to move to other locations in the wider area until the disturbance has ceased. There is the potential for disturbance to badgers setts within and in close proximity to construction works. As such, the potential exists for a **Short-term Significant Reversible Effects** on badger prior to mitigation.

Prior to mitigation, there is potential for indirect effects to otter through the transport of pollutants and/or contaminants which could negatively affect the aquatic animals such as salmonids on which otter depend. These effects could occur as the result of felling and/or construction activities. As such, any effects on otter prior to mitigation are predicted to be **Short-term Significant** and **Reversible**.

7.9.5 Bats

The Site is comprised predominantly of conifer plantation and open upland vegetation. Watercourses in the study area are limited to small 1st order streams and drainage ditches that run adjacent to forest blocks and/or access tracks. The conifer woodlands dominating the Site are connected to the surrounding landscape by the network of hedgerows separating agricultural fields. There are no hedgerows within the footprint of the Development.

Habitats occurring within the Site identified as having high ecological value for bats included access tracks (Buildings and artificial surfaces) and conifer plantation, due to their linear and edge features which are of value to both foraging and commuting bats. Scrub which occurs within the

Site is of low-moderate value for bats and is fragmented. Degraded raised bog and cutover bog/heath, limited areas of which occur within the Site are of low value for bats.

In summary, the areas of highest value to bats are the linear and edge habitats represented by access tracks and the edges of conifer plantation blocks.

No potential roosting features are present within the Site.

Foraging or commuting bats may be subject to disturbance effects during the construction phase of the Development through increased noise and lighting on the Site.

The Development will lead to a permanent loss of approximately 19.06 Ha or 15.8 % of habitats making up the study area. The vast majority of the study area is covered by conifer plantation (113.18 Ha or 94.03 %). The wooded habitats within the study area were not found to contain any potential bat roost trees. Wooded habitats and hedgerows are widespread in the general area and this small-scale loss of habitat will not result in a negative impact on the distribution of the local bat population. No commuting routes will be severed. The proposed felling will in fact increase the amount of edge habitat and thereby foraging opportunities for bats.

Onsite human construction activity may also cause disturbance to these animals. The foreseen potential effects are as follows:

Potential Direct Effects

- No direct effects have been identified

Potential Indirect Effects

- Temporary reduction in insect biomass arising from clearance of vegetation
- Disturbance due to increased human activity as bats are very intolerant of changes to their environment; and
- Loss of insect prey species due to tree trimming which may reduce the amount of available food for bats

As no roosts were recorded within the Site and as no commuting routes will be severed the effects on bats during the construction phase will be **Temporary Slight to Moderate Effects** and will require mitigation measures.

7.9.6 Avifauna

The effects of infrastructure such as wind farms on birds are highly variable and depend on a wide range of factors including the specification of the development, the topography of the surrounding land, the habitat affected and the numbers and species of birds present [65]. Developments such as wind farms in general have many effects on birds, including potential direct habitat loss and fragmentation, displacement due to disturbance, death and injury due to collisions and disruption of local or migratory movements, with a consequent increase in energy expenditure [66]. However, the principal concerns in terms of adverse effects on birds are (1) disturbance displacement, (2) collision, (3) habitat loss/change and (4) barriers to movement[82]. Of these, only two are applicable during construction: 1) disturbance and / or displacement and 2) habitat loss/alteration. Habitat loss is the primary potential direct impact during constructions and although disturbance and / or displacement could be viewed as effective habitat loss, these are essentially indirect and therefore covered under Indirect Effects.

[82] Langston, R.H.W. (2010). Birds and wind farms: where next? BOU Proceedings – Climate Change and Birds. http://www.bou.org.uk/bouproc-net/ccb/langston.pdf

Regarding effects on bird species, it is considered that the main potential source of effects on avian fauna is the construction of the wind farm, particularly the construction of turbines and the associated road network. In this case construction stage disturbance can be considered to be limited to the Development, including the Proposed Felling.

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

- Possible loss or deterioration of habitats; and
- Disturbance or displacement of birds.

Consideration of the survey data against Table 7-55 indicates that four 'Very High' sensitivity species have been recorded within the core study area (the Development and associated flight activity buffer):

- Golden Plover (Annex I, Red Listed)
- Hen Harrier (Annex I, Amber Listed)
- Kingfisher (Annex I, Amber Listed)
- Peregrine Falcon (Annex I, Green Listed)

Consideration of the survey data against Table 7-55 indicates seven 'High' sensitivity species have been recorded within the core study area (the Development and associated flight activity buffer). In addition, the High sensitivity species Grey wagtail has been included due to the likelihood of it's occurring downstream.

- Grey Wagtail (Red Listed)
- Kestrel (Red Listed)
- Meadow Pipit (Red Listed)
- Redwing (Red Listed)
- Snipe (Red Listed)
- Swift (Red Listed)
- Woodcock (Red Listed)

'Medium' sensitivity species are considered in this assessment. The 12 'Medium' sensitivity species recorded within the core study area (the Development and associated flight activity buffer) are:

- Goldcrest (Amber Listed)
- Greenfinch (Amber Listed)
- House Martin (Amber Listed)
- House Sparrow (Amber Listed)
- Lesser Black-backed Gull (Amber Listed)
- Linnet (Amber Listed)
- Sand Martin (Amber Listed)
- Skylark (Amber Listed)
- Starling (Amber Listed)
- Swallow (Amber Listed)
- Wheatear (Amber Listed)
- Willow Warbler (Amber Listed)

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

- Buzzard (Green Listed)
- Grey Heron (Green Listed)
- Great Spotted Woodpecker (Green Listed)
- Sparrowhawk (Green Listed)
- White-throated Dipper (Green Listed)

7.9.6.1 Habitat Loss or Alteration

Habitat loss can be direct through land take of breeding or foraging habitats for key species or indirect such as effective habitat loss through avoidance or disturbance. For direct effects during construction land take of potential breeding or foraging habitat is the primary impact. This may constitute land stripping or vegetation removal affecting ground nesting birds, hedgerow removal or trimming if this takes place during the breeding season and loss of nesting or roosting sites such as trees.

Effects on avifauna are assessed following guidance in Percival[61]. As outlined previously, key avian receptors have been assigned an evaluation of importance (or sensitivity) for assessment. Following this the significance of potential effects are rated as a product of both the magnitude of the predicted effect and the importance value (sensitivity) of the key receptor affected, based on the probability of the likely impact occurring.

The construction of the hardstandings, road and other infrastructure will result in some habitat damage and loss. Permanent felling of forestry will also be required around the turbines and at pinch points/swept path areas.

For the purpose of the consideration of the potential effects to birds, species have been grouped into three categories namely passerines and pigeons/doves, birds of prey and waders/waterfowl with kingfisher considered separately. A passerine is any bird of the order Passeriformes, which includes more than half of all bird species. A notable feature of passerines is the arrangement of their toes (three pointing forward and one back) which facilitates perching. The group are sometimes known as perching birds or, less accurately, as songbirds. Pigeon/dove belong to the order Columbidae comprised of birds with stout bodies, short necks and slender bills which primarily feed on seed, fruits and plants. Bird of prey are raptors that actively hunt other bird species. Waders are shorebirds with the majority of species eating small invertebrates picked out of mud or exposed soil.

<u>Passerines and Woodpecker</u>

The loss of habitat due to the construction of the project has the potential to affect passerines. Habitat loss is inevitable in the Development of any wind farm, especially when the Development of turbine foundations and hard stands, access roads and other associated construction is considered. This can result in reduced feeding and nesting opportunities for birds. However, direct habitat loss by the Development of wind farms tends to be relatively small65.

The Site is a predominantly closed habitat of conifer woodland with some open habitats present in areas around the boundary of the Site. Conifer woodland is suboptimal habitat for most passerine species. The Development will result in the loss of 18.01 Ha (15.9 %) of conifer plantation, 1.18 Ha (45.8 %) of scrub, 0.09 Ha (2.6 %) of cutover bog/wet heath, 0.03 Ha (100%) of artificial pond, 0.03 Ha (75 %) of recolonising bare ground within the study area (see Table 7-57). It is noted that 0.85 Ha (4.7 %) of conifer plantation and 0.09 Ha (2.6 %) of cutover bog/wet heath loss within the study area (land ownership boundary) are associated with the consented Grid Application.

Temporary disturbance of 0.07 Ha (2.0 %) of cutover bog/wet heath mosaic will also occur (see Table 7-58).

Goldcrest is a species which will nest in conifer woodland, habitat which is common in the Development and surrounding study area. The resultant loss for goldcrest is deemed to be a **Long-term Imperceptible Effect** and **Reversible**.

The limited open habitats within the Development site such as bog, heath and scrub, provide foraging and nesting habitat for meadow pipit, wheatear, skylark and linnet. The loss of scrub and disturbance to bog/heath habitats on these species will be a **Permanent Slight Impact** and **Reversible.** Also, as clear-felled habitat is revegetated it will provide further foraging habitat for these species.

Most of the conifer plantation dominated site provides limited foraging and nesting habitat for starling, greenfinch and willow warbler. The latter is often also associated with scrub. House sparrow are typically associated with hedgerows and artificial human habitats, but their presence indicates they may forage in the habitats on site. The loss of improved grassland, scrub, grassy verges and dry heath on these species is deemed to be **Medium-term Slight Effects and Reversible**. As clear-felled conifer habitat revegetates it will provide some foraging habitat for these species.

Woodland edges provide foraging and nesting habitat to species such as starling, greenfinch, great spotted woodpecker and willow warbler. There is therefore potential for a **Temporary Slight Effect** on these species which is **Reversible**.

Great spotted woodpecker is a species which typically nests in oak woodlands, with some coniferous woodland nearby. Conifer plantation is common within the area of the Development. There will be the loss of 18.01 Ha (15.9 % of total habitat) of conifer plantation. The resultant loss for greater spotted woodpecker is deemed to be **Permanent Slight Effect** and **Reversible.**

Grey wagtail forage in streams and rivers, and often nest in old bridges or buildings. As such there will be no direct effects on this species. Redwing is a winter visitor, associated primarily with its foraging habitats, predominantly farmland and also upland grasslands. Due to the absence of these habitats from the site, there will be no direct effects on this species.

The hirundines recorded (swallow, house martin and sand martin) forage on the wing over a diverse range of habitats, and breed in buildings (swallow, house martin) and sandy banks (sand martin). As their breeding habitats are not present onsite and foraging habitat will not be appreciably impacted, a **Temporary Imperceptible Effect** is predicted.

It is therefore, not expected that the wind farm development will cause a reduction in the baseline population of passerines as the area of nesting/foraging habitat lost will be **Imperceptible to Slight**. It is considered that the proposed effect of habitat loss will be a **Permanent Imperceptible to Slight Effect** which is **Reversible***.* However, the removal of scrub or felling of trees during the nesting season for birds could result in a **Localised Temporary Significant Reversible Effect** on nesting birds.

<u>Birds of Prey, Waders/Waterfowl and Kingfisher – Other Target Species</u>

Table 7-59 below displays the direct impact character during construction as well as the significance of effects without the implementation of mitigation.

Table 7-59: Impact of habitat loss to other target species

Key Receptor (Sensitivity)	Construction Direct Impact Character	Significance without mitigation
Buzzard (Low)	Observed during winter and summer VP surveys, with most observations (26) recorded in winter 2019/20. The highest number of breeding season observations (21) were made during summer 2021. No displaying or other behavior confirming breeding activity was recorded, however. As such it is considered that a pair could be breeding in or in the vicinity of the conifer plantations overlapping the Development <u>*on a precautionary basis*</u>. There will be the permanent loss of 18.01 Ha (15.9 % of total habitat) of conifer plantation, which is widespread in the area.	Magnitude of effects is assessed as **Medium** (5-20% habitat lost), species sensitivity is **Low**, overall effect significance is **Very Low** (Criteria: Percival, 2003). The proposed effect of habitat loss will be a **Long-term Not Significant Effect** (Criteria: EPA, 2022).

Key Receptor (Sensitivity)	Construction Direct Impact Character	Significance without mitigation
Golden Plover (Very High)	Golden plover were recorded three times during winter 2019/20 VP surveys. One record of Golden Plover calling but not seen was recorded in April 2021. The Site contains limited habitat of value for foraging golden plover. Of the habitats present, raised bog and wet heath/cutover bog mosaic are the most likely to be used by golden plover. There will be loss of 0.09 Ha of wet heath/cutover bog (1.6 % of peatland habitats) and temporary disturbance to 0.07 Ha (2 %) of wet heath/cutover bog.	Magnitude of effects is assessed as **Low** (1-5 % habitat lost), species sensitivity is **Very High**, overall effect significance is **Medium** (Criteria: Percival, 2003). The proposed effect of habitat loss will be a **Long-term Imperceptible Effect** (Criteria: EPA, 2022)
Hen Harrier (Very High)	There were no sightings of hen harrier during the breeding seasons of 2020 and 2021, and an absence of suitable breeding habitat in the core study area was noted. A total of six observations of hen harrier were recorded during winter 2019-20. All birds observed were lone ringtails. Two of the flight lines recorded entered the study area buffer, while the remainder were outside. Hen Harrier was not observed during winter 2020-21. There is limited (foraging) habitat for hen harrier within the core study area.	Magnitude of effects is assessed as **Low** (1-5 % habitat lost), species sensitivity is **Very High**, overall effect significance is **Medium** (Criteria: Percival, 2003). The proposed effect of habitat loss will be a **Long-term Slight Effect** (Criteria: EPA, 2022)
Kestrel (High)	Kestrel was recorded infrequently during winter 2019/20 and summer 2020, with three observations recorded in each season. Higher levels of activity were recorded during winter 2020-21 (6 records) and summer 2021 (17 records). The presence of 2 juveniles and adult pairs among summer 2021 records confirms breeding activity is occurring in the immediate environs of the site. Conifer plantation, wet heath/cutover bog and scrub all provide potential breeding and foraging habitats. There will be the permanent loss of 18.01 Ha (15.9 %) of conifer plantation, temporary loss of 1.18 Ha (45.8 %) of scrub, permanent loss of 0.09 (2.6 %) of wet heath/cutover bog and temporary disturbance of 0.07 Ha (2%) of wet heath/cutover bog, which represent potential breeding and foraging habitats for kestrel. Similar habitat is also present in the general area.	Magnitude of effects is assessed as **Medium** (5-20% habitat lost), species sensitivity is **High**, overall effect significance is **High** (Criteria: Percival, 2003). The proposed effect of habitat loss will be a **Long-term Moderate Effect** (Criteria: EPA, 2022)
Kingfisher (Very High)	Kingfisher was not recorded within the Development site or during any surveys within the study area. This species has been included as a precautionary measure as it may nest and forage in the wider river network downstream of the Development. The Site does not contain any rivers. There will be no direct loss of habitat.	Magnitude of effects is assessed as **Negligible** (<1% habitat lost), species sensitivity is **Very High**, overall effect significance is **Low** (Criteria: Percival, 2003). The proposed effect of habitat disturbance will be a **Short-term Not Significant Effect** (Criteria: EPA, 2022)

Key Receptor (Sensitivity)	Construction Direct Impact Character	Significance without mitigation
Lesser Black-backed Gull (Medium)	Recorded during summer 2020, feeding in a newly cut field outside the core study area; also recorded flying thought the SNH buffer in summer 2021. There will be no loss of lesser black-backed gull habitat.	Magnitude of effects is assessed as **Negligible** (<1% habitat lost), species sensitivity is **Medium**, overall effect significance is **Very Low** (Criteria: Percival, 2003). The proposed effect of habitat loss will be a **Long-term Imperceptible Effect** (Criteria: EPA, 2022)
Peregrine Falcon (Very High)	Individual birds were seen on four occasions during winter 2019/2020 and included both male and female birds. Three of the flight lines recorded traversed areas both inside and outside the study area buffer, while one was outside the study area buffer. Three Peregrine flight lines were recorded in summer 2021; all were individuals flying within the SNH buffer. Peregrine falcon may nest rarely in disused corvid nests, however more favorable nesting habitat in the form of quarries is available in the surrounding area.	Magnitude of effects is assessed as **Low** (1-5% habitat lost), species sensitivity is **Very High**, overall effect significance is **Medium** (Criteria: Percival, 2003). The proposed effect of habitat loss will be a **Long-term Slight - Moderate Effect** (Criteria: EPA, 2022)
Snipe (High)	Snipe were not recorded once during the breeding season (summer 2021). This record was of a flock of 30 birds flying across the SNH buffer in late August, indicative of a migratory flight. No observations of breeding Snipe within the Site were recorded, and potentially suitable habitat is extremely limited by the dominance of conifer plantations. Snipe were recorded incidentally on four occasions during winter 2019-20 VP surveys. A bird was heard calling from VP2 on 20th December 2019. The remainder of observations were of birds flying outside the study area buffer (19th December 2019 and 25th January 2020 from VP1; 23rd January 2020 from VP2). One record was made during winter 2020-21: four Snipe were flushed from a field outside the SNH buffer by horses.	Magnitude of effects is assessed as **Low** (1-5% habitat lost), species sensitivity is **High**, overall effect significance is **Low** (Criteria: Percival, 2003). The proposed effect of habitat loss will be a **Long-term Not Significant Effect** (Criteria: EPA, 2022)
Sparrowhawk (Low)	Sparrowhawk were recorded a total of 10 times during summer 2021, with all observations being of individual birds. A territorial display flight outside the SNH buffer was noted amongst these records. Sparrowhawk were recorded frequently during the 2019/2020 winter season, with a total of 18 individual observations, and less frequently during winter 2020-21 (6 observations). Conifer plantation is considered to be the most important foraging and breeding habitat on site. There will be the permanent loss of 18.01 Ha (15.9 %) of conifer plantation (potential breeding and foraging habitat) within the Site; habitat which is present within the general area.	Magnitude of effects is assessed as **Medium** (5-20% habitat lost), species sensitivity is **Low**, overall effect significance is **Very Low** (Criteria: Percival, 2003). The proposed effect of habitat loss will be a **Long-term Slight Effect** (Criteria: EPA, 2022)

Key Receptor (Sensitivity)	Construction Direct Impact Character	Significance without mitigation
Woodcock (High)	Breeding Woodcock surveys in summer 2021 confirmed breeding activity at the site and/or immediate vicinity. Based on the level of activity detected, the surveyor estimated 1-2 pairs of Woodcock could potentially be breeding at the site or nearby, however this has not been confirmed by surveys. Single observation during winter 2020 (incidentally recorded during mammal survey), and single observation during winter 2021 (recorded during transect survey). There is potential for direct impacts to breeding and foraging habitat within the Site. Conifer plantation, scrub and peatland habitats are likely to be the most important habitats for this species on site. There will be the permanent loss of 18.01 Ha (15.9 % of total habitat) of conifer plantation within the site; habitat subject to ongoing change during the forestry activities which is present within the general area.	Magnitude of effects is assessed as **Low** (1-5% habitat lost), species sensitivity is **High**, overall effect significance is **Low** (Criteria: Percival, 2003). The proposed effect of habitat loss will be a **Long-term Not Significant effect** (Criteria: EPA, 2022)

7.9.6.2 Disturbance and Displacement

High levels of activity and disturbance during construction may cause birds to vacate territories close to works, especially for species vulnerable to disturbance. The displacement of birds from areas within and surrounding developments can effectively amount to habitat loss. Examples of causes of disturbance during construction which may lead to displacement are vehicle and personnel movements, vibration and noise effects from the construction process and visual intrusion[65].

Studies during construction[62] and during operational effects of wind farms[63] have shown that certain species (e.g. large wading species) can be affected particularly as a result of construction effects (in that the affected species fail to recover to pre-construction densities).

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

Indirect Construction Effects on Avifauna are shown in Table 7-60 below.

Table 7-60: Indirect Construction Effects on Avifauna

Key Receptor (Sensitivity)	Construction Indirect Impact Character	Significance without mitigation
Buzzard (Low)	Observed during winter and summer VP surveys, with most observations (26) recorded in winter 2019/20. The highest number of breeding season observations (21) were made during summer 2021. No displaying or other behavior confirming breeding activity was recorded, however. As such it is considered that a pair could be breeding in or in the vicinity of the conifer plantations overlapping the Development *on a precautionary basis*. There will be the permanent loss of 18.01 Ha (15.9 % of total habitat) of conifer plantation, which is widespread in the area.	Probability of temporary to short-term effects. Sensitivity: **Low**. Magnitude assessed as **Medium**. Overall significance assessed as **Very Low**. (Criteria: Percival, 2003). Disturbance and/or habitat loss will be a **Short-term Imperceptible Effect** (Criteria: EPA, 2022).

Key Receptor (Sensitivity)	Construction Indirect Impact Character	Significance without mitigation
Great Spotted Woodpecker (Low)	Single bird recorded during botanical surveys in 2020. This species was also recorded during hinterland surveys in 2020 and 2021. Studies on the impact of wind farms during both construction 62 and operation 63 have found little evidence of significant disturbance effects on passerine species. This species could be affected by removal of conifer plantation. Possibly disturbed by noise.	Probability of temporary to short-term effects. Sensitivity: **Low**; magnitude **Low**. Overall impact is **Very Low**. (Criteria: Percival, 2003). Disturbance and/or habitat loss will be a **Short-term Slight Effect** (Criteria: EPA, 2022).
Grey Heron (Low)	This secondary species was recorded on two occasions during winter 2019-20, once during winter 2020-21 and once during summer 2021. Grey heron could occasionally use the drainage ditches and pond at the Site to hunt frogs and tadpoles. These habitats are not overlapped by the Development however they may be subject to indirect effects via changes in water quality.	Magnitude of effects is assessed as **Medium** (5-20% habitat lost), species sensitivity is **Low**, overall effect significance is **Very Low** (Criteria: Percival, 2003). The proposed effect of habitat loss will be a **Short-term Not Significant Effect** (Criteria: EPA, 2022).
Grey Wagtail (High)	This species has been included as it may forage in the wider river network near and downstream of the Development. The Site does not contain any rivers. There will be no direct loss of habitat. Potential effects are considered to be limited to indirect effects on water quality in foraging and breeding territories downstream of the Development.	Probability of temporary to short-term effects. Sensitivity: **High**. Magnitude assessed as **Low**. Overall significance assessed as **Low**. (Criteria: Percival, 2003). Disturbance and/or habitat loss will be a **Short-term Not Significant Effect** (Criteria: EPA, 2022).
Goldcrest (Medium)	Recorded during transect counts within the Site during breeding season 2020 and winter 2020-21. Studies on the impact of wind farms during both construction62 and operation63 have found little evidence of significant disturbance effects on passerine species. Direct breeding habitat loss is the main effect via felling of conifer plantation.	Probability of temporary to short-term effects. Sensitivity: **Medium**; magnitude **Low**. Overall impact is **Low**. (Criteria: Percival, 2003). Disturbance and/or habitat loss will be a **Short-term Slight Effect** (Criteria: EPA, 2022).
Golden Plover (Very High)	Golden plover were recorded three times during winter 2019/20 VP surveys. One record of Golden Plover calling but not seen was recorded in April 2021. The Site contains limited habitat of value for foraging golden plover. Of the habitats present, raised bog and wet heath/cutover bog mosaic are the most likely to be used by golden plover.	Probability of temporary to short-term disturbance to winter birds. Sensitivity: **Very High**. Magnitude assessed as **Negligible**. Overall significance assessed as **Low**. (Criteria: Percival, 2003). Disturbance and/or habitat loss will be a **Short-term Slight Effect** (Criteria: EPA, 2022).

Key Receptor (Sensitivity)	**Construction Indirect Impact Character**	**Significance without mitigation**
Greenfinch (Medium)	Recorded as an additional species during summer VP surveys in 2020 & 2021. Studies on the impact of wind farms during both construction62 and operation63 have found little evidence of significant disturbance effects on passerine species. Direct habitat loss is the main effect via scrub clearance.	Probability of temporary to short-term effects. Sensitivity: **Medium**; magnitude **Low**. Overall impact is **Low**. (Criteria: Percival, 2003). Disturbance and/or habitat loss will be a **Short-term Not Significant Effect** (Criteria: EPA, 2022).
Hen Harrier (Very High)	There were no sightings of hen harrier during the breeding seasons of 2020 and 2021, and an absence of suitable breeding habitat in the core study area was noted. A total of six observations of hen harrier were recorded during winter 2019-20. All birds observed were lone ringtails. Two of the flight lines recorded entered the study area buffer, while the remainder were outside. Hen Harrier was not observed during winter 2020-21. There is limited (foraging) habitat for hen harrier within the core study area. Disturbance during felling and construction works for birds hunting within site and nearby the Site could occur.	Probability of temporary to short-term effects. Sensitivity: **Very High**. Magnitude assessed as **Negligible**. Overall significance assessed as **Low**. (Criteria: Percival, 2003). Disturbance and/or habitat loss will be a **Short-term Slight Effect** (Criteria: EPA, 2022).
Hirundines: House Martin Sand Martin Swallow (Medium)	The site is of limited value for foraging hirundines. Alternative foraging grounds with more favourable habitat are available within the wider landscape. It is also likely these species will continue to use the site during construction.	Probability of temporary to short-term effects. Sensitivity: **Medium**. Magnitude assessed as **Negligible**. Overall significance assessed as **Very Low**. (Criteria: Percival, 2003). Disturbance and/or habitat loss will be a **Temporary Imperceptible Effect** (Criteria: EPA, 2022).
House Sparrow (Medium)	Studies on the impact of wind farms during both construction62 and operation63 have found little evidence of significant disturbance effects on passerine species. This species is reasonably tolerant of human presence, being accustomed to inhabit and exploit artificial habitats.	Probability of temporary to short-term effects. Sensitivity: **Medium**. Magnitude assessed as **Negligible**. Overall significance assessed as **Very Low**. (Criteria: Percival, 2003). Disturbance and/or habitat loss will be a **Temporary Imperceptible Effect** (Criteria: EPA, 2022).

Key Receptor (Sensitivity)	Construction Indirect Impact Character	Significance without mitigation
Kestrel (High)	Kestrel was recorded infrequently during winter 2019/20 and summer 2020, with three observations recorded in each season. Higher levels of activity were recorded during winter 2020-21 (6 records) and summer 2021 (17 records). The presence of 2 juveniles and adult pairs among summer 2021 records confirms breeding activity is occurring in the immediate environs of the site. Conifer plantation, raised bog, wet heath/cutover bog and scrub all provide potential breeding and foraging habitats. These habitats will be subject to loss and/or disturbance.	Probability of temporary to short-term effects. Sensitivity: **High**. Magnitude assessed as **Medium**. Overall significance assessed as **High**. (Criteria: Percival, 2003). Disturbance and/or habitat loss will be a **Short-term Moderate Effect** (Criteria: EPA, 2022).
Kingfisher (Very High)	Kingfisher was not recorded within the Development site or during any surveys within the study area. This species has been included as a precautionary measure as it may nest and forage in the wider river network downstream of the Development. The Site does not contain any rivers. There will be no direct loss of habitat. Potential effects are considered to be limited to indirect effects on water quality in foraging and breeding territories downstream of the Development.	Probability of temporary to short-term effects. Sensitivity: **Very High**. Magnitude assessed as **Low**. Overall significance assessed as **Medium**. (Criteria: Percival, 2003). Disturbance and/or habitat loss will be a **Short-term Moderate Effect** (Criteria: EPA, 2022).
Lesser Black-backed Gull (Medium)	Recorded during summer 2020, feeding in a newly cut field outside the core study area; also recorded flying thought the SNH buffer in summer 2021. There will be no loss of lesser black-backed gull habitat. Potential effects are limited to disturbance of birds foraging in agricultural fields near the Development.	Probability of temporary to short-term effects. Sensitivity: **Medium**. Magnitude assessed as **Negligible**. Overall significance assessed as **Very Low**. (Criteria: Percival, 2003). Disturbance and/or habitat loss will be a **Temporary Imperceptible Effect** (Criteria: EPA, 2022).
Linnet (Medium)	Recorded as an additional species during summer VP surveys in 2020 and 2021. Studies on the impact of wind farms during both construction62 and operation63 have found little evidence of significant disturbance effects on passerine species. Direct habitat loss is the main effect via scrub clearance.	Probability of temporary to short-term effects. Sensitivity: **Medium**; magnitude **Low**. Overall impact is **Low**. (Criteria: Percival, 2003). Disturbance and/or habitat loss will be a **Short-term Slight Effect** (Criteria: EPA, 2022).
Meadow Pipit (High)	Recorded as an additional species during summer VP surveys in 2020 and 2021. Studies on the impact of wind farms during both construction62 and operation63 have found little evidence of significant disturbance effects on passerine species. Direct habitat loss is the main effect via scrub clearance.	Probability of temporary to short-term effects. Sensitivity: **High**; magnitude **Low**. Overall impact is **Low**. (Criteria: Percival, 2003). Disturbance and/or habitat loss will be a **Short-term Slight Effect** (Criteria: EPA, 2022).

Key Receptor (Sensitivity)	Construction Indirect Impact Character	Significance without mitigation
Peregrine Falcon (Very High)	Individual birds were seen on four occasions during winter 2019/2020 and included both male and female birds. Three of the flight lines recorded traversed areas both inside and outside the study area buffer, while one was outside the study area buffer. Three Peregrine flight lines were recorded in summer 2021; all were individuals flying within the SNH buffer. Peregrine falcon may nest rarely in disused corvid nests, however more favourable nesting habitat in the form of quarries is available in the surrounding area. Disturbance unlikely, as the species adapts to disturbance-prone urban habitats easily; also recorded in low densities.	Probability of temporary to short-term effects. Sensitivity: **Very High**. Magnitude assessed as **Negligible**. Overall significance assessed as **Low**. (Criteria: Percival, 2003). Disturbance and/or habitat loss will be a **Short-term Slight Effect** (Criteria: EPA, 2022).
Redwing (High)	Studies on the impact of wind farms during both construction62 and operation63 have found little evidence of significant disturbance effects on passerine species. Flocks of foraging Redwing in agricultural land near the site could occasionally be startled by noise or human presence, however any such effects are likely to be brief, and birds are likely to habituate to such events.	Probability of temporary to short-term effects. Sensitivity: **High**. Magnitude assessed as **Negligible**. Overall significance assessed as **Very Low**. (Criteria: Percival, 2003). Disturbance and/or habitat loss will be a **Brief Imperceptible Effect** (Criteria: EPA, 2022).
Skylark (Medium)	Studies on the impact of wind farms during both construction62 and operation63 have found little evidence of significant disturbance effects on passerine species.	Probability of temporary to short-term effects. Sensitivity: **Medium**; magnitude **Low**. Overall impact is **Low**. (Criteria: Percival, 2003). Disturbance and/or habitat loss will be a **Short-term Slight Effect** (Criteria: EPA, 2022).
Snipe (High)	Snipe were not recorded once during the breeding season (summer 2021). This record was of a flock of 30 birds flying across the SNH buffer in late August, indicative of a migratory flight. No observations of breeding Snipe within the Site were recorded, and potentially suitable habitat is extremely limited by the dominance of conifer plantations. Snipe were recorded incidentally on four occasions during winter 2019-20 VP surveys. A bird was heard calling from VP2 on 20th December 2019. The remainder of observations were of birds flying outside the study area buffer (19th December 2019 and 25th January 2020 from VP1; 23rd January 2020 from VP2). One record was made during winter 2020-21: four Snipe were flushed from a field outside the SNH buffer by horses. The main effect is via disturbance of peatland habitats.	Probability of temporary to short-term effects. Sensitivity: **High**. Magnitude assessed as **Low**. Overall significance assessed as **Low**. (Criteria: Percival, 2003). Disturbance and/or habitat loss will be a **Short-term Slight Effect** (Criteria: EPA, 2022).

Key Receptor (Sensitivity)	Construction Indirect Impact Character	Significance without mitigation
Sparrowhawk (Low)	Sparrowhawk were recorded a total of 10 times during summer 2021, with all observations being of individual birds. A territorial display flight outside the SNH buffer was noted amongst these records. Sparrowhawk were recorded frequently during the 2019/2020 winter season, with a total of 18 individual observations, and less frequently during winter 2020-21 (6 observations). Surveyors did not observe any evidence of Sparrowhawk breeding within the Site. As such, while this species is active in the study area, surveys do not indicate the presence of breeding birds onsite. It is assumed on a precautionary basis for the purposes of assessment that Sparrowhawk could breed onsite in the future. Possible noise/visual intrusion disturbance to hunting/breeding birds within the Site could occur.	Probability of temporary to short-term effects. Sensitivity: **Low**; magnitude **Medium**. Overall impact is **Very Low**. (Criteria: Percival, 2003). Disturbance and/or habitat loss will be a **Short-term Slight Effect** (Criteria: EPA, 2022).
Starling (Medium)	Recorded during winter transect surveys (2019-20) and summer and winter VP surveys (2019, 2020 & 2021). Studies on the impact of wind farms during both construction62 and operation63 have found little evidence of significant disturbance effects on passerine species. Direct habitat loss is the main effect via scrub clearance and felling.	Probability of temporary to short-term effects. Sensitivity: **Medium**; magnitude **Negligible**. Overall impact is **Very Low**. (Criteria: Percival, 2003). Disturbance and/or habitat loss will be a **Short-term imperceptible Effect** (Criteria: EPA, 2022).
Wheatear (Medium)	Studies on the impact of wind farms during both construction62 and operation63 have found little evidence of significant disturbance effects on passerine species.	Probability of temporary to short-term effects. Sensitivity: **Medium**; magnitude **Low**. Overall impact is **Low**. (Criteria: Percival, 2003). Disturbance and/or habitat loss will be a **Short-term Slight Effect** (Criteria: EPA, 2022).
White-throated Dipper (Low)	A breeding pair was recorded along the River Dinin downstream of the Site during hinterland surveys in winter 2019/20. Neither this area and nor any other riverine habitats are overlapped by the Development, however they may be subject to indirect effects via changes in water quality.	Probability of temporary to short-term effects. Sensitivity: **Low;** magnitude **Low**. Overall impact is **Very Low**. (Criteria: Percival, 2003). Disturbance and/or habitat loss will be a **Short-term Imperceptible Effect** (Criteria: EPA, 2022).

Key Receptor (Sensitivity)	Construction Indirect Impact Character	Significance without mitigation
Willow Warbler (Medium)	Studies on the impact of wind farms during both construction62 and operation63 have found little evidence of significant disturbance effects on passerine species. Direct habitat loss is the main effect via scrub clearance and felling.	Probability of temporary to short-term effects. Sensitivity: **Medium**; magnitude **Low**. Overall impact is **Low**. (Criteria: Percival, 2003). Disturbance and/or habitat loss will be a **Short-term Slight Effect** (Criteria: EPA, 2022).
Woodcock (High)	Breeding Woodcock surveys in summer 2021 confirmed low levels of breeding activity at the site and/or immediate vicinity. Based on the level of activity detected, the surveyor estimated 1-2 pairs of Woodcock could potentially be breeding at the site or nearby, however this has not been confirmed by surveys. Single observation during winter 2020 (incidentally recorded during mammal survey), and single observation during winter 2021 (recorded during transect survey). There is potential for indirect impacts to breeding and foraging habitat within the Site.	Probability of temporary to short-term effects. Sensitivity: **High**. Magnitude assessed as **Medium**. Overall significance assessed as **High**. (Criteria: Percival, 2003). Disturbance and/or habitat loss will be a **Short-term Moderate Effect** (Criteria: EPA, 2022).

7.9.7 Aquatic Ecology

The principal effects from the Development on the aquatic environment are expected to occur during the construction phase. Primarily, these risks relate to water pollution and or contamination via siltation, hydrocarbons, concrete and or tree felling. The Construction Environmental Management Plan (CEMP), which details the construction methodology, has been developed to minimise the risk of potential contamination and water pollution. Potential effects relating specifically to hydrology are dealt with in **Chapter 8: Hydrology and Hydrogeology** and peat are dealt with in **Chapter 9: Land and Soils.** The potential effects relating to specific construction-phase activities on the aquatic environment are discussed in detail below.

7.9.7.1 Tree Felling

Felling will be required around all five turbine locations, in addition to access track buffers and 'swept path' felling at pinch points (felling to increase manoeuvring room at tight corners), see Figure 7.9. A total of 18.01 Ha or 15.9 % of conifer plantation shall be lost due to the Development. Whilst the Development catchment area is not considered an acid-sensitive area, there are risks associated with sediment and nutrient run-off in surface waters following tree felling activities, including vehicle tracking and extraction methods. The risks to receiving watercourses is considered highest where downstream hydrological connectivity exists. Of these felling areas, potential indirect hydrological connectivity to the Dinin via its tributaries the Boolyvanannan and un-named (segment code 15_916) streams. Proposed Felling areas, the onsite substation, site compound and hard standings at T1-T5 drain towards these watercourses. Part of the Proposed Felling area at T1 drains towards the Barrow via its tributaries the Rathornan and Boolyrathornan/Tomard. The proposed borrow pit location and access track west of the borrow pit also drains towards the Rathornan.

These watercourses were located 0.29km from the respective turbine locations at their closest point (see Table 7-61). The Dinin and Rathornan Rivers were found to support Salmonid populations. Atlantic salmon were recorded at Site 6 Black Bridge on the Dinin. This Site is within the River Barrow and River Nore SAC.

Salmon is listed as a qualifying interest for the River Barrow and River Nore SAC (002162), which is located c. 3.2 km downstream of the (EPA mapped) source of the Boolyvanannan at its closest point (Black Bridge/Site 6).

Therefore, the Proposed Felling process could result in effects on these watercourses through water quality deterioration via sediment release and nutrient run-off, which may cause effects on salmonid spawning habitat (siltation of gravels) as well as general fisheries habitat. The felling of mature conifers may result in periodic and localised changes to the pH of receiving watercourses ('acid pulses'), which may impact aquatic invertebrate communities and the sensitive developmental stages of salmonids[83]. However, the risk is reduced considerably given that the Development is not situated in an acid-sensitive catchment. Tree felling could also lead to an increase in nutrient enrichment of surface waters should brash remain in the riparian buffer zones.

No freshwater pearl mussel were recorded during aquatic surveys and there are no known populations downstream of the Development in the Dinin or Barrow Rivers. There are isolated records from the Nore downstream at Kilkenny and Thomastown (respectively over 30 km and 55 km downstream from the Development), however the main Nore population is located upstream between Durrow and Abbeyleix.

The trafficking of heavy machinery required for tree felling could lead to pollution of nearby receiving watercourses due to spillage of fuels and hydrocarbons. Haul roads passing close to watercourses could allow the migration of silt-laden run-off into adjacent watercourses via surface water pathways (see effects during turbine delivery below). There is also a risk that machinery associated with tree felling could act as a vector for introducing or dispersing non-native invasive species, which may spread along nearby watercourses.

Potential hydrological effects as a result of tree felling or felling activities are considered in **Chapter 8: Hydrology and Hydrogeology**. Potential tree felling effects on aquatic ecology, in the absence of mitigation, are assessed as being **Significant Negative Short-term** and at the Local Scale. Mitigation is required to avoid potential effects.

7.9.7.2 Infrastructure

The construction of access tracks, temporary compound, onsite substation, turbine foundations and hard-standings will include construction activity, tree felling, earthworks, and drainage. Therefore, the risk of water quality effects on adjacent watercourses via siltation, nutrient run-off and pollution exists.

The onsite substation, temporary site compound, turbine foundations (T2-5), met mast foundation, access tracks and crane hardstandings are within the Dinin catchment and as such may pose a threat to water quality in the Dinin via its tributaries which drain part of the Development catchment (these tributaries themselves are not of ecological significance and as such are of interest primarily in terms of their potential to convey pollutants to higher-value habitats downstream i.e. the Dinin).

The T1 turbine foundation, access tracks and proposed borrow pit are within the Barrow catchment and as such may pose a threat to water quality in the Barrow via its tributaries which drain part of the Development catchment. These tributaries themselves are not of ecological significance in proximity to the proposed site. The Rathornan provides salmonid spawning and nursery habitat c. 4.4 km downstream of the study area (land ownership boundary) and as such this lower section of the Rathornan could potentially be subject to effects (in addition to the primary receptor, the River Barrow). A drain intersecting the proposed access track west of the borrow pit which flows towards the EPA-mapped headwaters of the Rathornan is noted as potentially providing hydrological connectivity between proposed infrastructure and downstream ecological receptors.

Soil excavation works required to facilitate construction may liberate nutrients and increase the sediment load of surface water run-off, potentially affecting water quality and aquatic sensitivities

[83] Finn, R. N. (2007). The physiology and toxicology of salmonid eggs and larvae in relation to water quality criteria. Aquatic Toxicology, 81(4), 337-354.

in down-gradient watercourses. In addition, crushed stone used to construct the hard standings may act as a source of sediment.

Inappropriate management of the excavated material (e.g. inadequate silt fences on drainage channels alongside hard standings) could lead to loss of suspended solids to surface waters.

The use of cement in turbine foundations and for construction of the onsite substation also poses a risk to aquatic life. In the absence of appropriate mitigation, the potential for washout of uncured cementitious material poses a risk of injury or mortality to aquatic animals due to the caustically low pH associated with this type of substance.

Heavy machinery may also lead to pollution of nearby receiving watercourses due to spillage of fuels and hydrocarbons. Haul roads passing close to watercourses could allow the migration of silt-laden run-off into adjacent watercourses via surface water pathways (e.g. wheel rutting; see effects during turbine delivery below). There is also a risk that machinery could act as a vector for introducing or dispersing non-native invasive species, which may spread along nearby watercourses.

Potential hydrological effects are considered in **Chapter 8: Hydrology and Hydrogeology**. Increases in surface water run-off volumes due to the construction phase, including hard-standing areas, are outlined in **Chapter 8: Hydrology and Hydrogeology** and are predicted to be imperceptible.

Given the potential for proposed construction areas to drain towards the Rivers Dinin, Rathornan and Barrow, potential effects on aquatic ecology resulting from construction are considered **Significant Negative, Short-Term** and in the Local Context, in the absence of mitigation.

7.9.7.3 Site Drainage

The construction phase may result in significant changes/alterations to the existing drainage network within the Site, which may increase sediment and nutrient loads to receiving watercourses nearby. Inappropriate management of proposed infrastructure drainage could result in increased risk of water contamination to nearby watercourses via siltation, spillages etc., as well as cause alterations in the existing hydrology of the wider site.

As outlined above, the primary concerns regarding effects on aquatic ecological receptors due to the Development relate to the Dinin and Barrow Rivers, and to a lesser extent the lower reaches of the Rathornan. Increases in surface water run-off volumes due to the construction phase are outlined in **Chapter 8: Hydrology and Hydrogeology** and the effects of the increase in run-off is predicted to have an imperceptible impact on receiving waters.

Therefore, potential effects to aquatic ecology resulting from site drainage works/alterations are considered **Non-Significant Negative, Short-Term** and in the Local Context, in the absence of mitigation.

7.9.7.4 Peat Stability

A Peat Stability Assessment was carried out for the previously Consented Wind Farm 2011 EIS. Ground investigation was carried out at this site in 2020 and reconfirmed the findings of the 2011 Survey (See Appendix A9.1 & A9.2).

The findings of this assessment indicated the peat underlying the proposed infrastructure is very thin (0 - 1.2 m depth), and the stability risk assessment concluded very low and negligible risks. Overall, the peat stability risk assessment concludes the Factor of Safety (FoS) values are of acceptable levels and are greater than the required minimum of 1.3-1.5. The high FoS determined at this site indicates that there is minimal potential for failure i.e. an insignificant risk of peat failure.

Intrusive ground investigations were carried out in 2020 which confirmed the findings of the 2011 assessment. Therefore, it was determined that an updated peat stability assessment was not required.

Peat and topsoil, where present, will be stored beside access roads for use in re-instatement of road shoulders. Consideration will be given to the potential for entrapment of snow and water in their placement.

Although the risk of peat slippage is insignificant, potential effects on aquatic ecology in a 'worst-case scenario' are considered **Significant Negative, Short-Term** and in the Local Context, in the absence of mitigation.

Table 7-61: Summary of hydrological distances of watercourses from turbine locations

Watercourse	Turbine Locations				
	T1	**T2**	**T3**	**T4**	**T5**
Rathornan Stream	530m	720m	1km	900m	1.3km
Boolyrathornan Stream	450m	830m	1.2km	1.2	1.6km
Hill Gallows Stream	760m	1.1km	1.5km	1.4km	1.9km
Boolyvannanan Stream	1.3km	1km	755m	500m	290m
Unnamed Stream (EPA CODE: 15_916)	1.1km	900m	742m	380m	430m
River Dinin [South]	1.6km	1.2km	887m	1km	597m
Unnamed Stream (EPA CODE: 15_424)	1.7km	1.4km	1.2km	1.5km	1.1km
Unnamed Stream (EPA CODE: 15_1183)	1.8km	1.5km	1.1km	1.6km	1.2km
Raheendoran Stream	3.2km	3.1km	3km	3.5km	3.5km
Unnamed Stream (EPA CODE: 14_483)	3.9km	3.8km	3.7km	4.2km	4km
Rossmore Stream (Fushoge)	4.2km	4.1km	3.9km	4.4km	4.2km
Rossmore (Bog) Stream	4.4km	4.3km	4.1km	4.6km	4.3km

7.9.7.5 Pathogens and Invasive Species

Invasive Species
There is a risk that machinery used in constructing the hard standings could act as a vector for introducing or dispersing non-native invasive species, which may spread along nearby watercourses.

There is also a risk that machinery associated with tree felling could also act as a vector for introducing or dispersing non-native invasive species, which may spread along nearby watercourses.

It is difficult to predict with certainty how invasive species as a general group will spread downstream in a river catchment, given the variability of river morphology and flow patterns, and varying modes of dispersal used by different species. Effects arising from invasive flora are likely to be more severe closer to the source of introduction, however spread could continue downstream for considerable distances, resulting in a ***long-term significant impact in the local context,*** with potential for

long-term significant impacts downstream ***at the catchment scale,*** in the absence of mitigation.

Invasive fauna can be assumed to spread more effectively, and due to the difficulty in eradicating such species, ***long-term significant to permanent impacts at the [Barrow] catchment scale*** are predicted, in the absence of mitigation.

Crayfish Plague
There is also a risk that machinery required for excavating hard standings could act as a vector for introducing or dispersing waterborne pathogens, including crayfish plague (*Aphanomyces astaci*). With regards to white-clawed crayfish, the introduction of crayfish plague would result in a ***long-term to permanent significant impact in context of the Barrow catchment***, in the absence of mitigation.

7.9.8 Other Fauna

Common lizard may be directly affected through the loss of scrub and disturbance of raised bog and wet heath/cutover bog arising from the Development. However, since the peatland habitats will revegetate within 1-2 years and scrub will regenerate and also begin to colonise conifer felling areas the loss of habitat will be offset.

The main concern is disruption of actively used breeding habitat during breeding periods which could result in a **Short-term Significant Reversible Effect**.

An artificial pond and is located within the Development footprint, and in addition ephemeral pools may be present during the winter months. As such there is potential for common frog and smooth newt to be affected directly through habitat loss. Some insect habitat (indirectly affecting amphibians through prey reduction) will be lost through land take of scrub.

Common frog and smooth newt may be indirectly affected through sediment or pollution run off into waterbodies. It is considered possible that any unmitigated effects on water quality could be **Significant**. Interference with actively used amphibian breeding habitat during breeding periods could result in a **Short-term Significant Reversible Effect**.

The dragonfly/damselfly species (common hawker dragonfly, large red damselfly, blue-tailed damselfly and common blue damselfly) observed using the pond will be subject to a **Short-term Moderate Reversible Effect.**

It is proposed to create new wildlife pond within the reinstated borrow pit area (see Appendix A7.9)

Dingy skipper could be subject to disturbance and limited habitat loss during the construction phase. The larval foodplant of this species (common bird's foot trefoil) was recorded occasionally beside drainage ditches and within scrub in the study area. Scrub is present within the proposed T2 felling buffer, while drainage ditches are present along sections of proposed upgraded access track. As such, there is potential for disturbance to this species in these areas. Adult butterflies could also be subject to disturbance/habitat loss but can move away from impacted areas and use a wider range of habitats. Habitat disturbance and a reduction in larval foodplant density could result in a **Short-term Significant Reversible Effect**.

It is noted that a 1km grid square record for the larval foodplant of marsh fritillary (devil's bit scabious *Succisa pratensis*) near the northern site entrance is present in NBDC records (recorded in 2012), and another 1km grid square record for this plant species near the grid connection substation at Rossmore is also present in NBDC records (recorded in 2012).

Habitat and botanical surveys were undertaken throughout the land ownership boundary which encompasses the proposed development, and also along the grid connection and at TDR pinch points. These surveys were completed on 9th and 21st July 2020 during favourable weather conditions.

In addition, quadrat surveys were undertaken within the area of raised bog and cutover bog/wet heath within the land ownership boundary on 27th September 2020 during favourable weather conditions. This period corresponds with a key survey period for marsh fritillary: September is the optimal survey period for larval webs when the species is most notable. However, the species was not recorded during any ecological surveys on-site.

A detailed list of all flora species was recorded during these botanical and habitat surveys. The larval foodplant required by marsh fritillary (devil's-bit scabious) was not present within the development boundary or wider study area.

The dominant habitat in this area is *Conifer plantation* (WD4), composed of sitka spruce *Picea sitchensis* and lodgepole pine *Pinus contorta*, with grey willow *Salix cinerea* saplings typically present at points along the plantation edges. This densely planted monoculture offers little in terms of botanical biodiversity. The marginal habitats between blocks of conifer plantation and existing forestry tracks included *Scrub* (WS1) and *Recolonising bare ground* (ED3). *Drainage ditches* (FW4) were also present along forestry tracks.

The habitats onsite potentially most suitable for devil's bit scabious are *Raised bog* (PB1) and *Cutover bog /Wet heath HH3* mosaic (PB4/HH3); however, the physical characteristics and management of these habitats provide sup-optimal conditions for devil's-bit scabious. The desiccated raised bog is dominated by ling heather *Calluna vulgaris.* The cutover bog/wet heath supported an uneven mosaic of bare areas, lower-growing and taller vegetation, with abundant ling heather *Calluna vulgaris* and tormentil *Potentialla erecta*, and some purple moor grass *Molina caerulea* in localised patches. Bilberry *Vaccinium myrtillus* was also present, and soft rush *Juncus effusus* was occasionally recorded. These habitats have been subjected to drainage, and the cutover bog is the product of peat harvesting; these have cumulatively contributed to drying of peat in this area. Areas of invading *Dense bracken* (HD1) and *Scrub* (WS1) are present on the fringes of the cutover bog.

The vegetation in this area is rough and uneven, characterised by dense stands of heather, with open areas of low-growing vegetation, and occasional grass tussocks. The abundance of heather and sparse cover of grasses demonstrates the effect of drainage and peat harvesting in drying out the peat in this area. This, along with invading scrub and bracken has reduced the suitability of the habitat for devil's bit scabious, which favours wetter and more diverse vegetated habitats such as marshes, fens, and wet heath.

The absence of marsh fritillary and it's larval foodplant is corroborated by the absence of records for the species during ecological surveys.

The specific habitat conditions that marsh fritillary requires is low (ideally 25cm or less), open sward with abundant devil's-bit scabious *Succisa pratensis*. These suitable habitats are maintained by a variety of management, accidental or deliberate, including grazing and burning. Management and / or the enhancement of habitat for marsh fritillary often include measures including scrub clearance and low levels of grazing. There was no maintenance of the habitats within the site of the proposed development, with large areas overgrown with ling heather along with scrub and bracken starting to colonise the cutover bog making the area unsuitable for the species.

Habitat surveys were exhaustive and did not detect Devil's Bit Scabious. The botanical survey completed included a Devil's Bit Scabious survey, due to the methodology employed requiring the identification of all species which were encountered.

As such, while this plant species may be present in the local area, habitat and botanical surveys did not detect it, indicating that if it occurs, it is not present in any significant concentration at the site, and is confirmed as being absent from the development footprint. The only area within and in close proximity to the development footprint with potential to support a high density of this plant species is the open area of cutover bog/heath and raised bog between T2 and T3; this area was surveyed intensively during habitat/botanical surveys and quadrat surveys, neither of which yielded any records of Devil's Bit Scabious.

As there were no records of marsh fritillary from ecological site walkovers during a key survey period for the species or records of the food plant critical to the life cycle of the species, the proposed development will not result in a negative effect to the species.

7.10 Operational Phase

The operational phase will have lower potential for effects on the local ecology than the construction phase. The main potential operational effects of the project will arise from the rotation of the blades of the wind turbines and, to a lesser extent, from vehicular movement in relation to wind turbine maintenance along access roads. The rotation of the blades may result in displacement of local wildlife due to the avoidance by birds of the area around the turbines. In addition, the rotating blades present a potential collision hazard to local bird and bat species. The rotation of the blades of the turbines may also result in increased noise levels which may also cause disturbance to local wildlife. There are no expected operational effects on habitats; hence they are not discussed further.

7.10.1 European sites

A Natura Impact Statement (NIS) has been prepared for the Development. The NIS addresses potential effects on European sites resulting from the Development.

7.10.2 Natural Heritage Areas or Proposed Natural Heritage Areas

As discussed in Section 7.9.2, there is one NHA (Coan Bogs) and three pNHAs (Cloghristick Wood, Mothel Church Coolcullen and Whitehall Quarries) within 10 km of the Development. There is no ecological connectivity between the Site and Coan Bogs NHA and/or Cloghristick Wood pNHA. This, in addition to these sites being of importance for non-mobile ecological features (habitats) means no operational phase effects will occur on these sites.

There is potential for operational-phase effects to Mothel Church Coolcullen pNHA and Whitehall Quarries pNHA due to their ecological features being mobile species (Natterer's bat and Peregrine falcon respectively) (both species were recorded at the Development study area) which could be subject to collision risk and/or disturbance displacement effects due to the operation of turbines. Prior to mitigation there is potential for **Long-term Not Significant Effects** to Mothel Church Coolcullen pNHA via collision risk for Natterer's bat. This will be reduced by bat mitigation measures which are detailed below.

There is potential for **Long-term Imperceptible Effects** on Whitehall Quarries pNHA (via collision risk and disturbance/displacement of Peregrine falcon). Effects are considered to be imperceptible due to the core breeding season foraging range of 2 km[81] for peregrine falcon (Whitehall Quarries pNHA is c. 8.1 km from the Development). See section 7.10.5.

7.10.3 Mammals (excluding bats)

The level of human activity associated with the maintenance of the operational windfarm will be infrequent and minimal given that it will be monitored remotely. Maintenance of the felling buffers around turbines will result in periodic disturbance. The Development is located within a commercial forestry area, so there is already disturbance caused by human and machinery activity associated with forestry. As a result, any negative impact to terrestrial fauna during the operational phase of the windfarm would give rise to **Long-term Slight Reversible Effects**.

7.10.4 Bats

According to SNH (2021), the operational phase of wind farms can affect bats in the following ways:

- Collision mortality, barotrauma and other injuries (although it is important to consider these in the context of other forms of anthropogenic mortality)

- Loss or damage to commuting and foraging habitat, (wind farms may form barriers to commuting or seasonal movements, and can result in severance of foraging habitat);
- Loss of, or damage to, roosts;
- Displacement of individuals or populations (due to wind farm construction or because bats avoid the wind farm area).

To ensure that bats are protected by minimising the risk of collision, an assessment of Effect at a site requires an appraisal of:

- The level of activity of all bat species recorded at the site assessed both spatially and temporally.
- The risk of turbine-related mortality for all bat species recorded at the site during bat activity surveys.
- The effect on the species' population status if predicted effects are not mitigated.

In addition, further consideration with regards to the local population are included in the assessment process:

- Is the bat species at the edge of its range?
- Cumulative effects
- Presence of protected sites
- Proximity of maternity roosts
- Key foraging areas
- Key flight lines
- Possible migration routes.

As determined by bat surveys (refer to section 7.5.7) eight species of bat were recorded at the Site. The table below provides an ecological valuation of each bat species that occurs in Ireland and the collision risk factor, in relation to wind farms (according SNH, 2021 and EC, 2020). Four of the bat species recorded at the Site are considered to be High risk (Leisler's bat, Nathusius' pipistrelle, Soprano pipistrelle and Common pipistrelle).

Table 7-62: Ecological evaluation of the bat species recorded during the bat survey (CIEEM Guidelines, 2019) and "Bat Risk" in relation to Wind Turbines (SNH, 2019).

Geographical Scale of Importance	Species	Bat Risk
International	Leisler's Bat	High
Regional	Brown Long-eared Bat Natterer's Bat Nathusius' Pipistrelle	Low Low High
County	-	-
Local	Soprano Pipistrelle Common Pipistrelle Whiskered Bat Daubenton's Bat	High High Low Low
Negligible	-	-

Using the SNH guidelines outlined in Table 7-6, the following risk assessment for the individual turbines in relation to each bat species recorded was completed using the following values:

- Project Size = **Medium** (<10 turbines, however, other wind energy developments within 10km)
- Habitat Risk = **Moderate** (Suitable foraging habitat and connectivity to the wider landscape via linear features)

Therefore, a Site Risk Assessment score value of **3** was applied to the Site as a whole.

7.10.4.1 Impact Assessment

The Impact assessment is determined by multiplying the Site Risk Assessment value (3 as outlined above) by the Ecobat median (most frequent activity category) activity values converted to the percentile score as shown in Table 7-5.

The median activity levels for each of the High Risk (leisler, common pipistrelle, soprano pipistrelle and nathusius' pipistrelle) species were converted to the percentile score and an average taken over the three survey periods for 2020.

The Impact Assessment is then carried out for the individual turbines using the overall site assessment value (4) and compared to the Risk Assessment Matrix (Table 7-63) in order to determine the level of overall risk to the population.

It should be noted that the Impact Assessment is based on the median values to determine overall risk to population.

Table 7-63: Risk Assessment Matrix

	Ecobat activity percentile					
Site Risk	**Nil (0)**	**Low (1)**	**Low – Moderate (2)**	**Moderate (3)**	**Moderate – High (4)**	**High (5)**
Lowest (1)	0	1	2	3	4	5
Low (2)	0	2	4	6	8	10
Medium (3)	0	3	6	9	12	15
High (4)	0	4	8	12	15	18
Highest (5)	0	5	10	15	20	25

Overall assessment value (i.e. Turbine Risk value) is then compared to the ranges below:

Low Overall Risk (0-4)	Medium Overall Risk (5-12)	High Overall Risk (13-25)

7.10.4.2 Leisler's Bat

Four turbine locations have a Moderate Risk (turbine 2, 3, 4 and 5), and one turbine location is of High Risk in relation to Ecobat median values (turbine 1) with regards to Leisler's bat. This is presented in Table 7-64.

Table 7-64: Risk assessment for each turbine location - Leisler's bat

Turbine No.	Site risk value	Ecobat median category	Turbine risk (site risk x Ecobat median category)
1	3	5	**15**
2	3	3	**9**
3	3	4	**12**
4	3	3	**9**
5	3	3	**9**

7.10.4.3 Common Pipistrelle

Three turbine locations have a Moderate Risk (turbines 2, 4 and 5), while two turbine locations are of High Risk in relation to Ecobat median values (turbines 1 and 3) with regards to common pipistrelle. This is presented in Table 7-65.

Table 7-65: Risk assessment for each turbine location – Common pipistrelle

Turbine No.	Site risk value	Ecobat median category	Turbine risk (site risk x Ecobat median category)
1	3	5	**15**
2	3	4	**12**
3	3	5	**15**
4	3	4	**12**
5	3	4	**12**

7.10.4.4 Soprano Pipistrelle

Two turbine locations are of High Risk (turbines 1 and 3), two of Moderate Risk (turbines 2 and 4) and one is of Low Risk in relation to Ecobat median values (turbine 5) with regards to soprano pipistrelle. This is presented in Table 7-66.

Table 7-66: Risk assessment for each turbine location – Soprano pipistrelle

Turbine No.	Site risk value	Ecobat median category	Turbine risk (site risk x Ecobat median category)
1	3	5	15
2	3	3	9
3	3	5	15
4	3	3	9
5	3	1	3

7.10.4.5 Nathusius' Pipistrelle

Four turbine locations are of Moderate Risk (turbines 1,2, 4 and 5), and one turbine is of High Risk in relation to Ecobat median values (turbine 3) with regards to Nathusius' pipistrelle. This is presented in Table 7-67.

Table 7-67: Risk assessment for each turbine location – Nathusius' pipistrelle

Turbine No.	Site risk value	Ecobat median category	Turbine risk (site risk x Ecobat median category)
1	3	4	**12**
2	3	3	**9**
3	3	5	**15**
4	3	3	**9**
5	3	3	**9**

For this ecological assessment, the habitats adjacent to the Development may be considered in terms of extent, diversity, naturalness, rarity, fragility, typicality, recorded history, position, potential value and intrinsic appeal[49]. The potential of these habitats for bat fauna is considered in this framework also. Table 7-68 provides a summary of bat survey data and assessments.

Table 7-68: Summary of bat survey data and assessments

Turbine No.	Risk Assessment Leisler's bat	Risk Assessment Common pipistrelle	Risk Assessment Soprano pipistrelle	Risk Assessment Nathusius' pipistrelle	Clarifying comment	Bat Habitat within 200m	Bat Habitat along wind farm access tracks	Bat encounters wind farm access tracks	If no mitigation is applied, what is the potential impact level?
As indicated in this report	**Turbine risk (site risk x Ecobat median category)**	**Turbine risk (site risk x Ecobat median category)**	**Turbine risk (site risk x Ecobat median category)**	**Turbine risk (site risk x Ecobat median category)**	**Is location of Static at Turbine location (final layout)? Yes/No**			**In vicinity of Turbine location**	**Taking into consideration the clarifying comment.**
1	15	15	15	12	Yes	Yes	Yes	Yes	Moderate-High
2	9	12	9	9	Yes	Yes	Yes	Yes	Moderate
3	12	15	15	15	Yes	Yes	Yes	Yes	Moderate-High
4	9	12	9	9	Yes	Yes	Yes	Yes	Moderate
5	9	12	3	9	Yes	Yes	Yes	Yes	Low-Moderate

The assessments identified an overall potential for impact on the bat population as Medium for all four species should no mitigation be applied.

Bat mortality due to collisions with wind turbines is well known and studies have further shown that bats may be killed without physically contacting turbine blades. The death of bats due to the presence of the operating turbines may reduce local bat populations especially if a turbine is sited near a roost. The planned turbine development is also to be sited within an area which is over-flown by Leisler's bat and forest edge habitats are currently in use by seven other bat species. Although, as yet, there are no published results of a study of bat mortality from Irish wind turbines, considering recent research from mainland Europe and North America, there is an increasing amount of detailed published evidence that wind turbines cause bat fatalities. However, many of these overseas turbine/bat mortality studies are at wind farms, with significantly large numbers of turbines, sited along known bat migration routes where many hundreds or even thousands of bats commute seasonally resulting in numerous deaths and injuries.

There is currently no evidence that mortality of bats on the same scale occurs in Ireland. Also, although it is known that Nathusius' pipistrelle migrates from Scandinavia to Scotland and to the north of Ireland and back again[84], apart from this species, there is currently no evidence that internal or external migration routes of other bat species exist elsewhere in Ireland as no research has been undertaken. It has been suggested that lights for civil aviation above the nacelle may also attract bats but a 2014 study by Bennett and Hale[85] disproved this hypothesis. Nevertheless, risks to bats from wind turbines have to be acknowledged and there is the potential for some bat mortality to occur during the operation of the Development. Therefore, mitigation measures are recommended to reduce the likelihood of such fatalities.

Keyhole felling in woodland plantations for wind turbines (usually carried out to reduce turbulence) creates new edge habitat, which is favoured by certain bat species (particularly pipistrelles) for hunting. If these new woodland edges are too close to turbine blades, there is an increased risk of collision for bats hunting in these areas. Felling of forestry/woodland is required around all turbines (T1-T5).

Furthermore, as indicated in Richardson *et al*[86] common pipistrelle bats may be attracted to wind turbines. The study showed common pipistrelle activity was 37% higher at turbines than at control locations. Soprano pipistrelle showed no increase in activity between the turbine and control locations. The study authors considered that the observed higher levels of activity could be because there are more bats around turbines, or because animals spend more time in these locations relative to controls, even if the number of individual common pipistrelles remains the same. It is not possible to distinguish between these possibilities using acoustic data. In any case, higher levels of activity around turbines are likely to increase fatality risk and help to explain why fatality rates are often not predicted by acoustic surveys for common pipistrelle activity conducted prior to construction.

In the absence of mitigation, two of the seven turbine locations (T1, T3) are assessed as having a potential moderate-high impact to four high risk species recorded within the wind farm (Leisler's bat, common pipistrelle, Nathusius' pipistrelle and soprano pipistrelle).

[84] Russ, J., Hutson, A., Montgomery, W., Racey, P., & Speakman, J. (2001). The status of Nathusius' pipistrelle (*Pipistrellus nathusii* Keyserling & Blasius, 1839) in the British Isles. *Journal of Zoology, 254*(1), 91-100. doi:10.1017/S0952836901000589

[85] Bennett, V.J. and Hale, A.M. (2014). *Red aviation lights on wind turbines do not increase bat-turbine collisions*. Animal Conservation 17: Issue 4, 354-358

[86] Richardson, S.M., Lintott, P.R., Hosken, D.J. et al. Peaks in bat activity at turbines and the implications for mitigating the impact of wind energy developments on bats. Sci Rep 11, 3636 (2021). https://doi.org/10.1038/s41598-021-82014-9

Two turbines (T1 and T3) were assessed as having potential moderate-high effects, two turbines (T2 and T4) are assessed as having potential moderate effects, while one (T5) is assessed as low-moderate (for the same four species). As such, any effects on bats prior to mitigation (particularly felling buffers) are predicted to be **Long-term Significant Effects on a Local Level** and **Reversible**.

The cable for the Grid Application will be laid underground, and no further work will be required. Thus, no effects are envisaged during the operational phase within the grid connection route.

The foreseen potential effects during operation are as follows:

Potential Direct Effects

- Death through collision with turbine blades as bats are known to have difficulty in detecting the moving blades with their echolocation due to the movement and the angle of the blade surfaces
- Death through barotrauma as bats may be killed by the change of atmospheric pressure resulting from the turning blades which can cause their lungs to haemorrhage.

Potential Indirect Effects

- No indirect effects envisaged due to the implementation of mitigation measures and absence of roosts or potential roosts within the Development footprint.

7.10.5 Avifauna

7.10.5.1 Collision Risk

Studies on operational effects of wind farms[63] have shown that certain species do exhibit levels of turbine avoidance during operational phases which may be extrapolated to reductions in breeding bird densities; however, this may not be as significant as previously thought, certainly in comparison to effects during construction [62]. It seems that there is little evidence for consistent post-construction population declines in any species, suggesting for the first time that wind farm construction can have greater effects on birds than wind farm operation; this is supported in the literature [87]. A recent study on the effects of wind turbines on the distribution of wintering farmland birds[87] did not find any consistent patterns of turbine avoidance across the species groups studied (corvids, seed-eaters, gamebirds and skylark).

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

Not all bird species are equally susceptible to collision, and some species suffer proportionately high levels of collision mortality[66]. Morphology, physical flight characteristics and differences in vision are all influencing factors. Martin and Shaw, 2010[88], suggest that it is the characteristics of the section of a birds visual field that projects forward and hence 'looks' that are the key factors.

[87] Devereux, C.L., Denny, M.J.H., Whittingham, M.J. (2008). *Minimal Effects of wind turbines on the distribution of wintering farmland birds.* 45, Journal of Applied Ecology, 2008, pp. 1689-1694.

[88] Martin, G.R. and Shaw, J.M. (2010), *Bird collisions with power lines: Failing to see the way ahead?* Biological Conservation, Vol. 143, pp. 2695-2702.

In some species the vertical extent of the forward binocular vision is reduced and therefore the bird is rendered blind if, whilst in the process of flying it undertakes behaviour such as the detection of conspecifics, remote food sources etc. [88] [89].

Other species have reduced fovea, are emmetropic (default focus is distant) or may contain blind spots in their field of vision (as an evolutionary trait) which may cause susceptibility to collision. Flight height or the flight heights which birds habitually use along either migration or local flight paths is also an influencing factor. Relative size and high wing loading (or low manoeuvrability) are influencing factors as larger birds with poor manoeuvrability are generally perceived as at greater risk of collision with structures (see Brown et al., 1992, quoted in Drewitt and Langston[65]). Various species therefore exhibit different morphological and behavioural attributes which may contribute to collision risk.

Recent studies show that modern, larger multi-MW turbines show comparable fatality estimates with older generation models and expected increases in fatalities due to increases in rotor surface are not as expected, possibly due to increased altitude, increased distance between turbines and slower rotation speeds [90]. Appraisal of collision risk for the Development is based on a predicted rotor envelope of 19.5-136.5m (see Section 7.1).

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

Passerines

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

Non-Passerines

Potential collision risk to non-passerine target species is introduced in the following paragraphs and detailed in Table 7-69.

Collision Risk Modelling

The Collision Risk Model Report (See Appendix A7.10) presents the results of collision risk modelling for the proposed Bilboa Wind Farm, Co. Carlow. This modelling used data from vantage point surveys carried out in the winter of 2019-20, winter 2020-21, and summers of 2020 and 2021. The modelling was carried out using the Scottish Natural Heritage Collision Risk Model (Scottish Natural Heritage, 2000; Band *et al*., 2007 and Band, 2012). The bird occupancy method (Scottish Natural Heritage, 2000) was used to calculate the number of bird transits through the rotors, and the spreadsheet accompanying the Scottish Natural Heritage report was used to calculate collision probabilities for birds transiting through the rotors.

[89] Martin, G. 2011 *Understanding bird collisions with man-made objects: a sensory ecology approach.* Birmingham : Ibis, Vol. 183, pp. 239-254

[90] Krijgsveld K.L., Akershoek K., Schenk F., Dijk F. & Dirksen S. 2009. Collision risk of birds with modern large wind turbines. Ardea 97(3): 357–366.

The following raptor and waterfowl and wader species were recorded in the vantage point surveys:

Buzzard, Peregrine Falcon, Kestrel, Sparrowhawk, Hen Harrier, Lesser Black Backed Gull, Snipe, Golden Plover and Grey Heron.

The following nine raptor, wader and waterbird species were selected for collision risk modelling as they were recorded inside the 500m turbine buffer boundary at rotor swept heights during the VP surveys across 2019, 2020 and 2021:

- Buzzard (*Buteo buteo;* Green-listed);
- Hen Harrier (*Circus cyaneus*; Amber-listed; Annex I)
- Grey heron (*Ardea cinerea*; Green-listed);
- Kestrel (*Falco tinninculus*; Amber-listed);
- Peregrine (*Falco peregrinus*; Green-listed, Annex I);
- Lesser black-backed gull (*Larus fuscus*; Amber-listed);
- Sparrowhawk (*Accipiter nisus*; Amber-listed);
- Golden Plover (*Pluvialis apricaria*; Red-listed; Annex I);
- Snipe (*Gallinago gallinago*; Amber-listed).

These species have been selected because they were recorded within the 500 m buffers and at rotor swept heights, and are of conservation concern: i.e., they are red or amber-listed in Birds of Conservation Concern Ireland 2020-2026 (Gilbert et al., 2021), and/or are listed on Annex I of the Birds Directive (2009/147/EC) or green-listed and sensitive to wind farm developments (i.e. Buzzard). For all the other species recorded but not included for collision risk modelling, the effective collision risk can be assumed to be zero.

Table 7-69: Potential collision risk to non-passerine target species

Key Receptor (Sensitivity)	**Operational Direct Impact Character**	**Significance without mitigation**
Buzzard (Low)	Twenty-seven buzzard fatalities have been recorded within the European context, with 27 recorded in a review of 46 wind farms up to 2004[91]. However, this number is low in relation to the estimated European population of up to one million pairs[92] and best available knowledge suggests mortality due to wind farms is not sufficient to cause significant population declines of this green-listed species. Predicted number of collisions is 0.04 per year.	**Collision:** Magnitude effects is assessed as **negligible** (<1% population lost), species sensitivity is **low**, overall effect significance is **very low** (Criteria: Percival, 2003). Probability of impact **extremely unlikely**, based on recorded flight activity, height of proposed rotor envelope (19.5 – 136.5 m), published best scientific knowledge and moderate frequency of occurrence at the Site.

[91] Hotker, H., Thompson, K.H., Jeromin, H. (2006). *Impacts on biodiversity of exploitation of renewable energy sources: the example of birds and bats- facts, gaps in knowledge, demands for further research, andornithological guidelines for the development of renewable energy exploitation.* Bergenhusen: Michael-Otto-Institut im NABU, 2006.

[92] Gensbol, B. and Thiede, 2008 W. *Birds of Prey* Collins.

Key Receptor (Sensitivity)	Operational Direct Impact Character	Significance without mitigation
		Collision risk will be a **long-term imperceptible effect** (Criteria: EPA, 2022).
Golden Plover (Very High)	Golden plover have been recorded in low numbers as collision fatalities at wind farms [91] [93]. The published avoidance rate by SNH for collision risk modelling for this species is 98% [94], indicating a high micro-avoidance rate regarding collision with turbines. In further support of a high micro-avoidance rate, a study in the Netherlands of three operational wind farms where golden plovers were both diurnally and nocturnally active found no fatalities90. Golden plovers were not recorded breeding within the 500 m turbine envelope during the survey period which reduces magnitude. Predicted number of collisions is 0.46 per year.	**Collision:** Magnitude effects is assessed as **negligible** (<1% population lost), species sensitivity is **very high**, overall effect significance is **low** (Criteria: Percival, 2003). Probability of impact **extremely unlikely**, based on recorded flight activity, height of proposed rotor envelope (19.5 – 136.5 m), published best scientific knowledge and moderate frequency of occurrence at the Site. Collision risk will be a **long-term slight effect** (Criteria: EPA, 2022).
Hen Harrier (Very High)	No hen harriers were observed breeding on site, so potential collision risk significantly reduced due to the absence of breeding as territorial display known as 'skydancing', which often occurs at heights within the predicted rotor envelope. Documented as occasionally soaring or arriving at winter roosts 'at height' [95], however no documented roosts were recorded within 10 km of the Site. Literature suggests flying at low heights is a 'ubiquitous trait' supported by a number of studies[96]. The species has a high, published avoidance rate (99%) [94] in relation to wind turbines. Predicted number of collisions is 0.00 per year.	**Collision:** Magnitude effects is assessed as **negligible** (<1% population lost), species sensitivity is **high**, overall effect significance is **very low** (Criteria: Percival, 2003). Probability of impact **extremely unlikely**, based on recorded flight activity, height of proposed rotor envelope (19.5 – 136.5 m), published best scientific knowledge and low frequency of occurrence at the Site. Collision risk will be a **long-term imperceptible effect** (Criteria: EPA, 2022).

[93] Grunkorn, T. (2011). Proceedings: *Conference on wind energy and wildlife impacts*, 2-5 May 2011,Trondheim, Norway. Trondheim : NINA,.

[94] Scottish Natural Heritage (2017). Avoidance Rate Information and Guidance Note. *www.snh.gov.org.*

[Online] https://www.nature.scot/sites/default/files/2018-01/Guidance%20-%20Avoidance%20rates%20guidance%20-%20table%20only.pdf

[95] Watson, D. (1977). The Hen Harrier: T and AD Poyser,

[96] Whitfield, D.P. and Madders, M. (2006). *Upland Raptors and the Assessment of Wind farm Impacts*. Ibis 148, 43-56. British Ornithologists Union.

Key Receptor (Sensitivity)	Operational Direct Impact Character	Significance without mitigation
Kestrel (High)	Twenty-nine fatalities were recorded across 46 wind farms in a published review of the effects of turbine collision on birds in the European context [91]. The published avoidance rate is 95% [94]. Predicted number of collisions is 0.04 per year.	**Collision:** Magnitude effects is assessed as **negligible** (<1% population lost), species sensitivity is **high**, overall effect significance is **very low** (Criteria: Percival, 2003). Probability of impact **extremely unlikely**, based on recorded flight activity, height of proposed rotor envelope (19.5 – 136.5 m), and moderate frequency of occurrence at the Site. Collision risk will be a **long-term imperceptible effect** (Criteria: EPA, 2022).
Lesser Black-backed Gull (Medium)	A published review of 46 European wind farms [91] found 45 fatalities across wind farms. However, the published avoidance rate[94] is 98%, suggesting birds exhibit a high level of micro-avoidance. Predicted number of collisions is 0.03 per year.	**Collision:** Magnitude effects is assessed as **negligible** (<1% population lost), species sensitivity is **medium,** overall effect significance is **very low** (Criteria: Percival, 2003). Probability of impact **extremely unlikely**, based on recorded flight activity, height of proposed rotor envelope (19.5 – 136.5 m), published best scientific knowledge and moderate frequency of occurrence at the Site. Collision risk will be a **long-term imperceptible effect** (Criteria: EPA, 2022).
Peregrine Falcon (Very High)	Evidence of collision fatality is low, with only two birds recorded in published reviews of wind farm fatalities[91]. The SNH recommended avoidance rate for collision-risk modelling is 98%[94], suggesting high micro-avoidance capabilities. Predicted number of collisions is 0.00 per year.	**Collision:** Magnitude effects is assessed is **negligible** (<1% population lost), species sensitivity is **high**, overall effect significance is **very low** (Criteria: Percival, 2003). Probability of impact **extremely unlikely**, based on recorded flight activity, height of proposed rotor envelope (19.5 – 136.5 m), published best scientific knowledge and moderate

Key Receptor (Sensitivity)	Operational Direct Impact Character	Significance without mitigation
		frequency of occurrence at the Site. Collision risk will be a **long-term imperceptible effect** (Criteria: EPA, 2022).
Snipe (High)	A published review of 46 European wind farms [91] found 45 fatalities across wind farms. However, the published avoidance rate [94] is 98%, suggesting birds exhibit a high level of micro-avoidance. Predicted number of collisions is 0.01 per year.	**Collision:** Magnitude effects is assessed as **negligible** (<1% population lost), species sensitivity is **high,** overall effect significance is **very low** (Criteria: Percival, 2003). Probability of impact **extremely unlikely**, based on recorded flight activity, height of proposed rotor envelope (19.5 – 136.5 m), published best scientific knowledge and moderate frequency of occurrence at the Site. Collision risk will be a **long-term imperceptible effect** (Criteria: EPA, 2022).
Sparrowhawk (Low)	Sparrowhawks are a resident species of the wind farm study area, although no breeding has been recorded within the Site. Published fatality rates are low, with two fatalities from a review of 46 wind farms across Europe[91]. Predicted number of collisions is 0.01 per year.	**Collision:** Magnitude effects is assessed as **negligible** (<1% population lost), species sensitivity is **low**, overall effect significance is **very low** (Criteria: Percival, 2003). Probability of impact **extremely unlikely**, based on recorded flight activity, height of proposed rotor envelope (19.5 – 136.5 m), published best scientific knowledge and moderate frequency of occurrence at the Site. Collision risk will be a **long-term imperceptible effect** (Criteria: EPA, 2022).
Grey heron (low)	Two flights within the study area buffer were recorded. Predicted number of collisions is 0.01 per year.	**Collision:** Magnitude effects is assessed as **negligible** (<1% population lost), species sensitivity is **low**, overall effect significance is **very low** (Criteria: Percival, 2003).

Key Receptor (Sensitivity)	Operational Direct Impact Character	Significance without mitigation
		Probability of impact **extremely unlikely**, based on recorded flight activity, height of proposed envelope rotor envelope (19.5 – 136.5 m), published best scientific knowledge and moderate frequency of occurrence at the Site. Collision risk will be a **long-term imperceptible effect** (Criteria: EPA, 2022).
Woodcock (High)	A published review of 46 European wind farms[91] found one fatality across wind farms. However, the published avoidance rate[94] is 98%, suggesting birds exhibit a high level of micro-avoidance. This species was not recorded flying at rotor swept heights, so the effective collision risk for this species is zero.	**Collision:** Magnitude effects is assessed as **negligible** (<1% population lost), species sensitivity is **high**, overall effect significance is **very low** (Criteria: Percival, 2003). Probability of impact **extremely unlikely**, based on recorded flight activity, height of proposed rotor envelope (19.5 – 136.5 m), published best scientific knowledge and frequency of occurrence at the Site. Collision risk will be a **long-term imperceptible effect** (Criteria: EPA, 2022).

7.10.5.2 Displacement and disturbance

There is evidence that the rotor blades of wind turbines during operation can displace or exclude some species, which effectively results in habitat loss for these birds. Habitat loss can be direct through land take of breeding or foraging habitats for key species or indirect such as effective habitat loss through avoidance or disturbance due to factors such as perceived collision risk. Birds may therefore avoid areas proximal to turbines until habituation takes place. There are examples in the literature of habituation in species such as geese and swans[97] [98].

[97] Madsen, J., Boertmann, D. (2008) Animal behavioural adaptation to changing landscapes: spring-staging geese habituate to wind farms. Landscape Ecology, Vol. 23, pp. 1007-1011. (Madsen and Boertmann, 2008)

[98] Fijn, R., Krijgsveld, K., Tijsen, W.I, Prinsen, H and Dirksen Sjoerd (2012). *Habitat use, disturbance and collision risks of Bewick's Swans Cygnus columbianus bewickii wintering near a wind farm in the Netherlands.*: Wildfowl and Wetlands Trust, 2012, Wildfowl, Vol. 69, pp. 97-116.

Available evidence suggests that breeding passerines are not adversely affected by the presence of wind turbines. For example, a German study found no effect on numbers or spatial distribution of skylarks within 1km of turbines[99].

Whitfield and Madders[96], suggest that most studies do not detect any significant displacement of raptor species by wind turbines although there are occasional notable exceptions.

Displacement of birds by the presence of turbines is not considered to be a significant effect on the species assemblage given the limited amount of habitat available onsite and the availability of habitat in the greater area.

7.10.5.3 Barrier Effect

One of the potential operational effects of wind farms is avoidance where the wind farm may act as a barrier to movements[64]. The effect of birds altering their migration flyways or local flight paths to avoid any infrastructure is a form of displacement[65]. The primary impact of barrier effect is increased energy expenditure when birds have to fly further to circumvent an obstacle.

Effects can be highly variable and range from slight 'checks' in-flight direction, height or speed, through to larger diversions around objects. Studies have shown that birds on migration may show avoidance of wind farms[64] but the observed distances involved were trivial in regard to total migration distances, and hence energy expenditure.

In relation to nocturnal flight activity recent studies utilising radar on both offshore and coastal wind farms in Europe have recorded macro-avoidance rates in wildfowl at least as high, or higher at night than during the day, implying that diurnal avoidance rates are comparable to those in periods of lower visibility[100]. In the same study migrating flocks at night were recorded increasing their distance from individual turbines once inside the wind farm and also travelling in the corridors between turbines (Desholm and Kahlert, 2005)[100].

Potential disturbance and barrier effects due to the operation of the Development are outlined in Table 7-70 below.

Table 7-70: Disturbance and Barrier effect on target species

Key Receptor (Sensitivity)	Operational Direct Impact Character	Significance without mitigation
Buzzard (Low)	**Disturbance:** In a review of the published effects of wind farms on buzzard populations[91], it was found that overall, effects on buzzard populations post-construction, across both winter and breeding seasons was not significant and that buzzards do show habituation to the presence of wind farms[91]. **Barrier Effect:** Barrier effects on either migration or regular flights of Buzzard has been shown at two out of six studies to date (2004) in a European context [91]. The overall	**Disturbance:** Magnitude of effects is assessed as **Medium** (5-20% of habitat/population lost), species sensitivity is **Low**, overall effect significance is **Very Low** (Criteria: Percival 2003). Magnitude **Imperceptible** due to published habituation to wind farms; overall significance considered an **Imperceptible Long-term Effect** (Criteria: EPA 2022).

[99] Langston, R.H.W and Pullan, J.D. (2004). Effects of Wind Farms on Birds. Convention on the Conservation of European Wildlife and Habitats (Bern Convention).Nature and Environment, No. 139.Council of Europe Publishing, Strasbourg.

[100] Desholm, M., Kahlert, J. (2005). *Avian Collision Risk at an offshore windfarm.*: Biology Letters, 2005, Vol.1, pp. 296-298.

Key Receptor (Sensitivity)	Operational Direct Impact Character	Significance without mitigation
	barrier effect was not shown to be significant.	**Barrier Effect:** Magnitude effects is assessed as **Medium** (5-20% of habitat/population lost), species sensitivity is **Low**, overall effect significance is **Very Low** (Criteria: Percival 2003). Magnitude to birds in terms of energy expenditure assessed as **Imperceptible**; magnitude of daily barrier effect assessed as **Imperceptible**; overall significance considered an **Imperceptible Long-term Effect** (Criteria: EPA 2022).
Golden Plover (Very High)	**Disturbance:** Possible disturbance during winter months from feeding or roosting locations; feeding is mainly nocturnal and ample displacement habitat is available during daylight hours. Two observations of the species (22 birds) over study area. Literature suggests differences in densities pre- and post-construction of wind farms is not significant62; displacement is not significant but may occur up to 175 m[91]. **Barrier Effect:** Low published avoidance rates of wind farms90 and changes in densities within wind farms post construction62, suggests wind farms do not act as significant barriers to golden plover.	**Disturbance:** Magnitude of effects is assessed as **Negligible**; species sensitivity is **Very High**. Overall impact is **Low** (Criteria: Percival 2003). Magnitude **Not Significant**; overall significance considered Long-term, **Not Significant Effect** (Criteria: EPA 2022). **Barrier Effect:** Magnitude effects is assessed as **Negligible** (<1 % habitat lost), species sensitivity is **Very High**, overall effect significance is **Low** (Criteria: Percival, 2003). Magnitude to birds in terms of energy expenditure assessed as **Imperceptible**; magnitude of daily barrier effect assessed as **Imperceptible** as literature suggests low published avoidance rates of wind farms; overall significance considered an **Imperceptible Long-term Effect** (Criteria: EPA, 2022).
Hen Harrier (Very High)	**Disturbance:** No breeding or roosting takes place within the subject site; all observations were from winter 2019/20. Noise disturbance/visual intrusion unlikely to deter foraging as evidence suggests birds may continue to utilise wind farms post construction[101].	**Disturbance:** Magnitude effects is assessed as **Low** (< 1% population/ habitat lost), species sensitivity is **Very High**, overall effect significance is **Medium** (Criteria: Percival, 2003). Magnitude **Low**; overall significance

[101] Robinson, C., Lye, G. Battleby (2012). Pauls Hill Windfarm: Flight Activity and Breeding success of Hen Harrier.: Scottish Natural Heritage/Natural Power Consultants, 2012. Sharing Good Practice: Assessing the Impacts of Windfarms on Birds.

Key Receptor (Sensitivity)	Operational Direct Impact Character	Significance without mitigation
	Barrier Effect: Although barrier effect has been documented in at least one study in the European context; recent evidence suggests that birds continue to use wind farms post construction [96] [101] indicating wind farms may not be significant barriers.	considered a **Long-term not significant Effect** (Criteria: EPA, 2002). **Barrier Effect:** Magnitude effects is assessed as **Negligible** (< 1% population/ habitat lost), species sensitivity is **Very High**, overall effect significance is **Low** (Criteria: Percival, 2003). Magnitude to birds in terms of energy expenditure assessed as **Not Significant**; magnitude of daily barrier effect assessed as **Not Significant**; overall significance considered **Long-term not significant Effect** (Criteria: EPA, 2002).
Kestrel (High)	**Disturbance:** Disturbance (in terms of minimal distance to wind farm) has been recorded in 14 studies on wind farms in Europe; however, the maximum distance recorded was 150 m[91]. This is unlikely to be significant. Habituation to wind farms has been recorded in kestrel[91]. **Barrier Effect:** Barrier effects have been shown to a degree in either migrating kestrel or regular flight paths within the European context[91].	**Disturbance:** Magnitude of effects is assessed as **Medium**; species sensitivity is **High**, overall effect significance is **High** (Criteria: Percival 2003). Magnitude **Moderate** due to published habituation to wind farms; overall significance considered **Long-term Moderate Effect** (Criteria: EPA 2022). **Barrier Effect:** Magnitude of effects is assessed as **Medium** (5-20% of habitat/population lost), species sensitivity is **High**, overall effect significance is **Low** (Criteria: Percival 2003). Magnitude in terms of energy expenditure assessed as **Slight**; magnitude of daily barrier effect assessed as **Slight** as literature suggests low published avoidance rates of wind farms with habituation; overall significance considered a **Moderate Long-term Effect** but with habituation a **Slight Long-term Effect** (Criteria: EPA 2022).
Kingfisher (Very High)	**Disturbance:** In a review of the published effects of wind farms on birds[91], there was no information available on Kingfisher populations post-construction. The species was not recorded on-site, so any effects are likely to be negligible.	Magnitude of effects is assessed as **Negligible**; Species sensitivity is **Very High**, overall effect significance is **Low** (Criteria: Percival 2003). Magnitude **Not Significant** due to

Key Receptor (Sensitivity)	Operational Direct Impact Character	Significance without mitigation
	Barrier Effect: Barrier effects on either migration or regular flights of Kingfisher has not been shown to date (2004) in a European context[91]. The species was not recorded on-site, so any effects are likely to be negligible.	species being not recorded on site; overall significance considered **Long-term Not Significant Effect** (Criteria: EPA 2022). **Barrier Effect:** Magnitude effects is assessed as **Negligible** (<1% habitat lost), species sensitivity is **Very High**, overall effect significance is **Low** (Criteria: Percival, 2003). Magnitude to migrating birds in terms of energy expenditure assessed as **Imperceptible**; magnitude of daily barrier effect assessed as **Imperceptible**; overall significance considered an **Imperceptible Long-term Effect** (Criteria: EPA 2022).
Lesser Black-backed Gull (Medium)	**Disturbance:** Of a literature review, carried out by Percival61, all studies which indicated gull species being significantly affected or being a species found to have collided, were identified at wind farms on costal habitats. It is uncertain that disturbance may impact gull species in-land. **Barrier Effect:** Species such as gulls will be more at risk from collision effects as a result of their flight behaviour, but less sensitive to disturbance and displacement effects[102]. For gull species such as lesser black-backed, herring and greater black-backed gull, some studies indicate evidence for attraction, whereas others for displacement, with the remainder indicating no significant response61 [103].	**Disturbance:** Magnitude of effects is assessed as **Low** (1-5% habitat/population lost), species sensitivity is **Medium**, overall effect significance is **Low** (Criteria: Percival 2003). Magnitude **Not Significant** due to published habituation to wind farms; overall significance considered **Long-term Not Significant Effect** (Criteria: EPA 2022). **Barrier Effect:** Magnitude of effects is assessed as **Low** (1-5% population/habitat lost), species sensitivity is **Medium**, overall effect significance is **Low** (Criteria: Percival 2003). Magnitude to birds in terms of energy expenditure assessed as **Imperceptible**; magnitude of daily barrier effect assessed as **Imperceptible**; overall significance considered an **Imperceptible Long-term Effect** (Criteria: EPA 2022).
Peregrine Falcon (Very High)	**Disturbance:** Possible disturbance to foraging birds through noise, visual intrusion. No displacement from breeding sites due to none being recorded within the	**Disturbance:** Magnitude of effects is assessed as **Negligible**; species sensitivity is

[102] Humphreys, E.M., Cook, A.S.C.P., Burton, N.H.K. (2015). Collision, Displacement and Barrier Effect Concept Note BTO Research Report No. 669. The British Trust for Ornithology, The Nunnery, Thetford

[103] Cook, A.S.C.P., Humphreys, E.M., Masden, E.A. and Burton, N.H.K. (2014). The avoidance rates of collision between birds and offshore turbines. BTO.

Key Receptor (Sensitivity)	Operational Direct Impact Character	Significance without mitigation
	Site boundary[104]. **Barrier Effect:** Recorded infrequent flight activity suggests high proportion of flight activity below rotor height; the wind farm is unlikely to act as a significant barrier to a species such as peregrine.	**Very High**. Overall impact is **Low** (Criteria: Percival 2003). Magnitude **Not Significant** due to low level of sightings within the Site; overall significance considered **Long-term Not Significant Effect** (Criteria: EPA 2022). **Barrier Effect:** Magnitude of effects is assessed as **Low** (1-5% population/habitat lost); species sensitivity is **Very High**. Overall impact is **Low** (Criteria: Percival 2003). Magnitude to birds in terms of energy expenditure assessed as **Imperceptible**; magnitude of daily barrier effect assessed as **Imperceptible**; overall significance considered an **imperceptible, long-term Effect** (Criteria: EPA, 2022)
Snipe (High)	**Disturbance:** Possible disturbance during winter months from feeding or roosting locations; feeding is mainly in heath areas and grassy verge where invertebrates are present. Numbers recorded on site are low in relation to National Threshold (1-9 birds). Literature suggests differences in densities pre- and post-construction of wind farms has a significant impact upon snipe within the area62. **Barrier Effect:** Recorded infrequent flight activity suggests low proportion of flight activity below rotor height; the wind farm is unlikely to act as a significant barrier to a species such as snipe.	**Disturbance:** Magnitude of effects is assessed as **Negligible** (<1% population/habitat lost), species sensitivity is **High**, overall effect significance is **Very Low** (Criteria: Percival 2003). The proposed impact of disturbance will be a **Long-term Slight Effect** (Criteria: EPA 2022). **Barrier Effect:** Magnitude of effects is assessed as **Low** (<1% population/habitat lost), species sensitivity is **High**, overall effect significance is **Low** (Criteria: Percival 2003). Magnitude to birds in terms of energy expenditure assessed as **Imperceptible**; magnitude of daily barrier effect assessed as **Imperceptible** as literature suggests low published avoidance rates of wind farms; overall significance considered an **Imperceptible Long-term Effect** (Criteria: EPA 2022).
Sparrowhawk (Low)	**Disturbance:** In a review of the published effects of wind farms on sparrowhawk	**Disturbance:**

[104] Scottish Natural Heritage (2012). Assessing the cumulative impact of onshore wind energy developments. Scottish Natural Heritage.

Key Receptor (Sensitivity)	Operational Direct Impact Character	Significance without mitigation
	populations[91], it was found that overall, effects on sparrowhawk populations post-construction, across both winter and breeding season was not significant. Sparrowhawk do show habituation to the presence of wind farms[91]. The species was also observed to be breeding on the outer edge of the Site. **Barrier Effect:** Sparrowhawk is considered to be less sensitive or less willing to change their original migration direction when approaching wind farms[91]. The species also avoided wind farms less often and their local populations were less influenced by wind farms. The overall barrier effect was not shown to be significant.	Magnitude of effects is assessed as **Medium**, species sensitivity is **Low**, overall effect significance is **Low** (Criteria: Percival 2003). Magnitude **Not Significant** due to published habituation to wind farms; overall significance considered **Long-term Not Significant Effect** (Criteria: EPA 2022). **Barrier Effect:** Magnitude effects is assessed as **Low** (1-5% habitat/population lost), species sensitivity is **Low**, overall effect significance is **Low** (Criteria: Percival 2003). Magnitude to birds in terms of energy expenditure assessed as **Imperceptible**; magnitude of daily barrier effect assessed as Imperceptible; overall significance considered an **Imperceptible Long-term Effect** (Criteria: EPA 2022).
Grey heron (low)	**Disturbance:** In a review of the published effects of wind farms on grey heron populations[91], it was found that overall, effects on grey heron populations post-construction, across both winter and breeding seasons was not significant and that grey herons exhibit very low avoidance of wind farms, implying minimal disturbance effects. **Barrier Effect:** Barrier effects on either migration or regular flights of grey heron have been shown for four out of seven studies in a European context[91]. The overall barrier effect was not shown to be significant.	**Disturbance:** Magnitude of effects is assessed as **negligible**, species sensitivity is **low**, overall effect significance is **very low** (Criteria: Percival 2003). Magnitude **imperceptible** due to published habituation to wind farms; overall significance considered an **imperceptible long-term Effect** (Criteria: EPA 2022). **Barrier Effect:** Magnitude of effects is assessed as **low** (1-5% of habitat/population lost), species sensitivity is **low**, overall effect significance is **very low** (Criteria: Percival 2003). Magnitude to birds in terms of energy expenditure assessed as **imperceptible**; magnitude of daily barrier effect assessed as **imperceptible**; overall significance considered an **imperceptible long-term Effect** (Criteria: EPA 2022).

Key Receptor (Sensitivity)	Operational Direct Impact Character	Significance without mitigation
Woodcock (High)	**Disturbance:** As a nocturnal species, it is unlikely to be affected by noise/visual intrusion. **Barrier Effect:** Home ranges are small with birds recorded flying up to 1 km from nests sites to forage[105]. No published evidence of barrier effect to migrating birds [91].	**Disturbance:** Magnitude of effects is assessed as **Low**, species sensitivity is **High**, overall effect significance is **Low** (Criteria: Percival 2003). Magnitude **Not Significant**; overall significance considered **Long-term Not Significant Impact** (Criteria: EPA, 2022). **Barrier Effect:** Magnitude effects is assessed as **Low** (Guide: 1-5% habitat lost), species sensitivity is **High**, overall effect significance is **Low** (Criteria: Percival, 2003). Magnitude to migrating birds in terms of energy expenditure assessed as **Imperceptible**; magnitude of daily barrier effect assessed as **Imperceptible** as literature suggests low published avoidance rates of wind farms; overall significance considered an **Imperceptible Long-term Effect** (Criteria: EPA, 2022).

7.10.5.4 Hen Harrier – avoidance of breeding habitat creation

It has been identified that the construction of wind farms in upland afforested areas can give rise to the creation of suitable habitat for breeding Hen harrier through tree felling and the subsequent establishment of scrubby vegetation[106]. The unintentional creation of such habitats in the vicinity of wind turbines though felling of forestry can give rise to negative effects on Hen harrier.

As such, mitigation is required to prevent the establishment of Hen harrier breeding habitat at the wind farm following the felling of conifer stands.

7.10.6 Aquatic Ecology

Operational wind farms are not normally considered to have the potential to significantly affect the aquatic environment. The main risk to watercourses is via water quality effects, when oils and lubricants are used on the Site (e.g. infrastructure maintenance). If such substances leaked from the turbines or maintenance areas or were disposed of inappropriately, there is a risk of water contamination and subsequent effects on aquatic ecology.

[105] Hoodless, A.N., Hirons, G.J.M. (2007). *Habitat selection and foraging behaviour of breeding Eurasian Woodcock Scolopax rusticola: a comparison between contrasting landscapes*. Hoodless, A.N., Hirons, G.J.M. 149, IBIS, 2007, pp. 234- 249.

[106] Scottish Natural Heritage (2016) Wind farm proposals on afforested sites –advice on reducing suitability for hen harrier, merlin and short-eared owl

However, the likelihood of this occurring is very low, and the potential significance of this impact can be mitigated through effective mitigation and appropriate management. Spills of any oil or fuels from site vehicles onto hard standings and access tracks may leach to adjacent watercourses. However, this is unlikely to be a significant effect considering the low volumes of vehicular traffic involved in typical wind farm operations and the high standards that are implemented on a well-managed site.

There is limited potential for sediment release due to maintenance of felling buffers during the operational phase, however such disturbance will be intermittent and felled material can be left in place to avoid disturbance by machinery. Due to the natural 'grassing-over' the drainage swales and revegetation of other exposed surfaces, and the non-intrusive nature of site operations, there is a negligible risk of sediment release to the watercourses during the operational stage. Although the risk of peat slippage is assessed as being low to negligible there is potential for effects on aquatic ecology during the operational phase.

There is a potential risk of some hydrocarbons polluting the watercourses following run-off from the hard standings. There is, therefore, a potential for small oil spills which may enter surface waters and cause effects to aquatic ecology.

An increase in peak runoff rates will occur due to the increased area of hard surfaces, however this is minimal relative to the overall catchment size. The capacity of drainage and runoff attenuation infrastructure has been designed to reflect the increased overall area of hard surfaces.

Potential operational phase effects on aquatic ecology are considered **moderate short-term** and in the Local Context, in the absence of mitigation.

7.10.7 Other Fauna

Common lizard, common frog and smooth newt could potentially be subject to effects arising from vegetation clearance carried out to maintain turbine buffers. Effects on these species are considered **Short-term Slight Reversible Effects** and in the Local Context, in the absence of mitigation.

No effects on the dragonfly/damselfly species observed onsite are predicted for the operational phase.

It is noted that the creation of a wildlife pond within the reinstated borrow pit area will offset the temporary loss of this habitat during construction.

Dingy Skipper could potentially be subject to effects arising from vegetation clearance carried out to maintain turbine buffers. Effects on this species are considered **Short-term Moderate Reversible Effects** and in the Local Context, in the absence of mitigation.

7.11 Potential Effects During Decommissioning

Decommissioning activities will take place in a similar fashion to the construction phase. Potential effects will be similar to the construction phase but on a reduced scale. Potential Effects during decommissioning on the following are addressed below:

- Designated Nature Conservation Sites
- Habitats and Flora
- Mammals (excluding Bats)
- Bats
- Avifauna
- Aquatic Ecology and Fisheries
- Other Species

7.11.1 European Sites

A Natura Impact Statement (NIS) has been prepared for the Development. The NIS addresses potential effects on European sites resulting from the Development.

7.11.2 Natural Heritage Areas or Proposed Natural Heritage Areas

No effects to Natural Heritage Areas or Proposed Natural Heritage Areas are predicted to occur during decommissioning.

7.11.3 European Sites

Decommissioning may result in some temporary loss of habitat, primarily conifer plantation at access points which may require partial removal to facilitate the removal of turbine blades. This vegetation clearance would result in a **Short-term Imperceptible Reversible Effect** on the aquatic environment (potential indirect effects to European sites downstream).

7.11.4 Mammals (excluding Bats)

Vehicular traffic during decommissioning along access roads may result in fatalities; however, this is not expected to be significant due to the mainly diurnal requirement for access and speed restrictions which will be in place. It is considered unlikely that direct effects on badger during the decommissioning process will be significant, as setts are unlikely to have become established in locations to be affected.

The potential exists for indirect effects via both visual and noise disturbance, in particular decommissioning works overlapping with periods of activity by badger. Badgers may also be excluded from foraging areas due to screening/fencing erected during works. Indirect effects are considered unlikely to be significant due to works primarily taking place in daylight hours and the short duration of works.

<u>Otter</u>

It is considered extremely unlikely that direct effects on otter during the decommissioning process will be significant. Otters may be indirectly impacted through decommissioning works which disturb occupied breeding or resting sites. This is considered unlikely due to roads and stream/river crossings already being in place, and the low suitability of the small streams in the study area to host breeding sites.

Sediment and/or contaminated run-off entering streams and waterways could reduce water quality within areas where prey items occur. An increase in sediment could also lead to the smothering of spawning grounds if present thereby inducing longer term effects on prey availability; however, this should be minimal during the decommissioning process. It is considered that indirect effects on otter are unlikely.

7.11.5 Bats

The possible direct effects on bats during the decommissioning phase of the wind farm are greatly reduced compared with the construction phase of the project; works will be limited to turbine removal, resulting in potential disturbance only.

As such, potential effects due to decommissioning will be limited to:

- *Disturbance due to increased human activity.*
- *Trimming of vegetation to accommodate turbine removal.*

7.11.6 Avifauna

7.11.6.1 Potential Direct Effects

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

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

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

It is likely that the time period for decommissioning of the project would be c. 6 months.

Passerines

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

Birds of Prey

Surveys conducted for the Development indicate that Kestrel, Buzzard and Sparrowhawk may breed within the study area and surrounding landscape. Tree trimming will not be carried out during the bird breeding season. There shall be no further habitat loss during the decommissioning phase. Decommissioning during the breeding season may result in some minimal disturbance to breeding Kestrel, Sparrowhawk and Buzzard due to increased human activity and noise. The resultant effect on birds of prey is a **Temporary Imperceptible Reversible Effect.**

Waders and waterfowl

Lesser black-backed Gull and Snipe have been observed traversing the site, and breeding Woodcock have been recorded within the Site. The increase in human activity and noise may result in minimal temporary disturbance to these species.

Golden plover were observed three times within the study area (flight paths) and did not land; on one occasion this species was heard calling only. No effect is anticipated for this species

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

Kingfisher & Grey Wagtail

These species were not observed within the Site and there are no suitable habitats for these species on site. Underground cables along the cable route will stay in place. The resultant impact to Kingfisher and Grey Wagtail would be a **Temporary Imperceptible Reversible Effect**.

7.11.6.2 Potential Indirect Effects

The decommissioning phase of the Development poses similar risks of potential effects vis-á-vis the construction phase. However, it should be noted that the magnitude of the effect of decommissioning is normally reduced as all infrastructure is already in situ.

7.11.7 Aquatic Ecology

The decommissioning phase poses similar risks of potential effects to the construction phase. However, it should be noted that the magnitude of the effect of decommissioning is normally reduced as all infrastructure is already in situ. With suitable planning and provision of adequate mitigation, potential negative effects on the receiving aquatic environment during decommissioning can be minimised.

The decommissioning phase is described in **Chapter 5: Project Description** of this EIA Report and these works will be subject to a decommissioning plan, to be agreed with Carlow County Council.

During decommissioning, the turbines and foundations would likely be dismantled to below ground level. The crane hardstandings will be left in situ, along with the proposed Wind Farm tracks, for use by the landowner. This approach is considered to be less environmentally damaging than seeking to remove foundations, cables and roads entirely. The approach to decommissioning will be confirmed based on best practice at the time.

Potential decommissioning phase effects on aquatic ecology are considered **Slight Negative, Short-term** and in the Local Context, in the absence of mitigation.

7.11.8 Other Fauna

Effects on other fauna will be similar to the construction phase but greatly reduced.

7.12 Cumulative Effect Assessment

The CIEEM EcIA Guidelines[22] state that 'Cumulative effects can result from individually insignificant but collectively significant actions taking place over a period of time or concentrated in a location. Cumulative effects are particularly important in EcIA as ecological features may be already exposed to background levels of threat or pressure and may be close to critical thresholds where further impact could cause irreversible decline. Cumulative effects can also make habitats and species more vulnerable or sensitive to change.' Projects and proposals are identified as having potential to contribute to cumulative effects, in two categories: additive/incremental effects, and associated/connected effects. The guidance also notes it may be necessary to include constructed developments whose full environmental effects are not yet felt, and developments specifically referenced in national or local plans and policies.

The surrounding environment is dominated by conifer plantation and agricultural land. The main damaging operations and threats to the greater regions ecological resources are afforestation, industrialised agriculture and overgrazing. Afforestation i.e. the planting of conifer crops has affected the habitats within the study area.

The Site is dominated by conifer plantation with the added impact of the construction of forestry access roads, to plant, manage and harvest the plantation. The habitats formerly within the footprint of the plantation have been altered dramatically as a result of afforestation, with only fragmented sections of heath, and bog remaining. Forestry and agriculture creates habitat uniformity, negatively effects river catchments, and alters nesting and feeding habitats for animals. Specific threats and potentially damaging operations to valuable habitats include land drainage and reclamation and fertilisation. In addition, illegal dumping poses threats to the environment.

In-combination effects may occur should indirect effects such as a decline in water quality be sufficiently significant to cumulatively add to existing pressures on key species and habitats in the surrounding environment. To inform the current appraisal, planning searches were carried out on the relevant planning authority webpages[107] [108] [109] [110]. The lands at Carrigthomas, Macroom Co. Cork form part of the overall project and relate to replant lands. As such the lands are considered cumulatively with other elements of the wind farm project in this section.

7.12.1 Replant Lands

Replacement replanting of forestry in Ireland is subject to licence in compliance with the Forestry Act 1946 as amended. The consent for such replanting is covered by statutory instrument (S.I.) 558 of 2010 European Communities (Forest Consent and Assessment) Regulations 2010 as amended. This legislation provides for development of afforestation and forest road construction project's compliance with the Environmental Impact Directive insofar as it applies to forestry development.

As it is proposed to fell approximately 23.36 ha (17.16 ha for the Proposed Wind Farm, 6.2 ha for the Grid Application) of coniferous forestry for the Development (the total proposed felling includes 18.01 ha within the land ownership boundary and 5.35 ha outside the land ownership boundary). Replant lands of the same area (total proposed felling) are required. The replacement replanting of forestry can occur anywhere in the State subject to licence.

It is proposed to replant 23.36 ha on lands in Carrigthomas, Co. Cork (51.961275,-8.935654) (see Appendix A7.8 for Figures) which has been granted Forest Service Technical Approval for afforestation. These replanting lands are to fulfil the replanting obligations under the Tree felling Licence (TFL).

The habitats present within the replant lands are shown in Appendix A7.8.

7.12.1.1 Habitats

Improved Agricultural Grassland (GA1)
The dominant habitat type within the proposed replant lands is improved agricultural grassland (GA1). This is dominated by perennial ryegrass *Lolium perenne*, with occasional common mouse ear *Cerastium fontanum*, dandelion *Taraxacum officinale* and daisy *Bellis perennis*.

Wet grassland (GS4)
There are three areas within the proposed replant lands that are areas of "poorly-drained farmland that have not been recently improved" [Fossitt (2000) description of Wet Grassland GS4]. These areas are dominated by Yorkshire fog *Holcus lanatus*, with abundant immature gorse plants *Ulex europaeus*, creeping thistle *Cirsium arvense* and soft rush *Juncus effusus*. There is also occasional lesser spearwort *Ranunculus flammula* along the margins of these areas.

Scrub (WS1)
The majority of the field boundaries within the site are comprised of scrub. This habitat is dominated by gorse Ulex europaeus and bracken *Pteridium aquilinum*, with abundant bramble *Rubus fructicosus* agg. There is also frequent marsh pennywort *Hydrocotyle*

[107] http://www.eplanning.ie/CarlowCC/SearchExact [accessed 10/08/2022]
[108] http://webgeo.kildarecoco.ie/planningequiry [accessed 10/08/2022]
[109] https://planning.kilkennycoco.ie/SearchExact.aspx [accessed 10/08/2022]
[110] http://www.eplanning.ie/LaoisCC/searchtypes [accessed 10/08/2022]

vulgaris. There are some sections which also include occasional goat willow *Salix caprea* and hawthorn *Crataegus monogyna*.

Hedgerow (WL1)
A hedgerow is located at the northern end of the proposed replant lands, adjacent to the access road. This hedgerow is dominated by hawthorn *Crataegus monogyna* and goat willow *Salix caprea*, with an understorey of bramble *Rubus fructicosus* agg.

Treeline (WL2)
There is a short section of treeline in the northern section of the site, comprised of several sitka spruce *Picea sitchensis*.

Drainage ditch (FW4)
There are drainage ditches surrounding most sections of the site. The majority of these are dry. There are some shallow, wet drainage ditches also.

Spoil and bare ground (ED2)
There are tracks through the centre of the site which allow access between agricultural fields within the proposed replant land area. These tracks are unpaved, with vegetation growing along the centre of some sections.

7.12.1.2 Invasive Species

Two invasive species were recorded on the Replant Lands site boundaries; Montbretia *Crocosmia x crocosmiiflora* and Snowberry *Symphoricarpos albus*.

Montbretia is a herbaceous perennial and can grow up to 1m in height with spikes of large, funnel-shaped orange flowers. Its principal means of spreading is vegetatively by proliferation of underground corms; as such it is at risk of being spread by the movement of soil containing corms, from which re-growth can occur. Montbretia is common and widespread across Ireland, often thriving in many country lanes. Its risk of impact on native Irish species has not been assessed by the National Biodiversity Data Centre.

Snowberry is a deciduous shrub that can grow up to 6m tall, producing small dense clusters of white flowers and white berry-like fruits. It is found in a wide variety of habitat types and spreads mainly by vegetative means through sprouting, but also by rhizomes and potentially by seeds dispersed by birds eating the fruits. Snowberry is found extensively throughout Ireland but is classified by the National Biodiversity Data Centre as having a low risk of impact on native Irish species.

7.12.1.3 Fauna

No protected fauna or high-value faunal habitats were present at the replant lands site.

As the replant lands are situated in a different area (Carrigthomas, Macroom, Co. Cork) located 158 km south-west of the Development, no cumulative effects in conjunction with the Development are predicted. The replanting site is dominated by improved agricultural grassland and does not include any peatland habitats. Prior to mitigation, there is the risk of cumulative effects on water quality in conjunction with other forestry operations and agriculture in the surrounding area (Carrigthomas, Co. Cork).

The predicted effects prior to mitigation are **Slight Negative, Short-term** and in the Local Context.

7.12.2 Developments

7.12.2.1 Wind Farms

<u>Operational Wind Farms</u>

One operational wind farm, Gortahile Wind Farm is present in the surrounding area. Gortahile Wind Farm is made up of eight turbines and is located c. 1.5 km north of the Development.

It was commissioned in 2010. As it is an existing wind farm, no cumulative effects at construction stage are predicted. The potential for operational phase cumulative effects on birds and bats is considered further below.

The next closest existing wind energy development identified is a single turbine at Ballon Meats, Co. Carlow. Due to the distance of 17 km separating this from the Development and the small scale of the installation (single turbine), no cumulative effects are predicted to occur in this regard.

Proposed/Consented Wind Farm Developments

An 11-turbine development, Pinewoods Wind Farm, and an associated substation and 'loop in/loop out' connection to an adjacent electricity transmission line is permitted at Knockardagur, Co. Laois in an area draining to the Owveg River, a tributary of the Nore east of Ballinakill Co. Laois (c. 17 km north-west of Bilboa wind farm).

The consented Pinewoods Wind Farm and Grid Connection/Substation fall within the category of proposed/consented wind energy developments and as such are considered cumulatively in conjunction with the Development.

No other proposed or consented wind energy developments have been identified within 20 km of the Development.

7.12.2.2 Other Developments

No other proposed developments of a size or scale which could contribute to cumulative effects in conjunction with the Development were identified within the townlands overlapping and abutting the Site.

7.12.2.3 Forestry

Forestry is one of the main land uses within the Site and the greater area. Conifer plantation is the most dominant habitat within the Site boundary. The effects associated with forestry on the local environment are habitat loss, habitat alteration and potential reduction in water quality. Historically, it can be assumed that the forestry in the area has resulted in a loss of native grasslands, heath, and bog habitats. This would have reduced the habitat available for certain fauna and flora species. Forestry is likely to have contributed to a reduction in water quality locally, particularly within waterways which are directly encroached by conifer trees. Q values assigned to the Dinin in the vicinity of the Site were Q3-4 moderate, while a higher Q value of 4 (good) was recorded further downstream at Black Bridge.

Commercial forestry activities will continue to occur during the construction activities of the wind farm. While it is difficult to quantify the level of impact with certainty, in-combination effects are considered likely. These would include the increased release of sediments and nutrients to receiving watercourses. In the absence of mitigation potential indirect effects on the Dinin River and to a lesser extent The Barrow could occur, and **Short-term Moderate Reversible Cumulative Effects** are considered likely.

7.12.2.4 Agriculture

Intensive grassland management is prevalent within the surrounding landscape. The diversity of flora within these habitats has been reduced dramatically by drainage, reseeding, fertilisation and intensive grazing by cattle. The main potential impact would be an increase in nutrient levels of local watercourses. There is potential for the Development to contribute to cumulative effects on water quality in drains within the Site and local watercourses further downstream of the Site, through the potential for sediments and other pollutants entering the watercourses as a result of felling, construction activities in addition to ongoing farming operations. The risk of such effects would, for example, greatly increase if such works were taking place during the winter months or times of very high rainfall.

Due to the lower value and legacy effects of afforestation, significant direct effects on the watercourses draining the Site are *unlikely*. Potential indirect cumulative effects to the Rivers Dinin and to a lesser extent the Barrow could occur. These could be **Short-term Moderate Reversible Cumulative Effects** prior to mitigation.

7.12.3 Cumulative Effects during construction on key receptors

Potential Cumulative Effects during construction on key receptors identified are addressed below:

- Designated Nature Conservation Sites
- Habitats and Flora
- Mammals (excluding Bats)
- Bats
- Avifauna
- Aquatic Ecology and Fisheries
- Other Species

7.12.3.1 Designated Nature Conservation Sites

As noted above in Section 7.9.2, there are no hydrological pathways between the Development and any NHAs or pNHAs within 10 km. Predicted effects are limited to disturbance of foraging Natterer's bat associated with Mothel Church Coolcullen pNHA (in the event of night-time works) and disturbance of hunting peregrine falcon associated with Whitehall Quarries pNHA which could result in temporary avoidance of the Site. Similar effects could arise from works associated with the Grid Application and TDR and as such cumulative effects could occur in this regard.

However, the predicted limited duration and infrequent occurrence of night-time works, combined with the distance between the Development and Mothel Church Coolcullen pNHA in addition to the abundance of similar foraging habitats in the landscape means any such disturbance is not predicted to result in effects on the nursery colony at the pNHA. Effects on Whitehall Quarries pNHA via peregrine Falcon are considered unlikely due to the abundance of similar habitats in the landscape and the core foraging range of 2 km[81] for breeding peregrine falcon (Whitehall Quarries pNHA is c. 8.1 km from the Development).

Predicted effects are **Short-term, Imperceptible** and in the Local Context.

No effects are predicted to any other Nature Conservation sites during construction and no additive effects due to in combination effects with other existing sources of disturbance are predicted.

A Natura Impact Statement (NIS) has been prepared for the Development and accompanies this EIA Report. The NIS addresses potential effects on European sites resulting from the Development.

7.12.3.2 Habitats and Flora

Potential direct effects during construction have been identified as habitat loss and alteration, which will lead to some permanent loss of habitat. The most extensive habitat loss relates to Conifer plantation; 18.01 Ha of this habitat is proposed to be felled for construction of the wind farm within the land ownership boundary. Of this 18.01 Ha, 0.85 Ha is associated with the consented Grid Application.

The overall felling area for the consented Grid Application is 6.2 Ha, which includes the 0.85 Ha within the land ownership boundary, in addition to 5.35 Ha associated with the site access route.

As such, a total area of 23.36 Ha of conifer plantation will be lost due to construction of the proposed wind farm. Conifer plantation is a highly artificial habitat with limited botanical interest.

Habitat loss of cutover bog/wet heath will occur as a result of the upgraded onsite access tracks (Grid Application). This may result in effects in conjunction with disturbance to these habitats arising from Proposed Felling around T2 and T3. It is noted that the cutover bog/wet heath onsite is of considerably lower value than undisturbed wet heath.

It is also noted that measures to re-wet the cutover bog/wet heath and raised bog onsite are specified in the Habitat and Species Management Plan (see Appendix A7.9).

No significant habitat loss will arise from TDR works (limited to minor vegetation trimming).

The potential for the spread of invasive species from the Grid Application cable route exists if the cable route is constructed concurrently with the Development and plant and machinery resources are shared between these elements of the project.

Cumulatively there is likely to be a **Permanent Moderate Reversible Cumulative Effect** without mitigation.

7.12.3.3 Mammals (excluding Bats)

Mammal breeding or resting sites may be cumulatively affected by the Grid Application and TDR in conjunction with the Development, and with other activities which either remove potential breeding sites and foraging habitats such as farming and forestry which may for example remove badger setts, pine marten breeding sites, red squirrel dreys, etc. Planning permission and felling licences are provided with environmental control and best practice. Prior to the implementation of mitigation cumulative effects are likely to be **Short-term Moderate Cumulative Effects** which are potentially **Reversible.**

7.12.3.4 Bats

Potential cumulative effects on bats during the construction phase would be as follows:

- Displacement of populations
- Abandonment of young
- Mortality

Bat surveys undertaken during summer 2020 did not identify any potential roosting features within a study area which encompassed the Development and the Grid Application.

As noted above in Section 7.9.5, no commuting routes will be severed by the Development and as such no cumulative effects are predicted in that regard. Foraging or commuting bats may suffer disturbance effects during the construction phase of the Development through increased noise and lighting on the Site; this effect could interact with similar effects arising from the Grid Application (including the TDR).

Cumulative effects on bats are predicted to be **Short-term** and **Slight.**

7.12.3.5 Avifauna

Direct effects on avifauna during construction are primarily land take related, mainly due to the loss of nesting habitats to key species. Land take which is additional to the Development associated with the TDR and Grid Application will act cumulatively with these effects. Other sources of land take as outlined above do have the potential to cumulatively affect nesting or resident farmland or woodland species (the typical landscape characters) in addition to specialist species such as woodcock (potentially affected by forestry operations). Species such as linnet may be affected cumulatively by further loss of hedgerows due to farming practices etc.

Even though in-combination land take is unlikely to result in range loss of any species which frequent the subject site, mitigation may be required to neutralise the effect of the Development.

Any cumulative effects on birds during the construction phase would be **Long-Term Imperceptible Cumulative Effects.**

Cumulative effects on birds are predicted to be **Short-term** and **Slight.**

7.12.3.6 Aquatic Ecology

The TDR and Grid Application have the potential to result in cumulative effects on the aquatic receiving environment in conjunction with the Development. Cumulative effects could arise through the crossing of watercourses by the Grid Connection access and cable routes (a number of watercourses draining the Site are intersected by these). In addition, construction activities associated with the Grid Application cable route could act as sources of pollution at any location within the project catchment area.

No bridge upgrades are proposed for the TDR and as such there is no potential for cumulative effects on the aquatic environment in this regard.

Commercial forestry activities and agricultural practices will continue to occur during the construction activities of the wind farm. While it is difficult to quantify the level of impact with certainty, in-combination effects are considered likely. These would include the increased release of sediments and nutrients to receiving watercourses. In the absence of mitigation, **Significant Negative Short-term Cumulative Effects** are considered likely.

7.12.3.7 Other Fauna

Common lizard may forage and breed within the Site and may be affected by land take however given the large amount of displacement and alternative habitats available the in-combination effect for common lizard is assessed as a **Short-term Slight Cumulative Effect** which is **Reversible*.***

Frog and smooth newt may breed, forage and rest within the Site and may be affected indirectly by the Development via changes in water quality. This indirect effect could interact with the direct effect of habitat loss arising from excavation of the proposed Wind Farm borrow pit which overlaps a pond which could potentially be used by either species to breed. The overall in combination effect is assessed as a **Short-term Significant Cumulative Effect*.***

Dingy Skipper could be affected by disturbance of habitats arising from both the Development and the Grid Application in conjunction. A **Short-term Moderate Cumulative Effect** could occur*.*

No cumulative effects are predicted for Marsh Fritillary due to the absence of it's larval foodplant from the project footprint, and the unsuitability of habitats within the project footprint for this species.

7.12.4 Cumulative Effects during operation on key receptors

Potential Cumulative Effects during construction on key receptors identified are addressed below:

- Designated Nature Conservation Sites
- Habitats and Flora
- Mammals (excluding Bats)

- Bats
- Avifauna
- Aquatic Ecology and Fisheries
- Other Species

7.12.4.1 Designated Nature Conservation Sites

There is potential for operational-phase effects to Mothel Church Coolcullen pNHA and Whitehall Quarries pNHA due to their ecological features being mobile species (Natterer's bat and Peregrine falcon respectively) (both species were recorded at the Development study area) which could be subject to collision risk and/or disturbance displacement effects due to the operation of turbines. Operational-phase effects are not predicted to occur in conjunction with the Grid Application since they relate specifically to collision risk and disturbance/displacement effects

Prior to mitigation there is limited potential for indirect effects via collision risk to Mothel Church Coolcullen pNHA arising from the Development for Natterer's bat.

Bat activity surveys were not carried out for Gortahile Wind Farm which was lodged in 2004. An assessment of the site's faunal resources did however note the hilly and open nature of the site and concluded there was no suitable habitat for bats.

Although the assessment of bat activity levels at Gortahile Wind Farm is not strictly objective as the Ecobat analysis tool was not used as standard practice when this application was submitted, when the patterns of activity, species composition, nature of the sites and ecological connectivity are considered cumulatively any cumulative effects to bats during the operational phase would be a **Long-Term Imperceptible Cumulative Effect.**

There is potential for *Long-term Imperceptible Effects* on Whitehall Quarries pNHA (via collision risk and disturbance/displacement of Peregrine falcon) to arise from the Development. These effects could also act cumulatively with effects arising from the operation of Gortahile Wind Farm. These cumulative effects are similarly considered to be **Long-term Imperceptible Effects** due to the core breeding season foraging range of 2 km[81] for Peregrine falcon (Whitehall Quarries pNHA is c. 8.1 km from the Development).

7.12.4.2 Habitats and Flora

Operational phase direct effects are limited to periodic scrub clearance and/or tree felling to maintain the turbine buffers. As similar maintenance is unlikely to be required for the Grid Application, cumulative effects in this regard may occur in conjunction forestry and agricultural activities in the area. Cumulative effects are considered to be **Short-term Slight**.

7.12.4.3 Mammals (excluding Bats)

Mammal breeding or resting sites may be cumulatively affected by farming or forestry activities which may for example remove badger setts, pine marten or red squirrel breeding sites etc. However, given that no land take is predicted for the operational phase, no cumulative effect is predicted.

7.12.4.4 Bats

Potential cumulative effects on bats during the construction phase would be as follows:

- Reduction of local populations
- Mortality

The predicted effect on bats arising from the Development is Low-Moderate based on activity levels recorded onsite and subsequent Ecobat analysis.

Bat activity surveys were not carried out for Gortahile Wind Farm which was lodged in 2004. An assessment of the site's faunal resources did however note the hilly and open nature of the site and concluded there was no suitable habitat for bats.

Although the assessment of bat activity levels at Gortahile Wind Farm is not strictly objective as the Ecobat analysis tool was not used as standard practice when this application was submitted, when the patterns of activity, species composition, nature of the sites and ecological connectivity are considered cumulatively any cumulative effects to bats during the operational phase would be a **Long-Term Imperceptible Cumulative Effect**.

There is not considered to be any potential for cumulative effects in conjunction with the Grid Application.

7.12.4.5 Avifauna

Direct effects on avifauna during operation which may be cumulatively added to by other existing pressures or proposed developments include collision related mortality, ongoing disturbance/displacement and barrier effect. Flight height or the flight heights which birds habitually use along either migration or local flight paths is an influencing factor in determining whether the Development will combine with additional wind farms to produce additive, synergistic or antagonistic effects. These effects include: increased Barrier Effect (potentially obstructing migratory flightpaths), increased collision risk (through combined mortality in susceptible species) and increased disturbance to birds utilising foraging grounds whilst on migration.

The existing Gortahile wind farm c. 1.5 km north of the Development has been identified as the sole operational windfarm predicted to contribute to cumulative effects.

The predicted effects in terms of collision risk arising from the Development are **Long-term Imperceptible.**

Studies have found that local wintering birds will habituate to the presence of turbines and therefore avoid collision[111]. In addition, the lack of migration flyways in the area, along with the results of hinterland surveys indicate any cumulative barrier, disturbance/displacement effects on birds during the operational phase would be a **Long-Term Imperceptible Cumulative Effect**.

No evidence of breeding Peregrine was observed within the study area during two years of bird surveys.

The desktop study identified two active and one inactive Peregrine nest sites within 5 km of the Site boundary (NPWS records). During hinterland surveys, Peregrine was observed on one occasion in winter 2019-20, with a bird recorded flying past at Whitehall Quarries pNHA (c. 8.1 km south of the Bilboa Wind Farm Site). The hinterland survey also encompassed quarries within a 5 km radius which could provide suitable breeding habitat for Peregrine.

It is also noted the core foraging range of breeding Peregrine is 2 km[112], and that there are no quarries (optimal nesting habitat for Peregrine) within 2 km of the proposed turbine locations.

Collision risk modelling calculated a predicted collision risk of 0.0 collisions per year for Peregrine (0.08 collisions over the 30-year lifespan of the wind farm) based on two years of flight activity survey data (see Appendix A7.10).

111 Langston, R.H.W and Pullan, J.D. (2004). Effects of Wind Farms on Birds. Convention on the Conservation of European Wildlife and Habitats (Bern Convention).Nature and Environment, No. 139.Council of Europe Publishing, Strasbourg.

112 Scottish Natural Heritage (2016). *Assessing Connectivity with Special Protection Areas*V.3

Considering the distance of the consented Pinewoods wind farm at Knockardugar Co. Laois in relation to the Development core study area, the cumulative collision risk on any avian receptors would be considered negligible.

Cumulative collision mortality combined with other wind farm developments is predicted to be a **Long-Term Imperceptible Cumulative Effect**.

The lack of migration flyways in the area, along with the results of hinterland surveys indicate any cumulative barrier, disturbance/displacement effects on birds during the operational phase would be a ***Long-Term Imperceptible Cumulative Effect***.

7.12.4.6 Aquatic Ecology

Operational wind farms are not normally considered to have the potential to significantly affect the aquatic environment. The main risk to watercourses is via water quality effects, when oils and lubricants are used on the Site (e.g. infrastructure maintenance). If such substances leaked from the turbines or maintenance areas or were disposed of inappropriately, there is a risk of water contamination and subsequent effects to aquatic ecology.

However, the likelihood of this occurring is very low and is unlikely to be a significant effect considering the low volumes of vehicular traffic involved in typical wind farm operations and the high standards that are implemented on a well-managed site. Due to the natural 'grassing-over' the drainage swales and revegetation of other exposed surfaces, and the non-intrusive nature of site operations, there is a negligible risk of sediment release to the watercourses during the operational stage. Potential cumulative operational phase effects on aquatic ecology are considered **Short-term Slight Cumulative Reversible Effects** and in the **Local Context,** in the absence of mitigation.

7.12.4.7 Other Fauna

No cumulative effects are predicted for common frog or smooth newt during the operational phase.

Common lizard could potentially be subject to effects arising from vegetation clearance carried out to maintain turbine buffers. Effects on common lizard are considered **Short-term Slight Cumulative Reversible Effects** and in the Local Context, in the absence of mitigation.

Dingy Skipper could potentially be subject to effects arising from vegetation clearance carried out to maintain turbine buffers. Effects on this species are considered **Short-term Slight Cumulative Reversible Effects** and in the Local Context, in the absence of mitigation.

7.12.5 Decommissioning stage cumulative effects

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

7.13 Mitigation Measures

Mitigation measures are described below which will avoid, reduce and where possible, offset likely significant effects arising in relation to ecology from the construction, operation and decommissioning of the Development. These mitigation measures shall be implemented in full.

7.13.1 Mitigation by Avoidance and design

The following measures are incorporated into the Development design to reduce effects on designated sites, flora and fauna through avoidance and design:

- The hard-standing area of the wind farm has been kept to the minimum necessary for the specified turbine rotor size, including all site clearance works to minimise land take of habitats and flora.
- Site design and layout deliberately avoided direct effects on designated sites, as recommended by statutory bodies as English Nature and the Royal Society for the Protection of Birds [65].
- Care has been taken to ensure that sufficient buffers are in place between wind farm infrastructure and hydrological features such as rivers and streams. No new stream crossings shall be required within the Site.
- Directional drilling is the preferred installation method where the grid connection crosses watercourses.
  As such, in-stream works will not be required and the potential for contaminant or pollutant input will be greatly reduced as a result. This will reduce the potential for cumulative effects on water quality arising from the Development in conjunction with The Grid Application.

7.13.2 Mitigation measures during the construction phase of the Development

Construction of the Development is expected to cause temporary adverse effects (disturbance) on local ecological receptors, as outlined in the impact appraisal above. The mitigation measures described below will reduce these effects significantly.

7.13.2.1 Project Ecologist

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

7.13.2.2 Habitats and Flora

The area of the proposed works will be kept to the minimum necessary, including all site clearance works, to minimise disturbance to habitats and flora. In this case, the footprint of the Development has been kept to the minimum necessary, including the use of layout design methods including the use of existing roads.

All works will be restricted to the immediate footprint of the Development, which will be wholly within the Development site boundary and kept separate from any key areas for biodiversity (see CEMP; Appendix 4.1). Machinery, and equipment will be stored within the site compound. Designated access points will be established within the Site and all construction traffic will be restricted to these locations. Access to the Site will be via the existing local road L7129.

7.13.2.3 Management of the Spread of Non-native Invasive Species

Strict biosecurity measures will be implemented if plant and machinery working in areas with invasive species along the Grid Application cable route is used at the Development. All machinery shall be disinfected and visually inspected before leaving works areas where invasive species are present.

Strict measures shall also be implemented to prevent the spread of crayfish plague.

Any operatives entering watercourses will be required to disinfect clothing and equipment coming in contact with water prior to and after entering the watercourse. The same disinfection measures shall apply (disinfection and wash down before and after works) to any machinery working in or near watercourses. For the purposes of this measure, watercourses include both include both drainage ditches and rivers.

An invasive species management plan which details management measures for each invasive plant species is included in Appendix A7.11.

7.13.2.4 Mammals (excluding bats)

An ecologist will supervise areas where vegetation, scrub and hedgerow removal will occur prior to and during construction as appropriate (e.g., an ecologist may be required during some clearance works of areas where vegetation is too dense to check beforehand). This will ensure that any site-specific issues in relation to wildlife not currently present (e.g. Badger setts) on site will be reconfirmed prior to commencement of works so as to allow appropriate mitigation measures to be put in place.

In the event that an issue arises, the NPWS will be updated, consulted with and the relevant guidelines will be implemented as appropriate (e.g. '*NRA guidelines for the treatment of badgers prior to the construction of national road schemes*'; NRA, 2005).

Construction operations will take place predominantly during the hours of daylight to minimise disturbances to faunal species at night. Some works may occur at night but the project ecologist/ECoW shall manage the timing and location of night-time works to avoid sensitive features.

7.13.2.5 Badgers

A pre-construction mammal survey will be undertaken within the footprint of the Development in order to reconfirm the existing environment as described in the EIA Report and, in the event that a badger sett should be encountered at any point, then NPWS will be informed and NRA *Guidelines for the Treatment of Badgers Prior To the Construction of National Road Schemes* will be followed.

Badgers can move between setts regularly and may also excavate new setts within their territory. As such there is potential for badger setts to be established onsite in the intervening period between planning and construction stages.

If planning permission is granted and a derogation/disturbance licence is required, the NPWS will be consulted with and a derogation/disturbance licence will be sought in order to implement mitigation measures prior to construction.

Setts within the footprint of proposed infrastructure would require (following evacuation if active) controlled destruction under ecological supervision, while setts within tree felling buffers and in close proximity to the Development would require temporary hard-blocking and exclusion for the duration of construction works to ensure that badgers potentially occupying these setts during construction works are not injured.

No hard-blocking or sett exclusions will be undertaken during the badger breeding season (December-June inclusive).

Construction of an artificial sett will be undertaken in consultation with NPWS in the case that sufficient alternative setts are not available due to hard blocking of setts near the Development footprint.

A report detailing evacuation procedures, sett excavation and destruction, and any other relevant issues will be submitted to the NPWS, in fulfilment of the wildlife licence conditions.

Vegetation clearance

There is the potential for setts to be discovered during vegetation clearance works. Care will need to be taken during this early stage of the Development and a competent ecologist will be required on-site for these works. If setts are discovered all works within 30m of the sett shall cease including vegetation clearance. NPWS shall be contacted and a derogation/disturbance licence shall be sought. An activity survey shall be carried out to assess the potential for the sett to be used by badgers.

Measures to prevent the injury of Badgers during proposed mitigation measures

In the event that a badger is found injured during the proposed mitigation measures, it is important to realise that injured badgers will be frightened and can be very dangerous. They are strong animals and are not used to being handled, so no attempt will be made to touch an injured badger, as this could result in workers being bitten. NPWS shall be contacted along with ISPCA and potentially a vet specified by NPWS capable of treating the species.

7.13.26 Red Squirrel

Where possible, any required felling of trees in forestry areas will be limited to time periods outside which red squirrel may have young in dreys (peak period January to March). If this is unavoidable then areas to be clear felled will be surveyed in advance by a suitably qualified ecologist to determine whether any occupied dreys are present. A license under the Wildlife Act will be sought as necessary.

7.13.27 Pine Marten

Where possible, felling of trees in forestry areas will be limited to time periods outside which pine martens may have young in dens (March and April). If this is unavoidable then areas to be clear felled will be surveyed in advance by a suitably qualified ecologist to determine whether any occupied pine marten dens are present. A necessary license under the Wildlife act will be applied for should any sites have to be disturbed.

7.13.28 Irish Hare, Pygmy Shrew, Irish Stoat and Hedgehog

These species are mobile and will disperse, however, hibernating Hedgehogs and the young of Irish hare, pygmy shrew or hedgehog are vulnerable during clearance of vegetation. An ecologist will check for the presence of hibernating hedgehog and or young mammals as appropriate, prior to vegetation clearance works prior to or during construction (as necessary). Where habitat is too dense the ecologist will supervise vegetation removal and grassland trimming/maintenance during clearance works as appropriate.

- Outside of the bird breeding season (March 1st to August 31st inclusive) attention will be paid to the removal of vegetation with regards to leverets, October to March for hibernating hedgehog and September to October for breeding pygmy shrew as is appropriate.
- Within the breeding bird season and outside of it, attention will be paid to the removal of vegetation and/or maintenance of dense grassland for breeding hare (all year), pygmy shrew (April to October) and hedgehog (April to July), Irish stoat (March- August).

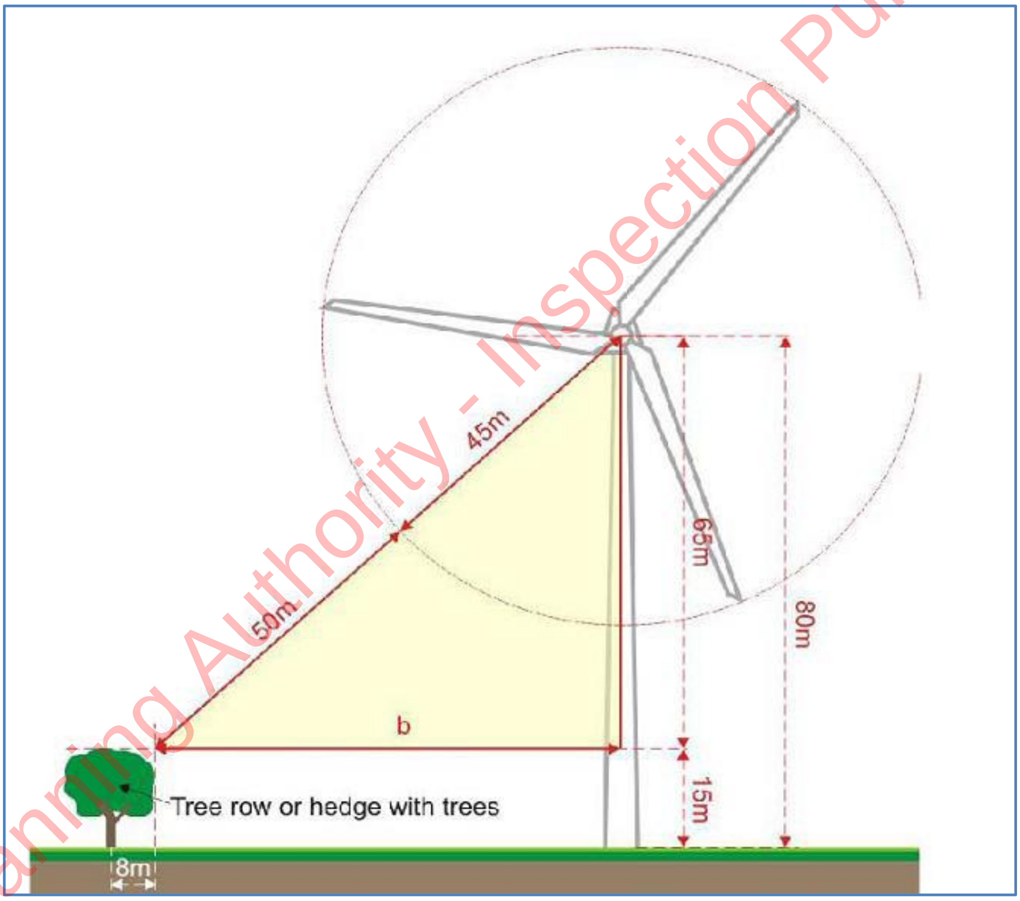
7.13.2.9 Bats

According to SNH guidance [8]:

> *"The Eurobats guidance recommends a 200m buffer around woodland areas. There is, however, currently no scientific evidence to support this distance in the UK and it is recommended that a distance of 50m between turbine blade tip and nearest woodland (or other key habitat features such as wetlands etc.) is adequate mitigation in most, lower risk situations. Exceptionally, larger buffers may be appropriate, e.g. near major swarming and hibernation sites. The longevity of wind farms should also be taken into account and the maximum growth, or management, of woodland and other relevant habitat features considered in their planning."*

These distances were taken into account during the design phase the Development.

The following formula was used to calculate the required felling buffer for each turbine (taking into account the height of surrounding woodland/plantations at each turbine location):



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

where: b = the distance on the ground
between the edge of the canopy and the turbine (m)
bl = blade length (m)
hh = hub height (m)
fh = feature height (m)

$$b = \sqrt{\{(50 + 58.5)^2 - (78 - 20)^2\}}$$

$$b = 91.7 \text{ m}$$

Note: fh for each turbine location is given in column 3 of Table 7-71 below

Each of the locations of the five turbines was surveyed and the bat activity findings recorded informed the application of the 50m blade tip buffer described above at all 5 turbine locations. Surrounding habitats, height of surrounding trees and felling buffer calculated using the above equation are included Table 7-71 below.

To minimize risk to bat populations, a buffer zone is recommended around any treeline, hedgerow, woodland feature, into which no part of the turbine should intrude. The buffers recommended for each turbine are presented in Table 7-71.

Table 7-71: Assessment of potential turbine/bat conflict zones

Turbine number	Habitats Requiring Felling	Surrounding Tree Height (fh/m)	Felling Buffer Radius (m)
1	Conifer plantation (WD4)	20	91.7
2	Conifer plantation (WD4); Scrub (WS1)	20	91.7
3	Conifer plantation (WD4)	20	91.7
4	Conifer plantation (WD4)	20	91.7
5	Conifer plantation (WD4)	20	91.7

Existing trees / scrub will be cleared around all five turbines to provide a vegetation-free buffer zone around each turbine. The minimum distance has been taken into consideration for felling of conifer plantation around wind turbines. All buffers will be maintained throughout the lifetime of the wind farm. The buffers will be kept open by mechanical means only. Chemical control methods will not be used.

The following mitigation measures for bats are proposed:

<u>Supervision of vegetation clearance</u>

An ecologist/ECoW will supervise areas where vegetation, scrub and hedgerow removal will occur prior to and during construction as appropriate (e.g., ecologist may be required during some clearance works of areas where vegetation is too dense to check beforehand). This will ensure that any site-specific issues in relation to wildlife not currently present (e.g., Bat roost locations) on site will be discovered prior to commencement of works to allow appropriate mitigation measures to be put in place. In the event that an issue arises, the NPWS will be informed and the relevant guidelines will be implemented as appropriate (e.g. NRA guidelines).

<u>Lighting restrictions</u>

In general, artificial light creates a barrier to bats so lighting should be avoided where possible. Construction operations within the Site will take place during the hours of daylight where possible to minimise disturbances to faunal species at night. Where lighting is required, directional lighting (i.e. lighting which only shines on work areas and not nearby countryside) will be used to prevent overspill. This can be achieved by the design of the luminaire and by using accessories such as hoods, cowls, louvers and shields to direct the light to the intended area only.

It is understood that flashing red aviation lights will be provided on perimeter turbines. These will not negatively impact bats [85].

Pre-construction Survey

If three years lapse from between planning-stage surveys in 2020 and installation of the wind turbines, it will be necessary to repeat one season of surveys during the activity period. Future survey work will be completed according to best practice guidelines available[9] [10] [8] and includes static detector, activity and roost inspection surveys.

7.13.2.10 Avifauna

Subject to other environmental concerns (e.g., run-off), the removal of trees and scrub will be undertaken outside of the bird breeding season (March 1st to August 31st inclusive). This will help protect nesting birds.

That clearance of vegetation, including conifer forestry, from the site should only be carried out in the period September to February inclusive, i.e. outside the main bird breeding season. Where vegetation removal is required to be carried out outside this period, vegetation must be inspected for nesting birds, under licence issued by NPWS, by a suitably qualified Ecologist immediately prior to removal.

This in line with best practice recommendations for mitigation measures in regard to birds and wind farms as recommended by statutory bodies such as English Nature and the Royal Society for the Protection of Birds[65].

Construction operations will take place during the hours of daylight to minimise disturbances to roosting birds, or active nocturnal bird species. This is in line with best practice recommendations for mitigation measures in regard to birds and wind farms as recommended by statutory bodies such as English Nature and the Royal Society for the Protection of Birds [65]. Limited operations such as turbine erection may require night-time operating hours; these works will be supervised by the project ecologist/ECoW.

Toolbox talks will be undertaken with construction staff on disturbance to key species during construction. This will help minimise disturbance. This is in line with best practice recommendations for mitigation measures with regard to birds and wind farms as recommended by statutory bodies such as English Nature and the Royal Society for the Protection of Birds[65].

Kingfisher: Implement mitigation measures outlined in **Chapter 8: Hydrology and Hydrogeology** of this EIA Report, the CEMP and Aquatic Ecology Mitigation in below, to minimise and prevent the identified indirect effects to water quality.

A re-confirmatory survey (March/April) will be conducted of the turbine locations to assess any evidence of buzzard, kestrel, sparrowhawk and woodcock activity or taking up new territories. Should any new nests be recorded, works at these locations will be restricted to outside the breeding season (April-July) or until chicks are deemed to have fledged (following monitoring).

7.13.2.11 Lights on Turbines

It appears that the lighting on top of wind turbines may affect the likelihood of bats colliding with turbines. Research on this topic, which is reviewed in Powelsland[113], indicates that intermittent lighting is less likely to cause species to collide with turbines.

The use of "white lights" on the turbines will be avoided as these can attract night flying birds such as migrants, and insects, which in turn can attract bats. Certain turbines will be illuminated with medium intensity fixed red obstacle lights of 2000 candelas where

[113] Powelsland, R.G. (2009). Impacts of windfarms on birds: a review. *Science for Conservation,* 289. Wellington, New Zealand: Publishing Team, Department of Conservation.

required by the IAA. Lighting will be fitted with baffles to ensure that the light is directed skywards and will not be discernible from the ground.

7.13.2.12 Aquatic Ecology - Water Quality Measures during the Construction Phase

Proposed Mitigation Measures for the Construction Stage of the project

Construction phase mitigation for site drainage will follow that outlined in **Chapter 8: Hydrology and Hydrogeology** and the CEMP (Appendix A4.1). The mitigation measures outlined will be adhered to in conjunction with those outlined in this section.

Proposed Mitigation Measures for Tree Felling

Tree felling will be required at all five turbine locations (i.e. T1, T2, T4, and T5), along internal access tracks, and at the site compound and substation. It is estimated that 18.01 Ha of conifer plantation WD4 and 1.18 Ha of scrub will be removed to facilitate the Development. Tree felling will be undertaken prior to the construction of site access tracks and hardstanding areas.

There is a requirement in the Forest Service Code of Practice and in the FSC Certification Standard for the installation of buffer zones adjacent to aquatic zone (Forestry Service, 2000a and b)[114] [115]. However, no proposed felling areas for the Development are present within c.110m of aquatic zones, with the exception of forestry drains. Therefore, the risk of effects from felling on water-dependent species is reduced.

Tree felling will be the subject of a felling license from the Forest Service and to the conditions of such a license. A Limited Felling License will be in place prior to works commencing on site. To ensure a tree clearance method that reduces the potential for sediment and nutrient run-off, the construction methodology will follow the specifications set out in the following guidance documents:

- DAFM (2019). Standards for Felling and Reforestation;
- Forestry Service (2000). Forest Service Forestry and Water Quality Guidelines;
- Forestry Service (2000). Forest Harvesting and Environmental Guidelines;
- DAFM (2018). Draft Plan for Forestry and Freshwater Pearl Mussel in Ireland

Additional mitigation measures for the protection of aquatic ecology and receptors during felling activities will follow those outlined in the CEMP (Appendix A4.1).

Given the sensitivity of aquatic ecological receptors downstream (notably Atlantic salmon), mechanised operations will be suspended during and immediately after periods of particularly heavy rainfall. It is proposed to undertake felling in the spring to facilitate the sowing of grass seeds post-harvest to aid sediment filtration and nutrient absorption, using native grass species *Holcus lanatus* and *Agrostis capillaris* [116].

Removal of branch lop-and-top and other debris (brash) from felling areas within 20m of forestry drains (i.e. up-slope of active pathways to larger downstream watercourses) will reduce nutrient seepage immediately post-felling and in the proceeding years after felling has occurred [117].

Proposed Mitigation Measures Wind Farm Construction

Please refer to **Chapter 8: Hydrology and Hydrogeology** and the CEMP (Appendix A4.1) for detailed mitigation measures for site drainage and silt attenuation to prevent

[114] Forestry Service (2000). Forest Service Forestry and Water Quality Guidelines

[115] Forestry Service (2000). Forest Harvesting and Environmental Guidelines

[116] DAFM (2018). Draft Plan for Forestry and Freshwater Pearl Mussel in Ireland

[117] DAFM (2019). Standards for Felling and Reforestation;

effects to the water quality of downstream watercourses during the construction phase. These include measures to prevent run-off erosion from vulnerable areas and consequent sediment release into nearby watercourses to which the Development site discharges. The mitigation measures proposed will reduce potential direct and indirect effects from the Development.

Excavated subsoil material not required for in-site reinstatement will be removed to the designated material storage area so the risk of water quality effects to receiving watercourses via siltation or nutrient release will be further reduced through siltation management as detailed in the CEMP.

During construction / upgrading of proposed tracks, there will be sealed silt fences placed at both sides of watercourse crossing points and to a minimum of 10m upstream and downstream of each crossing at both sides of the proposed access track as well as at any locations where proposed works run adjacent to watercourses.

Any spoil heaps from excavations for wind turbine bases and cable trenches will be covered with geotextiles. Any stockpiling of materials will be at least 50m back from any watercourses. Sediment from surface water run-off and excavated material will be filtered by surrounding silt fences. Berms will be covered with a geo-textile matting to avoid sediment runoff; and will be surrounded by silt fencing until vegetation has been established in the following growing season. Cables will be installed in trenches and will be located underneath and directly adjacent to access tracks where the layout permits. Trench excavation will take place during dry periods where possible in short sections and left open for minimal periods to avoid acting as channels for surface water flows. Clay bunds will be constructed within any cable trenches at intervals.

An Emergency Erosion and Silt Control Response Plan is included the CEMP which details the required measures to implement in the event of a 'worst case' scenario on the proposed development site. Timing of the proposed works near any watercourse or other works which may impact directly on a watercourse will also take account of the fisheries constraints (such as the salmonid open season from 1st July to the 30th of September) within the study area.

Secure concrete washout areas will be designated on site and not located within 50m of any watercourse. Standing water in the excavations at the turbine bases will contain an increased concentration of suspended solids. Therefore, excavations will be pumped into temporary lined settlement basins as necessary which will be constructed prior to the excavations and will drain into existing or proposed drainage channels on the site. Settlement ponds will be maintained, where appropriate, during the operational phase to allow to the adequate settlement of suspended solids and sediments and prevent any deleterious matter from discharging into any natural waters.

Wheel washing facilities, which drain to silt traps will be provided at the site entrance. Additional silt fencing will be kept on site for ongoing maintenance. Portaloos will be used as toilet facilities for site personnel. Sanitary waste will be removed from site via a licensed waste disposal contractor and will not be discharged on site.

Any diesel or fuel oils stored on site will be bunded to 110% of the capacity of the storage tank and will not be located near any drain or watercourse. Fuel tanks will be designed and stored in accordance with best practice guidelines. Refuelling will be carried out on a designated concrete pad, draining to an oil interceptor, away from watercourses. Drip trays and spill kits will be available on site, as well as appropriate containment facilities to ensure that any spills from the vehicles are contained and removed off site.

All measures for the protection of water quality within the Development site, as detailed in the CEMP (Appendix A4.1), will also protect the aquatic ecology and fisheries value of downstream watercourses. The measures adopted within the CEMP will ensure effective protection of aquatic ecological interests downstream of the Development, particularly the habitats supporting sensitive aquatic species and with connectivity to the River Barrow and River Nore SAC (002162).

7.13.2.13 Proposed Mitigation Measures during Construction for the Grid Connection

The following measures will avoid cumulative effects on water quality arising in conjunction with the Grid Application cable route.

Horizontal directional drilling will be used at grid connection watercourse crossings where other methods would result in adverse effects.

These works will be subject to site-specific method statements agreed with Inland Fisheries Ireland in advance of construction commencement. There will be no works conducted between October and June (inclusive) to protect spawning salmonids and or lamprey species in the crossed watercourses. These works will be supervised by an Ecological Clerk of Works (ECoW), that will monitor water quality during construction. The management of excavated bankside material, trench water and water quality risks associated with hydraulic drilling fluid are addressed in the CEMP (Appendix 4.1). These include:

- A site-specific drilling design, risk assessment and method statement shall be prepared by the contractor prior to the works.
- If drilling fluids are required, a biodegradable fluid such as CLEARBORE shall be used rather than Bentonite.
- HDD operations to be limited to daytime hours and conditions when low levels of rainfall are forecast.
- The depth of the bore shall be at least 3m below the bed of the watercourse.
- Visual inspection to take place at all times along the bore path of the alignment.
- A field response plan to minimize loss of returns of drilling fluid and actions to restore returns shall be provided.
- Silt fences will be constructed around proposed work areas prior to commencement of works.
- No refuelling will take place within 50m of the watercourse or any sensitive habitats.
- Pre-construction verification surveys shall take place at drilling sites to confirm the presence of any sensitive species.
- A qualified biological monitor will be onsite for the duration of the drilling operation.

To reduce the risk of invasive species and pathogen introduction (e.g. Crayfish plague), all equipment will be thoroughly checked, cleaned and dried in accordance with best practice as specified in the CIRIA guidelines below. Furthermore, plant machinery which has worked within riparian corridors or come in to contact with water will be steam-cleaned and dried in advance of works commencement in the Barrow catchment. Crayfish plague is known from the River Barrow catchment since 2022. The potential introduction of Crayfish plague is of particular concern at watercourse crossings given the potential for White-clawed Crayfish populations downstream.

Works within and adjacent to watercourses, as part of HDD and in the existing bridge deck, will adhere the guidelines set out in the best practice documents as listed below;

- CIRIA (2001). Control of water pollution from construction sites - Guidance for consultants and contractors (C532). Construction Industry Research and Information Association, London.
- CIRIA (2006). Control of Pollution from Linear Construction Project; Technical Guidance (C648). Construction Industry Research and Information Association, London.

- CIRIA (2015a). Manual on scour at bridges and other hydraulic structures, second edition (C742). Construction Industry Research and Information Association, London.
- CIRIA (2015b). Environmental Good Practice on Site (4th edition) (C741). Construction Industry Research and Information Association, London.
- CIRIA (2019). Culvert, screen and outfall manual (C786). Construction Industry Research and Information Association, London.
- DHPLG (2019). Draft Revised Wind Energy Development Guidelines. Department of Housing, Planning and Local Government. December 2019
- Enterprise Ireland (unknown). Best Practice Guide (BPGCS005) Oil storage guidelines.
- IFI (2016). Guidelines on Protection of Fisheries during Construction Works in and adjacent to waters. Inland Fisheries Ireland, Dublin.
- IFI (2019) Windfarm scoping document (draft). Inland Fisheries Ireland, Dublin.
- IWEA (2012). Best Practice Guidelines for the Irish Wind Energy Industry. Guidance prepared by Fehily Timoney and Company for the Irish Wind Energy Association.
- Kilfeather, P.K. (2007). Maintenance and protection of the Inland Fisheries resource during road construction and improvement works. Requirements of the Southern Regional Fisheries Board. Southern Regional Fisheries Board, Clonmel, Co. Tipperary
- Murphy, D.F. (2004). Requirements for the Protection of Fisheries Habitat During Construction and Development Works at River Sites. Eastern Regional Fisheries Board, Dublin.
- NRA (2008). Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes. National Roads Authority.
- PPG1 - General Guide to Prevention of Pollution (UK Guidance Note);
- PPG5 – Works or Maintenance in or Near Watercourses (UK Guidance Note);
- SNH (2012). Assessing the cumulative impact of onshore wind energy developments. Scottish Natural Heritage, March 2012.
- SNH (2019b). Good Practice during Wind Farm Construction (4th edition). Scottish Natural Heritage.

7.13.2.14 Peat stability

Where the peat layer is typically of 1 m thickness or greater and side slope is significant or where failure of the peat could result in landslip, the peat may require to be excavated down to rockhead or suitable sub-soil horizon, leaving batters on each side with angles sufficient to ensure stability of the peat. Similarly, for excavations typically less than 1 m, but where the local gradient gives concern with regards to the stability of the peat, suitable slopes shall be formed for stability. Peat will not be allowed to dry out and silt fences will be employed to minimise sediment levels in run-off. Material will be stored at least 50 m from watercourses in order to reduce the potential for sediment to be transferred into the wider hydrological system.

Where peat less than 1m in thickness is extracted for access roads, a cut and fill method will be used. Lateral drains will be established on the uphill side of the road to drain water from the slops and cross drains will be established at regular intervals depending on site conditions.

Where peat greater than 1m in thickness is extracted, the peat will be required to be excavated down to rock level, leaving batters on each side and with angles sufficient to ensure stability.

A cut off ditch can be established uphill of the batter. The road surface will have a crossfall to drain run off into the ditches. A lateral drain will be made on the uphill side of the road with cross drainpipes at appropriate locations. The outlet of the drain will be at appropriate locations, with hessian/copra mats placed at the outfalls (where appropriate) in order to minimise erosion during periods of heavy rainfall or snow melt.

Material excavated during track construction will either be stored adjacent to the track or within agreed spoil deposition areas and compacted in order to limit instability and erosion potential. Peat will not be allowed to dry out and silt fences will be employed if required to minimise sediment levels in run-off. Material will be stored at least 50 m from watercourses in order to reduce the potential for sediment to be transferred into the wider hydrological system.

Where peat stockpiles are used silt fences and semi permeable obstructions will be used to prevent silt run off

Peat restoration activities will be overseen by the Ecological Clerk of Works (ECoW) to ensure methods are properly adhered to

The surface layer of peat and vegetation will be stripped separately from the any catotelmic or other superficial soils. This will typically be an excavation depth of up to 0.5 m.

Careful handling is essential to retain any existing structure and integrity of the excavated materials and thereby maximise the potential for excavated material to be re-used;

To minimise handling and transportation of peat, acrotelmic and catotelmic will be replaced, as far as is reasonably practicable, in the locality from which it was removed. Acrotelmic material is to be placed on the surface of reinstatement areas.

Temporary storage of peat will be minimised, with restoration occurring in parallel with other works.

Reinstatement will, in all instances, be undertaken at the earliest opportunity to minimise storage of turves and other materials.

Managing the construction work as much as possible to avoid periods when peat materials are likely to be wetter i.e. high rainfall events.

Temporary storage and transport of peat on site from excavations to temporary storage areas will be minimised.

7.13.2.15 Other Fauna

In the event that construction is required to proceed during the breeding seasons of common frog/smooth newt, translocation will be undertaken where active breeding areas are within the Development footprint. Protection of existing hydrological conditions where drains are adjacent to or within the zone of influence (i.e. could be impacted by drainage works elsewhere) are required. In the event that the hydrology of existing breeding areas within the zone of influence cannot be maintained, translocation to suitable receptor sites can be used. If necessary, suitable replacement habitats will be created.

Amphibian fencing will be erected to prevent re-entry to areas which have been evacuated and any areas which could be occupied by amphibians during the construction period.

Densely vegetated areas and other features offering hibernacula will be searched for hibernating lizard prior to clearance if works are scheduled to be carried out between November – March inclusive. If hibernating lizards are encountered a buffer will be established and clearance will be postponed in that area until April.

A preconstruction survey for Dingy Skipper including a Bird's foot trefoil survey and egg/caterpillar searches (dependent on time of year) will be undertaken to identify if this species and/or it's larval foodplant is present within the works footprint. In the event of either being observed, sensitive areas will be cordoned where feasible. If required, careful translocation of plants and eggs to suitable areas outside the works footprint will be completed.

7.13.3 Mitigation measures during operation

7.13.3.1 Designated Nature conservation sites

Implement mitigation measures outlined in the CEMP, in addition to the NIS to minimise and prevent the identified indirect effects on water quality as outlined previously.

7.13.3.2 Habitats and Flora

Implement mitigation measures outlined in the CEMP, in addition to the NIS, to ensure that there will be no contamination of water bodies due to siltation or contaminated run-off during the operational phase.

7.13.3.3 Bats

Turbines will operate in a manner which restricts the rotation of the blades as far as is practicably possible below the manufacturer's specified cut-in speed[8]. This is usually achieved by feathering the blades during low wind speeds; the angle of the blades is rotated to present the slimmest profile possible towards the wind, ensuring they do not rotate or 'idle' when not generating power.

Turbine blades spinning in low wind can kill bats, however bats cannot be killed by feathered blades which are not spinning [118]. The feathering of turbine blades combined with increased cut-in speeds have been shown to reduce bat fatalities by up to 50%[8].

As such, the feathering of blades to prevent 'idling' during low wind speeds is proposed for all turbines.

Cut-in Speeds/Curtailment

Increasing the cut-in speed above that set by the manufacturer can reduce the potential for bat/turbine collisions. A study by Arnett *et al.*[119] showed a 50% decrease in bat fatalities can be achieved by increasing the cut-in speed by 1.5 m/s.

Species with elevated risk of collision (Leisler's bat, soprano, Nathusius' and common pipistrelle) in particular would benefit from increasing the cut-in speed of turbines, as dictated on a case-by case basis depending on the activity levels recorded at each turbine.

Cut-in speeds will be increased during the bat activity season (April-October) or where temperatures are optimal for bat activity to 5.5 m/s from 30 minutes prior to sunset and to 30 minutes after sunrise at turbines where surveillance shows high bat activity levels for High and Medium-Risk species and/or if bat carcasses are recorded.

The duration required depends on the level of mitigation required for each individual turbine i.e. a full bat activity season or only spring and autumn (duration will be determined by the first year of surveillance).

Cut-in speeds restrictions will be operated according to specific weather conditions:

- When the air temperature is greater than 7°C (as bat activity does not usually occur below this temperature).
- Generally, bat activity peaks at low wind speeds (<5.5m/s). As such, it has been shown that curtailing the operations of wind turbines at low wind speeds can

[118] Horn, J., E. B. Arnett, and T. H. Kunz. 2008. Interactions of bats with wind turbines based on thermal infrared imaging. Journal of Wildlife Management 72:123–132

[119] Arnett E.B., Huso M.M., Schirmacher M.R., Hayes J.P. (2011) Altering turbine speed reduces bat mortality at wind-energy facilities. Front Ecol Environ 9(4):209–14. http://dx.doi.org/10.1890/100103.

reduce bat mortality dramatically, particularly during late summer and the early autumn months.

Due to the considerable unnecessary down time resulting from the proposed "blanket curtailment" (above) and the advances in smart curtailment, a focused curtailment regime is further proposed from the year two of operation.

This will focus on times and dates, corresponding with periods when the highest level of bat activity occur within the Site. This includes the use of the SCADA (Supervisory Control and Data Acquisitions) operating system (or equivalent) to only pause/feather the blades below a specified wind speed and above a specified temperature within specified time periods.

Post-construction surveys will be undertaken for the first three years of operation to confirm if blanket curtailment restrictions can be amended in line with post-construction activity levels. The post construction surveys will be used to update the current curtailment regime (blanket curtailment) designed around the values for the key weather parameters and other factors that are known to influence collision risk. This will include all of the following:

- Wind speed in m/s (measured at nacelle height)
- Time after sunset
- Month of the year
- Temperature (ºC)
- Precipitation (mm/hr)

Post Construction surveys

Monitoring will take place for at least 3 years after construction, providing sufficient data to detect any significant change in bat activity relative to pre-construction levels. It will assess changes in bat activity patterns and the efficacy of mitigation to inform any changes to curtailment.

During years one to three of operation (under blanket curtailment restrictions) bat activity will be measured continuously between April and mid-October at each turbine location, in combination with carcass surveys. In addition, wind speed and temperature data will be continuously recorded at the nacelle height of each turbine.

Modern remotely-operated wind turbines as proposed here allow cut-in speeds to be controlled centrally/automatically, facilitating an operation regime designed to minimise harmful impacts to bats.

The feathering of turbine blades combined with increased cut-in speeds have been shown to reduce bat fatalities from 30% to 90% (Adams et al., 2021, Arnett et al., 2008, 2011, 2013; Baerwald et al., 2009).
The most recent of studies showed a 63% decrease in fatalities (Adams et al., 2021).

Monitoring Curtailment

If, following the initial 3 years of post-construction surveys, bat activity increases above the baseline and/or remains consistently high and carcass searches indicate fatalities are occurring (refer below), increased cut-in speeds will continue. This will subsequently be monitored in years 5, 10 and 15, with further review after each monitoring period.

Alternatively, if it is found that the results of bat activity surveys and fatality searches confirm that the level of bat activity at turbine locations is reduced (to low) then consent will be sought from Carlow County Council (in consultation with NPWS) for the cessation in the requirement for these cut-in speeds / curtailment measures, or a reduction on the timing restrictions for these measures.

Where post construction acoustic surveys are undertaken, they will utilise full spectrum automatic detectors deployed, as a minimum, for one complete bat activity season.

Acoustic monitoring will be supplemented with thermal imaging cameras etc. to provide more detailed information on bat activity in the vicinity of turbines.

Due to the level of Leisler's activity within the study area, nacelle-level surveys are also proposed for the post construction surveys. These will be used to identify the level of Leisler's bat activity above the tree canopy and within the height of the rotor-swept area.

An assessment of static data gathered during operational surveillance will be completed using the online analysis tool Ecobat as recommended by SNH[8] as a minimum, or other equivalent guidance as dictated by up-to date standards and practices.

Buffer zones

The vegetation-free buffer zones around the identified turbines will be managed and maintained during the operational life of the Development.

Due to mitigation by design (felling buffers), turbines will be sited at a suitable separation distance from trees and trees or vegetation are to be removed to ensure a woodland-free buffer zone.

The immediate surroundings of individual turbines will be managed and maintained so that they do not attract insects (i.e. the concentration of insects in the wind turbine vicinity should be reduced as much as possible, but not such that insect abundancies affected elsewhere on the Site). This will be achieved through physical management of habitats without the use of toxic substances.

The radius of each buffer zone as determined by the height of surrounding vegetation is listed below in Table 7-72 below:

Table 7-72: Vegetation Free Buffer Zones for Bats

Turbine number	Felling Buffer Radius (m)
1	91.7
2	91.7
3	91.7
4	91.7
5	91.7

Monitoring of mitigation measures

The success of the implemented mitigation measures for bats on the project will be monitored for a period of no less than three years post construction and appropriate measures taken to enhance these if and where required. A recommended schedule for monitoring is given in Table 7-73 below.

Bat fatality monitoring

Whilst no significant residual effects on bats are predicted, the development could provide an opportunity to gain baseline data on bat/turbine interaction and it is recommended that the scheme be monitored for bat fatalities for the first three years of operation (post construction surveys) and subsequently in years 5, 10 and 15 as part of the additional curtailment monitoring schedule. A comprehensive onsite fatality monitoring programme is to be undertaken following published best practice (e.g. SNH 2021 or equivalent at the time of operation).

The primary components of the bird mortality programme are outlined below, and an assessment of bat mortality will essentially follow the same methodology:

a) Carcass removal trials to establish levels of predator removal of possible fatalities. This will be done following best recommended practice and with due cognisance of published effects such as predator swamping, whereby excessive placement of carcasses increases predator presence and consequently skews results. No turbines which are used for carcass removal trials will be used for subsequent fatality monitoring.
b) Turbine searches for fatalities will be undertaken following best practice in terms of search area (focusing on hard standing) and at intervals selected to effectively sample fatality rates as determined by carcass removal trials in (a) above. [120]
c) A standardised approach with a possible control group and/or variation in search techniques such as straight line transects/ randomly selected spiral transects/ dog searches will be undertaken. This will provide a means of robustly estimating the post construction collision fatality impact (if any).
d) Recorded fatalities will be calibrated against known predator removal rates to provide an estimate of overall fatality rates.

Table 7-73: Monitoring schedule recommended for bat mitigation measures

Mitigation measure	Monitoring required	Description	Duration
Bat boxes and tubes	Monitor bat use	Bat boxes and tubes to be placed at locations removed from the wind farm as determined by project ecologist/ECoW at least one season before construction starts. These shall be examined by a licensed bat specialist according to NPWS recommendations. Records should be submitted to *Bat Conservation Ireland* for inclusion in its bat distribution database. Re-site if necessary. Annual cleaning required if well used by bats or if used by birds. Replacement if damaged/lost.	From mounting to 3 years post construction.
Mortality study	Fatality monitoring	Corpse searches beneath turbines to assess the impact of operation on bats.	From initial operation conducted during years 1, 2, 3, 5, 10 and 15 post construction. (Requirement for years 5, 10 and 15 subject to consultation with NPWS).

[120] Suitably trained dogs with handlers are significantly more efficient and faster than humans in locating carcasses and should preferably be used to achieve more robust results. Dog searches are, however, resource-demanding and may not always be necessary to identify if a problem exists.

Table 7-74: Summary of Operational-phase Mitigation Measures for Bats

Moderate and Moderate-High Level Bat Mitigation **Applies to T1, T2, T3, T4**
Operate the wind turbines in a manner that reduces the movement of the blades below the cut-in speed (e.g. by feathering the blades).
Put in place a monitoring programme for the first year of operation to ensure that bat activity is at a low level in vicinity of these turbines. Review monitoring results to determine if further bat mitigation measures are required.
Continue monitoring for years 1, 2, 3, 5, 10 and 15 post construction (requirement for years 5, 10 and 15 subject to consultation with NPWS).
Undertake a carcass search for years 1, 2, 3, 5, 10 and 15 post construction of the wind farm to determine whether a higher cut-in speed of the blades is required (requirement for years 5, 10 and 15 subject to consultation with NPWS).
Clear and maintain buffer zone free of woodland/trees within 50m of turbine blade tips.
Maintain immediate area around the wind turbines in a manner that does not attract insects.

7.13.3.4 Avifauna

A post construction monitoring programme is to be implemented at the subject site in order to confirm the efficacy of the mitigation measures; the results of this will be submitted annually to the competent authority and NPWS. Published guidance on assessing the effects of wind farms on birds from English Nature and the Royal Society for the protection of birds recommends the implementation of an agreed post development monitoring programme as a best practice mitigation measure[65].

In addition, published recommendations on swans and wind farms[121] suggests that systematic post construction monitoring; adapted to quantify collision, barrier and displacement, be conducted over a period of sufficient duration to allow for annual variation or in combination effects. The following individual components are proposed.

- Fatality Monitoring (to be conducted during years 1, 2, 3, 5, 10 and 15 post construction, with the requirement for years 5, 10 and 15 subject to consultation with NPWS)- A comprehensive fatality monitoring programme is to be undertaken following published best practice; the primary components are as follows:
- Initial carcass removal trials to establish levels of predator removal of possible fatalities. This is to be done following best recommended practice and with due cognisance to published effects such as predator swamping, whereby excessive placement of carcasses increases predator presence and consequently skews results[122].

  No turbines which are used for carcass removal trials are to be used for subsequent fatality monitoring. Carcass removal trials shall be continued for the duration of fatality searches.
- Turbine searches for fatalities are to be undertaken following best practice [98 123] in terms of search area (minimum radius hub height) and at intervals selected to effectively sample fatality rates based on carcass removal rates (e.g. 1 per month). To be conducted during years 1, 2, 3, 5, 10 and 15 post construction (requirement

[121] Rees, E.C. (2012) Impacts of wind farms on swans and geese: A review. Wildfowl 62:37–72

[122] Shawn, K. *et al.* (2010). Novel scavenger removal trials increase wind turbine-caused avian fatality estimates. Smallwood, 5, Journal of Wildlife Management, Vol. 74, pp. 1089-1097.

[123] Grunkorn, T. (2011). Proceedings: *Conference on wind energy and wildlife impacts*, 2-5 May 2011,Trondheim, Norway. Trondheim : NINA,.

for years 5, 10 and 15 subject to consultation with NPWS) to allow for annual variation and cumulative effects.

- A standardised approach with a possible control group and/or variation in search techniques such as straight line transects/ randomly selected spiral transects/ dog searches will be undertaken. This will provide a means of robustly estimating the post construction collision fatality impact (if any).
- Recorded fatalities to be calibrated against known predator removal rates to provide an estimate of overall fatality rates.

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

- Flight Activity Survey -to be conducted during years 1, 2, 3, 5, 10 and 15 post construction (requirement for years 5, 10 and 15 subject to consultation with NPWS). A flight activity survey is to be undertaken during the summer and winter months to include both Vantage Point and hinterland surveys as Per SNH guidance [6]:
- Record any barrier effect i.e. the degree of avoidance exhibited by species approaching or within the wind farm (Drewitt and Langston, 2006). Target species to be all raptors, all wild goose and duck species, all swan species and all wader species.
- Record changes in flight heights of key receptors post construction.

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

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

This aims to:

- Assess displacement levels (if any) of wildfowl such as swans post construction
- Assess overall habitat usage changes within the vicinity of the Wind Farm Development post construction.

This survey is to be conducted during years 1, 2, 3, 5, 10 and 15 post construction (requirement for years 5, 10 and 15 subject to consultation with NPWS) to allow for annual variation and cumulative effects. Dependant on results further monitoring requirements will be agreed with NPWS.

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

- Breeding Bird Survey - to be conducted during years 1, 2, 3, 5, 10 and 15 post construction (requirement for years 5, 10 and 15 subject to consultation with NPWS). A breeding bird survey (moorland breeding bird and Common Bird Census), following methods used in the baseline survey to be repeated yearly between early April to early July. This aims to:
- Assess any displacement effects such as those recorded on breeding birds. Overall density of breeding birds to be annually recorded.

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

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

Prevention of Hen harrier breeding habitat establishment

The primary measure recommended in the SNH (2016) Guidance Note[106], management of ground vegetation to 30cm or less in large open areas within 500m of turbines, is complimentary to the maintenance of bat felling buffers and will be incorporated into the maintenance regime for these areas.

The area of raised bog/cutover bog is not anticipated to support high growing vegetation during the rehabilitation process; the re-wetting of these areas is likely to reduce the vegetation height. If required, this area can also be managed to maintain vegetation height of 30cm or less by mechanical means.

There are no other large open areas at the site suitable for nesting or roosting potentially requiring management of this type.

Aviation Lighting

The colour, mode, intensity and density of lighting has been shown to influence the degree to which birds (specifically, nocturnally migrating passerines) are attracted to wind turbines at night. Guidance on mitigating the effects of aviation lighting on birds is provided in the information note '*The Effect of Aviation Obstruction Lighting on Birds at Wind Turbines, Communication Towers and Other Structures*' (NatureScot 2020).

Studies have shown that red lighting is more attractive to birds, and that steady burning lights are more attractive than flashing ones, while structures with no lighting were the least attractive [124] [125]. The directional intensity of lighting is also a factor in reducing the attraction of birds.

As such, the following mitigation is proposed, pending approval by the IAA:

Lighting will not be installed on all turbines. The exact arrangement is subject to approval by the IAA, however it is considered that lighting can be limited to the minimum number of turbines to identify the outline of the wind farm (e.g. T1, & T5, or T1, T3 & T5).

Flashing white or green lights will be fitted. If red lights are required by the IAA, flashing lights will be used.

The most intense light will be focused within the horizontal plane, reducing the attraction of high and low-flying birds. Further to this, shielding will be fitted to prevent light emissions towards the ground. As for the previous measures, the viability and exact specifications for this aspect are subject to approval by the IAA.

7.13.3.5 Aquatic Ecology

The primary impact to aquatic ecology resulting from the operational phase is an increase in surface water run-off from hard-standing areas. Mitigation for the maintenance regime is outlined in **Chapter 8: Hydrology & Hydrogeology**. The maintenance of the Development will incorporate effective maintenance of the drainage system, including

[124] Kerlinger et al., 2010 *Night Migrant Fatalities and Obstruction Lighting at Wind Turbines in North America*

[125] Gehring et al., 2009 *Communication towers, lights, and birds: Successful methods of reducing the frequency of avian collisions*

visual inspections in accordance with maintenance schedule in CIRIA C753. Therefore, it is not envisaged that maintenance will involve or accrue significant effects on the hydrological regime of the area. Quarterly inspections of the erosion and sediment control measures on site (i.e. drains, swales, outfalls to field drains) will be undertaken for the first year following construction and annually thereafter to ensure operational efficiency.

7.13.3.6 Peat stability

Where the peat layer is typically of 1 m thickness or greater and side slope is significant or where failure of the peat could result in landslip, the peat may require to be excavated down to rockhead or suitable sub-soil horizon, leaving batters on each side with angles sufficient to ensure stability of the peat. Similarly, for excavations typically less than 1 m, but where the local gradient gives concern with regards to the stability of the peat, suitable slopes shall be formed for stability.

7.13.4 Mitigation Measures during Decommissioning

The same mitigation measures will apply for the decommissioning phase as for the construction phase.

7.14 Ecological Enhancement

A number of measures to enhance the ecological value of the site are proposed. These are detailed in Appendix A7.9. The measures include:

- Re-wetting/restoration of the peatland habitats onsite by blocking drains
- The creation of a new wildlife pond within the reinstated borrow pit area
- Installation of a Pine marten den box
- Creation of shelter habitats for insects, amphibians, reptiles and small mammals (mining bee banks, insect hotels, log piles and refugia/hibernacula)
- Meadow planting along access track verges

7.14.1 European sites

The Natura Impact statement concluded that, on the basis of objective scientific information, the main

7.15 Residual Effects

7.15.1 European sites

The Natura Impact statement concluded that, on the basis of objective scientific information, the main wind farm site, turbine delivery route, grid connection and replant lands will not, either alone or in combination with other plans or projects, adversely affect any of the constitutive interests of the River Barrow and River Nore SAC (or any other European site), in light of the sites' conservation objectives.

7.15.2 Natural Heritage Areas or Proposed Natural Heritage Areas

Potential for construction and operational-phase effects to Mothel Church Coolcullen pNHA and Whitehall Quarries pNHA via mobile species (Natterer's bat and Peregrine falcon respectively) was identified. Following mitigation, **Long-term Slight Effects** to Mothel Church Coolcullen pNHA are reduced to **Long-term Imperceptible Effects**.

Effects on Whitehall Quarries pNHA were considered to be **Long-term Imperceptible** prior to mitigation and remain the same after (monitoring will detect whether effects rise above the level of **Imperceptible**).

7.15.3 Mammals

Measures to protect red squirrel, pygmy shrew, Irish stoat and pine marten include restricting felling operations to outside their breeding periods, and pre-felling surveys where this cannot be facilitated. Badgers will be protected through a suite of measures including pre-construction surveys, temporary hard-blocking of setts in felling areas and in close proximity to the Development and the implementation of buffer zones as required. No actions to exclude badgers from active setts will be undertaken during the breeding season (December - June inclusive).

Some permanent loss of areas of scrub and conifer plantation habitats which could be used by foraging and breeding mammals for shelter/breeding will occur. While scrub may develop in these areas, this will be periodically disturbed during the course of operation of the Development due to the maintenance of tree-free turbulence/bat mitigation buffers around turbines. The implementation of mitigation measures will reduce residual effects to **Long-term Imperceptible Negative Reversible Effects** in the local context.

For Otters, by implementing the water quality mitigation measures outlined in the CEMP, residual effects are considered to be **Non-Significant, Short-Term** and in the local context (i.e. sub-catchment scale).

The habitats used by protected mammal species within the Development footprint and felling areas represent a small amount of the total available within the study area and are also present within the wider landscape.

7.15.4 Bats

The turbines are to be located within or close to existing tree—dominated vegetation but providing a 50m vegetation-free buffer zone (50m from turbine blade tip to top of surrounding trees) around each turbine will reduce the risk of collision and/or barotrauma to foraging and/or commuting species such as pipistrelles. Post construction bat fatality monitoring will also be undertaken at the subject site.

The adjudged worst-case scenario is that, during operation, the turbines may possibly cause injury or death to a few individual specimens of Leisler’s bat as it is a high-flying species (10m to 70m+). However, the amount of time spent hunting at the upper height limit cannot be assessed accurately due to the maximum distance (60m to 80m) of detection of this species by ultrasound detectors[7] but most activity and time can be expected to occur in the mid-region of the species hunting altitude i.e. 40m.

The resulting effect of the Development on local bat populations, with implemented mitigation measures, is considered to be a **Slight to Imperceptible Residual Negative Reversible Effect** and in the Local Context with the favourable conservation status (FCS) of bat species being unaffected and all species confirmed or expected in or near the study areas are predicted to persist.

7.15.5 Habitats and Flora

The Development will lead to some permanent loss of habitat. The habitat loss will be the total area covered by the felling buffers and covered by the proposed development infrastructure.

Not all land take is permanent as felled areas will regenerate periodically to develop into scrub.

The implementation of invasive species control measures will avoid the spread of invasive species as a result of cumulative interactions between the Development and Grid application cable route.

The Development shall result in the short-term disturbance of 0.07 Ha (2% of total) of Cutover bog / Wet heath (PB4/HH3) Mosaic. These areas will recover and re-vegetate within 1-3 years. The loss of 0.09 Ha (2.6 %) of Cutover bog / Wet heath (PB4/HH3) Mosaic will be offset by the proposed re-wetting and restoration of peatland habitats within the land ownership boundary (see Appendix A7.9).

With the application of the appropriate mitigation measures as outlined, it is considered that the effects of the Development will be minimised to an acceptable level, resulting in **no residual effects**.

7.15.6 Avifauna

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

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

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

7.15.7 Aquatic Ecology

Overall, the Development will have an imperceptible to significant negative, short-term effect on sensitive aquatic receptors prior to mitigation.

By implementing the mitigation measures outlined in Section 7.13, the CEMP and **Chapter 8: Hydrology and Hydrogeology**, effects on water-dependent species and habitats are considered to be **Not-significant, Short-term** and in the local context (i.e. sub-catchment scale).

7.15.8 Other Fauna

Following mitigation, residual effects are assessed as **Imperceptible Reversible Residual Effects** in the local context.

7.16 Statement of Significance

Following mitigation, the significance of residual effects has been reduced to levels ranging from **Imperceptible to Not significant**.

Effects are considered to be significant for the purposes of the EIA Regulations where the effect is classified as being of 'major' or 'moderate' significance.

As such, following mitigation there are no significant effects from the Development on ecological receptors. No significant cumulative effects from the Development and other wind farm developments and activities are predicted following implementation of mitigation measures.

Therefore, the overall effect of the Development on Biodiversity is **'Not Significant'.**

8 HYDROLOGY AND HYDROGEOLOGY

8.1 INTRODUCTION

This Chapter of the Environmental Impact Assessment Report (EIA Report) evaluates the effects of the proposed Bilboa Wind Farm (the Development), on the hydrology and hydrogeology resource. This Chapter has been compiled using information from the previously submitted EIA Chapter 8 (2020) as well as the Further Information (FI) submitted to Carlow County Council (CC) in November 2021.

All elements of the proposed Bilboa Wind Farm are the same as the Consented Wind Farm, therefore, this assessment references the previous EIS, EIA Report and FI Report, where appropriate, as the basis for the determination of hydrological and hydrogeological impacts associated with the Development.

The land within Development boundary (the Site) which contains the Development is located approximately 8 kilometres (km) southwest of the town of Carlow, County Carlow within Carlow County Council, as shown on Figure 1.1.

This Chapter of the EIA Report is supported by the following Figures provided in Volume II EIA Report Figures:

- Figure 8.1: Hydrology Study Areas; and
- Figure 8.2: Hydrology Catchments.

This Chapter of the EIA Report is supported by the following Technical Appendix documents provided in Volume III Technical Appendices:

- A4.1: Construction Environmental Management Plan (CEMP).

This Chapter includes the following elements:

- Key Conclusions of 2011 EIS & FI, 2020 ES and 2021 FI;
- Legislation, Policy and Guidance;
- Assessment Methodology and Significance Criteria;
- Baseline Conditions;
- Embedded Mitigation
- Assessment of Potential Effects;
- Cumulative Effects Assessment;
- Mitigation and Residual Effects;
- Summary of Effects; and
- Statement of Significance.

8.2 KEY FINDINGS OF EIS & FI

The findings of the 2011 Environmental Impact Statement (the 2011 EIS) and FI were that the residual and cumulative effects on the hydrological environment from the Original Wind Farm are minimal following implementation of measures to mitigate effects, and not significant in EIA terms.

The key receptors identified in relation to the water environment were minor surface watercourses that ultimately drain to the River Barrow and groundwater units which are poor aquifers of unproductive (low yielding) strata, but highly vulnerable to pollution.

Chapter 11 (Hydrology & Hydrogeology) of the 2011 EIS identified no designated sites in connectivity with the Original Wind Farm; however, it should be noted that Chapter 8 (Ecology) of the 2011 EIS notes the Original Wind Farm being 2.5km upstream of the River Barrow and River Nore SAC.

No areas within the Original Wind Farm red line boundary or within 4 km of the Site were susceptible to flooding. It also identified no major effects to the hydrological environment as a result of forestry felling and removal works.

The 2011 FI Report summarised that there would be no adverse residual effects on groundwater or surface water fed private water supplies to surrounding properties or any third-party users of surface water or groundwater for water supply purposes.

8.2.1 Summary of the 2011 EIS

Hydrological effects were assessed within Chapters 8 and 11 of the 2011 EIS. Chapter 8 of the 2011 EIS also considers ecology and aquatic ecology, which are addressed in detail in Chapter 7 of this EIA. This section of the hydrology and hydrogeology chapter focuses on hydrological conditions and effects.

8.2.1.1 2011 Environmental Impact Assessment

The 2011 EIS identified the hydrological baseline of the Site; the Site is located on the watershed between the catchment of the River Barrow to the southeast, and the Dinin River section of the River Nore catchment to the northwest. The southeast of the site is approximately 7 km from the River Barrow, to which it drains via three small tributaries which join together approximately 3 km downstream to form the stream flowing under the Rathornan Bridge to join the Barrow upstream of Leighlin bridge. Both the River Barrow and River Nore are part of the River Barrow & River Nore SAC.

Potential effects identified from the Original Wind Farm on hydrology included:

- Pollution of watercourses during construction with suspended solids due to run-off from construction;
- Pollution of watercourses during construction with nutrients due to ground disturbance;
- Pollution of watercourses during construction due to forestry clear felling;
- Pollution of watercourses during construction with substances such as fuels, lubricants, waste concrete, waste water from site toilet and wash facilities;
- Pollution of watercourses with surface drainage water from paved areas and road surfaces;
- Hydrological impacts due to changes in the flow rates of streams/rivers;
- Permanent loss of habitat due to culverting or bank/stream alterations; and
- Obstruction to upstream movement of aquatic fauna due to culverting.

Mitigation measures and commitments proposed to limit construction phase effects on hydrological receptors were:

- Release of suspended solids to all watercourses kept to a minimum, with total suspended solids not exceeding 25 mg/l in discharges to salmonid streams or watercourses joining salmonid streams;
- Tree felling to be carried out from all proposed clearfell areas where possible to do so without causing a significant increase in suspended solids to streams & rivers;
- Where brash removal without serious additional risk of suspended solids generation is not possible using conventional methods, brash will be left on site but removed as far back as possible from watercourses. Brash must be removed within 20 m of all watercourses including drains;
- Stacking and loading of timber will not be carried out in proximity to a watercourse and, where possible, will be located on dry ground;
- A suite of mitigation measures were specified to prevent pollution during the construction phase by concrete, hydrocarbons and other pollutants; and
- A biological and chemical monitoring system will be put in place on potentially affected streams prior to and during the construction phase.

Mitigation measures and commitments proposed to limit effects on hydrological receptors during operation included:

- A sustainable drainage system will be installed on the new and upgraded access tracks will prevent significant pollution to surface receiving waters, which will be capable of achieving at least an 85 % reduction of suspended solids in runoff; and
- Flow attenuation will be included in the drainage design to ensure no significant increase in peak stream/river flows.

The 2011 Environmental Impact Statement (the 2011 EIS) and FI determined minimal residual and cumulative effects on the hydrological environment from the Original Wind Farm,

The key receptors identified in relation to the water environment are minor surface watercourses that ultimately drain to the River Barrow and groundwater units which are poor aquifers of unproductive (low yielding) strata but which are highly vulnerable to pollution.

8.2.1.2 2011 Hydrological & Hydrogeological Impact Assessment

Chapter 11 of the 2011 EIS identified that the site was located between the Dinin River and River Barrow surface water catchments, and runoff from the Site predominantly drains to two unnamed streams to the south and west of the Site.

The hydrogeology of the site was classified as bedrock, which underlies the Site as a Poor Aquifer which is generally unproductive. The vulnerability of the aquifers underlying a localised area to the southeast of the Site is rated as Extreme by the GSI due to the presence of rock at the surface. The rock at the surface coincides with the exposure of Namurian Shales along the edge of the Castlecomer Plataeu. The aquifers underlying the rest of the Site are rated as "high to low".

Potential effects related to hydrology identified in Chapter 11 of the 2011 EIS include:

- Peat instability, impacting on surface waters and groundwater dependent ecosystems;
- Waste generation and management, impacting on groundwater dependent ecosystems;
- Groundwater contamination, impacting on surface waters and aquifers;
- Emplacement of materials, impacting on site geochemistry and hydrochemistry;
- Physical changes to surface water, impacting on surface waters and dependent ecosystems;
- Suspended sediment, impacting down-gradient streams and rivers, aquifers and groundwater dependent ecosystems;
- Excavation seepage, impacting down gradient streams;
- Accidental spillage of hydrocarbons, impacting down-gradient streams and rivers, and groundwater dependent ecosystems;
- Release of cement-based products, impacting surface water, groundwater and groundwater dependent ecosystems; and
- Impacts on surface and groundwater quality from site run-off, impacting down-gradient streams and rivers, and groundwater dependent ecosystems.

Following the appropriate mitigation measures detailed within the Orignal Wind Farm CEMP, as well as commitments that natural routes of watercourses would be maintained and no-onsite discharge of domestic wastewater would take place, residual effects were identified as minimal. Therefore, no significant effects from the Original Wind Farm were identified on hydrology or hydrogeology.

8.2.2 Summary of the 2020 EIA Report Hydrology Chapter

The 2020 EIA Report evaluates the effects of the increase in rotor size (the Rotor Modification) and crane hardstanding size (the Crane Hardstanding Modification) the pursuant to the development of wind turbines at the Bilboa Wind Farm ('the Consented Modification'), on the hydrology and hydrogeology resource. The Consented Modification and the Original Wind Farm in combination for the Consented Development. The Proposed Development is physically the same as the Consented Development.

The Chapter concludes that the Consented Modification has no significant direct or cumulative effects on the hydrological environment based on the assessment of:

- Key Conclusions of 2011 EIS & FI;
- Changes to Legislation, Policy and Guidance;
- Methodology and Significance Criteria;
- Baseline Conditions;
- Embedded Mitigation;
- Assessment of Potential Effects;
- Cumulative Effects Assessment; and
- Mitigation and Residual Effects.

8.2.3 Summary of the 2021 FI Hydrology Section

The Hydrology section of 2021 FI Report (Section 3.4) is the Applicant's response to the FI Request raised by Carlow County Council, and addresses revisions to the 2020 Environmental Impact Assessment Report (EIA Report) and Natura Impact Statement in respect of Application PL 21/15. Application 21/15 requests consent under Section 34 of the Planning and Development Act 2000, as amended (the Planning Act) from Carlow County Council to modify the rotor diameter; crane hardstanding size; felling; and operational life pursuant to the consented development of wind turbines at the Bilboa Wind Farm.

The FI Request requested that the following amendments and additions be made:

- *"Notwithstanding existing planning permissions, the report should include at least a summary of all relevant sections from the 2011 EIS. This is required in view of case law regarding project splitting regarding EIA.*
- *A map should be included which will show watercourses and drains within the site and along the grid connection route.*
- *The applicant shall examine potential impacts on the Paulstown public water supply.*
- *The applicant shall examine potential impacts on the Bilboa public water supply.*
- *The applicant is advised that a submission was received from the Health Service Executive - Environmental Health Officer who has indicated that the proposed development is understood to be within the vicinity of the Ballinabranna Group Water scheme. It is recommended that an assessment of the impacts, if any, of the proposed development on the Ballinabranna Group Water scheme is undertaken and mitigation measures necessary to protect this drinking water source be outlined. Wells identified as 'domestic use only' should be tested prior to and on completion of the construction of the wind turbines in order to ensure that the quality of the drinking water supplied to private homes is not impacted by construction activity.*
- *A map shall be provided which will show all private and public water supplies within 2 km of the Site Boundary.*
- *Additional detail shall be submitted on proposed works to be carried out at stream and culvert crossings."*

In response to the FI Request raised by Carlow County Council, the 2021 FI report provided the following information:

- A summary of the 2011 EIS;
- A map showing the watercourses and drains within the Site and along the grid connection route
- A detailed consideration of the population with the combined Development;
- Consideration of potential effects on Paulstown and Bilboa Public Water Supplies, and the Ballinabranna Group Water Scheme;
- A Figure to show all private and public water supplies within 2 km of the Site; and
- Details on the works proposed to be carried out at stream and culvert crossings.

8.3 LEGISLATION, POLICY AND GUIDANCE

The following legislation, guidance, and information sources specific to hydrological and hydrogeological resources have been considered when carrying out this assessment:

- The Water Framework Directive (WFD) (2000/60/EC)[1] establishes a framework for the protection, improvement, and sustainable use of all water environments. It is transposed into Irish law by means of the following regulations;
  - European Communities (Water Policy) Regulations, 2003[2];
  - European Communities Environmental Objectives (Surface Waters) Regulations, 2009[3];
  - European Communities Environmental Objectives (Groundwater) (Amendment) Regulations, 2016[4];
  - European Union Waste Water Discharge Regulations, 2020[5];
  - European Communities (Good Agricultural Practice for Protection of Waters) Regulations, 2010[6];
  - European Communities (Technical Specifications for the Chemical Analysis and Monitoring of Water Status) Regulations, 2011[7]; and
  - European Union (Water Policy) Regulations 2014[8].

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[1] European Commission (2000) The EU Water Framework Directive – integrated river basin management for Europe [Online] Available at: https://ec.europa.eu/environment/water/water-framework/index_en.html (Accessed: 27/06/20222)

[2] Government of Ireland (2003) S.I. No. 722/2003 – European Communities (Water Policy) Regulations 2003 [Online] Available at: http://www.irishstatutebook.ie/eli/2003/si/722/made/en/print#article1 (Accessed: 27/06/20222)

[3] Government of Ireland (2009) S.I. No. 272/2009 – European Communities Environmental Objectives (Surface Waters) Regulations 2009 [Online] Available at: http://www.irishstatutebook.ie/eli/2009/si/272/made/en/print (Accessed: 27/06/20222)

[4] Government of Ireland (2016) S.I. No. 366/2016 – European Communities Environmental Objectives (Groundwater) (Amendment) Regulations 2016 [Online] Available at: http://www.irishstatutebook.ie/eli/2016/si/366/made/en/print (Accessed: 27/06/20222)

[5] Government of Ireland (2020) S.I. No. 214/2020 – European Union (Waste Water Discharge) Regulations 2020 [Online] Available at: https://www.epa.ie/pubs/legislation/wwda/europeanunionwastewaterdischargeregulations2020sino214of2020.html (Accessed: 27/06/20222)

[6] Government of Ireland (2010) S.I. No. 610/2010 - European Communities (Good Agricultural Practice for Protection of Waters) Regulations, 2010 [Online] Available at: http://www.irishstatutebook.ie/eli/2010/si/610/made/en/print (Accessed: 27/06/20222)

[7] Government of Ireland (2011) S.I. No. 489/2011 - European Communities (Technical Specifications for the Chemical Analysis and Monitoring of Water Status) Regulations, 2011 [Online] Available at: http://www.irishstatutebook.ie/eli/2011/si/489/made/en/print (Accessed: 27/06/20222)

[8] Government of Ireland (2014) S.I. No. 350/2014 – European Union (Water Policy) Regulations 2014 [Online] Available at: http://www.irishstatutebook.ie/eli/2014/si/350/made/en/print (Accessed: 27/06/20222)

- The Carlow County Development Plan (DCCDP) 2022-2028[9] in accordance with Section 12(1)(b) of the Planning and Development Act, 2000 (as amended) outlines the strategy for the proper planning and sustainable development of Carlow County over the period 2022-2028. The Plan is consistent with the National Planning Framework (2018) (NPF) and the Regional Spatial and Economic Strategy (2020) (RSES). The draft plan is further supported by;
  - A Strategic Environmental Assessment (SEA) Environmental Report[10], prepared in accordance with the Planning and Development (Strategic Environmental Assessment) Regulations 2004 (S.I No. 436 of 2004) (as amended);
  - An Appropriate Assessment (AA) Natura Impact Report[11] pursuant to the Habitats Directive (92/43/EEC) and the Planning and Development Act 2000 (as amended); and
  - A Strategic Flood Risk Assessment[12] pursuant to The Planning System and Flood Risk Management Guidelines (2009).

Other relevant legislation includes:

- Protection of the Environment Act 2003[13];
- European Communities (Drinking Water) (No. 2) Regulations 2007[14];
- European Communities (Assessment and Management of Flood Risks) Regulations 2010[15] and subsequent 2015 amendment[16]; and
- Water Quality (Dangerous Substances) Regulations, 2001[17].

Guidance documents include:

- Guidelines on the information to be contained in Environmental Impact Assessment Reports[18];
- Revised Draft Wind Energy Development Guidelines (DWEDG) 2019[19];

[9] Carlow County Council (2021) Draft Carlow County Development Plan 2022-2028 [Online] Available at: Chapter 1: Introduction and Context | Carlow County Council's Online Consultation Portal (Accessed 27/06/20222)
[10] Carlow County Council (2021) SEA Environmental Report (2021) [Online] Available at: Microsoft Word - Carlow Draft CDP 2022-2028 SEA ER (Accessed 27/06/20222)
[11] Carlow County Council (2021) Natura Impact Report (2021) S.I No. 436 of 2004 [Online] Available at: Microsoft Word - Carlow Draft CDP 2022-2028 AA NIR (Accessed 27/06/20222)
[12] Carlow County Council (2021) Strategic Flood Risk Assessment for Draft Carlow County Development Plan 2022-2028 (2021) [Online] Available at: JBA Consulting Report Template 2015 (carlow.ie) (Accessed 27/06/20222)
[13] Government of Ireland (2003) Protection of the Environment Act 2003 [Online] Available at: http://www.irishstatutebook.ie/eli/2003/act/27/enacted/en/html (Accessed: 27/06/20222)
[14] Government of Ireland (2007) S.I. No. 278/2007 – European Communities (Drinking Water) (No. 2) Regulations 2007 [Online] Available at: http://www.irishstatutebook.ie/eli/2007/si/278/made/en/print (Accessed: 27/06/20222)
[15] Government of Ireland (2010) S.I. No. 122/2010 – European Communities (Assessment and Management of Flood Risks) Regulations 2010 [Online] Available at: http://www.irishstatutebook.ie/eli/2010/si/122/made/en/print (Accessed: 27/06/20222)
[16] Government of Ireland (2015) S.I. No. 495/2015 – European Communities (Assessment and Management of Flood Risks) (Amendment) Regulations 2015 [Online] Available at: http://www.irishstatutebook.ie/eli/2015/si/495/made/en/print (Accessed: 27/06/20222)
[17] Government of Ireland (2001) S.I. No. 12/2001 – Water Quality (Dangerous Substances) Regulations, 2001 [Online] Available at: http://extwprlegs1.fao.org/docs/html/ire52859.htm (Accessed: 27/06/20222)
[18] Environmental Protection Agency (2022) *Guidelines on the information to be contained in Environmental Impact Assessment Reports* [Online] Available at: EIAR_Guidelines_2022_Web.pdf (epa.ie) (27/06/2022)
[19] Government of Ireland Department of Housing, Planning and Local Government (2019) Draft Revised Wind Energy Development Guidelines December 2019 [Online] Available at: https://www.housing.gov.ie/sites/default/files/public-consultation/files/draft_revised_wind_energy_development_guidelines_december_2019.pdf (Accessed: 27/06/20222)

- The Planning System and Flood Risk Management Guidelines 2009 and accompanying technical appendices[20];
- European communities (Drinking water) (no.2) Regulations 2007 – Private Water Supplies Handbook[21]; and
- National Peatlands Strategy, 2017[22].

8.4 ASSESSMENT METHODOLOGY AND SIGNIFICANCE CRITERIA

8.4.1 Pre-Application Consultation Responses

Consultation and the responses received for this EIA Report topic was undertaken with the organisations shown in Table 8.1.

Table 8.1: Consultation Responses

Consultee	Type and Date	Summary of Consultation Response
Environmental Protection Agency Ireland	Pre-Application Consultation Letter (sent via email only) 08/10/2020	No response received to date.
Irish Water	Pre-Application Consultation Letter (sent via e-mail only) 08/10/2020	No response received to date.
Office of Public Works	Pre-Application Consultation Letter (sent via e-mail only) 08/10/2020	No response received to date.
River Basin District	Pre-Application Consultation Letter	No response received to date.
Carlow County Council	EIA Report and Natura Impact Statement (Application 21/15) December 2020	FI Report (2021) issued to Carlow County Council in response to an FI request by Carlow County Council to address revisions to the original EIA report and Natura Impact Statement.

8.4.2 Scope of Assessment

The key issues for the assessment of potential hydrology and hydrogeology effects relating to the Development include short-term (construction) and long-term (operation), which are outlined in this Section.

Potential short-term effects arising from the construction phase include:

- Chemical pollution of watercourses and the wider hydrological and hydrogeological environment, including groundwater, as a result of construction works, including from cement works and oil and fuel (hydrocarbons);

[20] Office of Public Works (2009) Guidelines on the Planning System and Flood Risk Management and Technical Appendices [Online] Available at: https://flooding.ie/planning-guidelines/ (Accessed: 27/06/20222)
[21] EPA Office of Environmental Enforcement (2010) A Handbook on the Implementation of the Regulations for Water Services Authorities for Private Water Supplies [Online] Available at: https://www.epa.ie/pubs/advice/drinkingwater/privatewatersupplieshandbook/Introduction.pdf (Accessed: 27/06/20222)
[22]NWPS (2017) National Peatlands Strategy, 2017 [Online] Available at: https://www.npws.ie/peatlands-and-turf-cutting/peatlands-council/national-peatlands-strategy (Accessed 27/06/20222)

- Sediment and silt pollution of watercourses and the wider hydrological and hydrogeological environment, including groundwater, as a result of construction works;
- Impediments to watercourse and near-surface flow;
- Increase in surface water run-off rates as a result of felling; and
- Negative short-term changes to quantity, quality, and continuity of private and/ or public water supplies.

Potential long-term effects include:

- Increased run-off from the Crane Hardstanding;
- Chemical pollution of watercourses and the wider hydrological and hydrogeological environment, including groundwater, as a result of operational vehicles and activities e.g., fuel tank leakage; and
- Negative long-term changes to quantity, quality, and continuity of private and/ or public water supplies.

8.4.3 Elements Scoped Out of Assessment

Assessment of the effects of flooding on the Development have been scoped out as the Office of Public Works (OPW) flood maps do not identify a probability of river flooding or pluvial flooding (rainfall) within the area of the Development or the Wider Study Area and no previous flood events have been recorded at the Site.

Additionally, potential effects associated with chemical pollution have been scoped out of the assessment as they will be the same as the 2011 EIS and FI.

8.4.4 Study Area

The study area is defined by the land within the Site red line boundary (the Site Boundary) as shown on Figure 1.2 (the Core Study Area). The Development is located approximately 8 km south of Bilboa in County Carlow on an area of forested land at an elevation ranging from 290 m above ordnance datum (AOD) to 300 m AOD (the Site). It lies within the upstream surface water catchment of the River Barrow (Hydrometric Area 14) and the River Dinin (Hydrometric Area 15), as shown on Figure 8.2. The Site has a number of small watercourses which drain to the south of the Site discharging to the River Barrow.

A wider hydrological survey area of 5 km is defined to assess the potential effects on the downstream water environment (the Wider Study Area). At distances greater than 5 km, it is considered the Development is unlikely to contribute to a hydrological effect in terms of chemical or sedimentation effects, due to dilution and attenuation of potentially polluting chemicals.

A survey area of 2 km from the Site Boundary is defined to identify and assess the risk to water supplies (the Water Supply Study Area).

The Hydrology Study Areas are shown in Figure 8.1.

8.4.5 Design Parameters

The Crane Hardstanding has been designed to avoid impinging on the original 50 m watercourse buffers emplaced during the 2011 EIS.

8.4.6 Baseline Survey Methodology

The baseline survey methodology consists of review of the 2011 EIS & FI Reports and desk-based assessment of current and any updated publicly available datasets, including:

- Geological Survey Ireland Spatial Resources and maps[23];
- EPA catchments data[24];
- EPA maps database[25];
- Office of Public Works Flood Maps[26];
- Office of Public Works Hydro-Data (gauging station measurements)[27];
- National Parks and Wildlife Services Map Viewer[28];
- Water Framework Directive Ireland 'Water Maps'[29]; and
- Met Éireann Weather Observations Website (WOW-IE)[30].

This desk-based assessment and consultation process, as outlined in Section 8.4.1 will inform the assessment of whether the Development effects on the hydrological and hydrogeological receptors. The assessment is also informed by the ecology survey and ground investigation works undertaken. It will also identify any potential new receptors not identified in the 2011 EIS, for example water supplies or designated sites which have been instated since 2011.

8.4.7 Methodology for the Assessment of Effects

The significance of the potential effects of the Development has been classified by professional consideration of the sensitivity of the receptor and the magnitude of the potential effect.

Arcus EIA methodology for assessing the significance of potential effects, in accordance with the EIA Regulations, is outlined in **Chapter 2: EIA Methodology**.

The assessment criteria specific to hydrology and hydrogeology is outlined in Section 8.4.7.1 to Section 8.4.7.3. The assessment is based on a source-pathway-receptor methodology, where the sensitivity of the receptors and the magnitude of potential change upon those receptors identified within the study areas outlined in Section 8.4.4.

8.4.7.1 Sensitivity of Receptors

The sensitivity of the baseline conditions, including the importance of environmental features on or near to the Site or the sensitivity of potentially affected receptors, will be assessed in line with best practice guidance, legislation, statutory designations and / or professional judgement.

Table 8.2 details the framework for determining the sensitivity of receptors.

Table 8.2: Framework for Determining Sensitivity of Receptors

Sensitivity of Receptor	Definition
High	• A large, medium or small waterbody with a WFD water quality classification of 'Good'.

[23] Geological Survey Ireland (n.d.) Public Data Viewer Series [Online] Available at: https://www.arcgis.com/apps/MapSeries/index.html?appid=a30af518e87a4c0ab2fbde2aaac3c228 (Accessed: 27/06/20222)
[24] EPA (n.d.) Catchments.ie [Online] Available at: https://www.catchments.ie/ (Accessed: 27/06/20222)
[25] EPA (n.d.) EPA maps [Online] Available at: https://gis.epa.ie/EPAMaps/ (Accessed: 27/06/20222)
[26] Office of Public Works (n.d.) Flood maps [Online] Available at: http://www.floodinfo.ie/map/floodmaps/ (Accessed: 27/06/20222)
[27] Office of Public Works (2020) Hydro-data: the hydrometric web-site of the Office of Public Works [Online] Available at: https://waterlevel.ie/hydro-data/home.html (Accessed: 27/06/20222)
[28] Department for Culture, Heritage and the Gaeltacht (n.d) National Parks and Wildlife Services Map Viewer [Online] Available at: http://webgis.npws.ie/npwsviewer/ (Accessed: 27/06/20222)
[29] Water Framework Directive Ireland – Water Matters (n.d.) Water Maps Online Viewer [Online] Available at: http://www.wfdireland.ie/maps.html (Accessed: 27/06/20222)
[30] Met Éireann (2020) WOW-IE Weather Observations Website [Online] Available at: https://wow.met.ie/ (Accessed: 27/06/20222)

Sensitivity of Receptor	**Definition**
	• The hydrological receptor and downstream environment has limited capacity to attenuate natural fluctuations in hydrochemistry and cannot absorb further changes without fundamentally altering its baseline characteristics / natural processes. • The receptor is located within an active flood plain. • The hydrological receptor will support abstractions for any public water supply, or private water abstractions which supply more than 25 people and/ or 100 livestock (at any given point). • Aquifer of local importance. Groundwater body is a moderately productive aquifer, with moderate yield from secondary fractures and near-surface weathering. Exploitation of local groundwater is not far-reaching. Local areas of nature conservation known to be sensitive to groundwater effects. • Areas containing geological or geomorphological features considered to be of regional importance. • Pristine or active peat bog habitat; evidence that peat body has an intact hydrological system or possibility that peat may not recover to pristine status. • Receptor contains areas of regionally important economic mineral deposits.
Medium	• A large, medium or small waterbody with a WFD water quality classification of 'Moderate'. • The hydrological receptor and downstream environment will have some capacity to attenuate natural fluctuations in hydrochemistry but cannot absorb certain changes without fundamentally altering its baseline characteristics / natural processes. • The hydrological receptor is of regional environmental importance. • The hydrological receptor does not act as an active floodplain or other flood defence. • The hydrological receptor supports abstractions for private water supply for up to 25 people and/ or 100 livestock. • Aquifer of limited value (less than local) as water quality does not allow potable or other quality sensitive uses. Exploitation of local groundwater is not far-reaching. Local areas of nature conservation known to be sensitive to groundwater effects. • Peat bog habitat; evidence that peat body has an intact hydrological system or possibility that peat could recover to pristine status.
Low	• A large, medium or small waterbody with a WFD water quality classification of 'Poor' or 'Bad'. • The hydrological receptor and downstream environment will have capacity to attenuate natural fluctuations in hydrochemistry but can absorb any changes without fundamentally altering its baseline characteristics / natural processes. • The hydrological receptor is not of regional, national or international environmental importance. • The hydrological receptor is not designated for supporting freshwater ecological interest. • GWDTEs/ wetlands which are groundwater dependent but have moderate (>50 %) functional impairment by man-made influence (such as drainage or forestry). • GWDTEs which are ombrotrophic. • The hydrological receptor does not act as an active floodplain or other flood defence. • The hydrological receptor is not used for recreational use. • The hydrological receptor does not support abstractions for public water supply or private water abstractions. • Geological features or geology not protected and not considered worthy of specific protection.

Sensitivity of Receptor	Definition
	• Poor groundwater quality and / or very low permeability make exploitation of groundwater unfeasible. Changes to groundwater not expected to affect local ecology. • Degraded or inactive peat; small isolated areas of peat; soil not sensitive to change, e.g. degraded / grazed; shallow, evidence of widespread erosion. Significant active land drainage has occurred resulting in ongoing dewatering of peat.
Negligible	The receptor is resistant to change and is of little environmental value.

8.4.7.2 Magnitude of Change

The magnitude of potential change will be identified through consideration of the Development, the degree of change to baseline conditions predicted as a result of the Development, the duration and reversibility of an effect and professional judgement, best practice guidance and legislation.

The criteria for assessing the magnitude of change are presented in Table 8.3.

Table 8.3: Framework for Determining Magnitude of Change

Magnitude of Change	Definition
High	• A short-term major shift in hydrochemistry or hydrological conditions sufficient to negatively change the ecology of the receptor. This change will equate to a downgrading of a WFD water quality classification by two classes e.g. from 'High' to 'Moderate'; • A moderate loss (50 - 75 % of study area) of wetland habitat, or where there will be some hydrological severance which will fundamentally affect the integrity of the feature; • A minor permanent or long-term negative change to groundwater quality or available yield. • Changes to groundwater quality or water table level that will temporarily negatively alter local ecology or will lead to a groundwater flooding issue.
Medium	• A short or long term non-fundamental change to the hydrochemistry or hydrological environment, resulting in a change in ecological status. This change will equate to a downgrading of a WFD water quality classification by one class e.g. from 'High' to 'Good.' • A moderate increase in the probability of flooding onsite and offsite, adding to the area of land which requires protection by flood prevention measures or affecting the ability of the functional flood plain to attenuate the effects of flooding by storing flood water. • A loss of part (approximately 10 % to 50 % of study area) of a wetland habitat –hydrological severance affects the integrity of the feature, but it could still function; • Changes to the local groundwater regime that may slightly affect the use of the receptor; • The yield of existing supplies may be reduced or quality slightly deteriorated; • Fundamental negative changes to local habitats may occur, resulting in impaired functionality.
Low	• A detectable non-detrimental change to the baseline hydrochemistry or hydrological environment. This change will not result in a downgrading of the WFD water quality classification; • A marginal increase in the probability of flooding onsite and offsite, adding to the area of land which requires protection by flood prevention measures or affecting the ability of the functional flood plain to attenuate the effects of flooding by storing flood water; • A detectable but non-material effect on the receptor (up to 5 %) or a moderate effect on its integrity as a feature or where there will be a

Magnitude of Change	Definition
	minor severance or disturbance such that the functionality of the receptor will not be affected. • A detectable effect on a wetland habitat (loss of between 5 % - 10 % of study area) or a minor effect on a wetland's integrity as a feature or where there will be a minor severance or disturbance such that the functionality of the receptor will not be affected. • Changes to groundwater quality, levels or yields do not represent a risk to existing baseline conditions or ecology.
Negligible	• No perceptible changes to the baseline hydrochemistry or hydrological environment. • No change to the WFD water quality classification. • No increase in the probability of flooding onsite and offsite. • A slight or negligible change from baseline condition of water supply resources.

8.4.7.3 Significance of Effect

The sensitivity of the asset and the magnitude of the predicted effects will be used as a guide, in addition to professional judgement, to predict the significance of the likely effects. Table 8.4 summarises guideline criteria for assessing the significance of effects.

Table 8.4: Framework for Assessment of the Significance of Effects

Magnitude of Change	**Sensitivity of Resource or Receptor**			
	High	**Medium**	**Low**	**Negligible**
High	Profound – Very Significant	Significant - Moderate	Moderate - Slight	Slight - Imperceptible
Medium	Significant - Moderate	Moderate	Slight	Imperceptible
Low	Moderate - Slight	Slight	Slight – Not Significant	Imperceptible
Negligible	Slight - Imperceptible	Imperceptible	Imperceptible	Imperceptible

Profound or substantial effects are considered to be 'significant' in the context of the EIA Regulations and are shaded in light grey in the above table.

8.4.8 Assessment Limitations

This Chapter has been limited to the information available from the 2011 EIA and 2020 EIA, FI and publicly available data sources as detailed in Section 8.4.2. The assessment is desk-based only.

8.5 BASELINE CONDITIONS

There have been no changes to land use and no substantial changes to the hydrological regime associated with the Site and therefore limited changes to the Baseline Conditions presented in Section 11.2.2 of the 2011 EIS. This has been verified by the ecology surveys undertaken by Fehily Timoney Consultancy and is outlined in **Chapter 7: Biodiversity**.

Sections have been updated where datasets have been updated since the submission of the 2011 EIS.

8.5.1 Surface Hydrology

The Development lies within the upstream surface water catchment of the River Dinin, a major tributary of the River Nore, in the north of the site and the River Barrow catchment in the south. The surface water catchments in relation the Development are shown in Figure 8.2.

There are a number of small artificial drains associated with the forestry plantation and drainage network which discharge north into a minor unnamed tributary of the River Dinin at S 63615 71366 in the north-west of the Site. The site walkover conducted for the 2011 EIS states that a field drain is located to the north and east of the Site which intercepts run-off and drains to the north-west discharging into the unnamed tributary. There is no drainage off of the Site to the north-east.

The southern extent of the Core Study Area consists of forestry plantation drainage ditches. A number of small streams originate immediately to the south of the Site Boundary and drain south in line with existing agriculture field boundaries, before discharging to a large unnamed tributary of the River Barrow 3 km to the south-east of the Site Boundary.

The upstream section of the River Dinin, and minor tributary located within the Core Study Area, has an overall Water Framework Directive (WFD) river waterbody status (2013-2018) of 'moderate'.

The streams which discharge to the south of the Core Study Area do not have a WFD waterbody quality status but drain to the River Barrow which has an overall WFD waterbody quality status (2013-2018) of 'moderate'.

8.5.2 Hydrogeology

The Geological Survey Ireland (GSI) bedrock 1:100,000 scale maps[31] indicates the underlying geology as a heavily faulted sequence of shale, sandstone and siltstones. Faults trend north-west to south-east with bedding generally perpendicular, dipping to the north-west.

Published geology indicated the Development is underlain by till superficial deposits, primarily in the east of the Core Study Area. The till superficial deposits are derived from sandstone, limestone and shales and (Namurian) are largely impermeable.

The aquifer units associated with the bedrock are poor aquifer (PI) which is unproductive, meaning low yield of water, except for localised zones where fracture or weathering results in minimal yields. Recharge to this aquifer is likely to be in areas of higher topography at the top of slopes and recharge is considered minimal due to the relatively impermeable nature of the bedrock unit and overlying impermeable superficial deposits.

The majority of the Core Study Area is located within the Shanragh ground water body which has an overall WFD Status (2013-2018) of 'good'.

The National Groundwater Vulnerability Ireland is a classification system to determine the "ease with which groundwater may be contaminated by human activities"[32]. The vulnerability classification system scales from Extreme 'X' Groundwater Vulnerability as the most vulnerable to Low 'L' Groundwater Vulnerability as the least vulnerable.

The groundwater vulnerability of the site is rated as Extreme due to the presence of rock outcropping at surface and minimal peat coverage, however the aquifer unit is confined by the overlying till deposits, with a very small proportion of the aquifer being exposed at the surface.

[31] Geological Survey Ireland (2020) Geological Survey Ireland Spatial Resource [Online] Available at: https://dcenr.maps.arcgis.com/apps/MapSeries/index.html?appid=a30af518e87a4c0ab2fbde2aaac3c228 (Accessed: 27/06/20222)
[32] Geological Survey Ireland (n.d.) Groundwater Vulnerability [Online] Available at: https://www.gsi.ie/en-ie/programmes-and-projects/groundwater/activities/understanding-ireland-groundwater/groundwater-vulnerability/Pages/default.aspx (Accessed: 27/06/20222)

8.5.3 Public and Private Water Supplies

The 2011 ES Report identified the following groundwater wells within 2 km of the Site Boundary:

- Borehole (GSI Reference: 2617SWW316); and
- Hand dug well (GSI Reference: 2617SWW315).

The yield of water from both sources is classified as poor (< 40 m^3/ day).

The 2011 FI Report responded to a request for further information on water supplies, particularly in relation to private groundwater supplies and any potential effects on these supplies. The 2011 FI Report identified 34 properties within 1 km of the Development, at distances of 20 m from the Site Boundary. The 2011 FI Report did not identify if these properties were supplied by a private water supply or where such supplies are located.

Review of the Geological Survey Ireland (GSI) wells and springs database identified the 4 boreholes, 5 dug wells and 2 springs for private water supply use and one borehole for public supply use within the Water Supply Study Area as detailed in Table 8.5.

Table 8.5: GSI Wells and Springs located within 2 km of the Site Boundary

GSI Reference	Supply Type	Yield Class	Use	Distance and Direction from Development
2617SWW316	Dug Well	Poor	-	On Site
2617SWW315	Borehole	Poor	-	On Site
2617SWW345	Borehole	Failure (2.2 m^3/d). Very dirty water.	Agriculture & Domestic Use (Carlow Co. Council)	1.6 km east
2615NWW044	Borehole	Moderate (43.6 m^3/d)	-	1.7 km west
2617SWW383	Dug Well	-	Agriculture & Domestic Use	300 m west
2617SWW351	Dug Well	-	Domestic Use Only	1.4 km north-east
2617SWW352	Dug Well	Poor (dry in summer)	Domestic Use Only	1.4 km north-east
2617SWW353	Dug Well	-	Domestic Use Only	1.5 km north-east
2617SWW347	Borehole	-	Public Supply (Co. Council)	1.3 km north-east
2617SWW350	Spring	-	Domestic Use Only	1.5 km north-east
2617SWW354	Spring	Very good yield	Domestic Use Only	1.7 km north-east
2617SWW348	Borehole	Very good supply	Agriculture & Domestic Use	1.2 km north-east
2617SWW051	Spring	-	-	1.1 km north
2617SWW087	Dug Well	-	-	1.1 km north
2617SWW088	Borehole (17.7 m deep)		-	1 km north
2617SWW089	Dug Well	Low in summer	-	1 km north

There are also a number of small supplies located to the west of the Development associated with the settlement of Agharue, however these are all located upstream and greater than 1 km from the Development and are therefore not considered to be at risk from effects of the Development.

8.5.4 Flooding

The Office of Public Works (OPW) flood maps[33] do not identify a probability of river flooding or pluvial flooding (rainfall) within the area of the Development or the Wider Study Area and no previous flood events have been recorded at the Site.

The OPW high-end future scenario predictive flood extents do not identify a probability from river flooding into the future.

The Development is not considered to be at risk from river or pluvial flooding and the Development is located within an area which avoids or has minimised risk of flooding. As such, a standalone Flood Risk Assessment has not been undertaken as part of the EIA, acting in line with the County Carlow Development Plan[34].

8.5.5 Designated Sites

Designations include Special Areas of Conservation (SAC), Special Protections Areas (SPA) and Natural Heritage Areas (NHA). These have been identified through the National Parks and Wildlife Services map viewer.

There is one identified designation within the Wider Study Area in connectivity with the Development, as outlined in Table 8.6.

Table 8.6: Designated Sites within 5 km of Site Boundary

Designation	Distance from the Development	Qualifying Interest	Hydrologically Connected to the Development
River Barrow and River Nore SAC	4.7 km south-east 2.3 km west	Watercourses of plain to montane levels (with the Ranunculion fluitantis and Callitricho-Batrachion vegetation); freshwater pearl mussel; Nore pearl mussel; white-clawed craysfish; sea lamprey; brook lamprey; Twaite shad (fish); salmon; otter; Kilarney fern; alluvial forests; petrifying springs with tufa formation; old sessile oak woods.	Yes – downstream of Development. Connected by unnamed tributary of River Barrow.
Cloghristick Wood NHA	4.6 km south-east	Woodland	No – hydrologically disconnected by River Barrow.
Coan Bogs NHA	2.0 km northwest	Peatlands	No – hydrologically disconnected by the River Dinin and associated tributaries.

Beyond a distance of 5 km, designations are considered to be hydrologically disconnected from the Site (in terms of surface water pollution events, as the Development is proposed

[33] https://www.floodinfo.ie/map/floodmaps/#

[34] Carlow County Council (2021) Draft Carlow County Development Plan 2022-2028 [Online] Available at: Chapter 1: Introduction and Context | Carlow County Council's Online Consultation Portal (Accessed 27/06/20222)

in areas that are outside surface water sub-catchments) or are of sufficient distance to remain unaffected by the Development and are not considered further within this Report.

The River Barrow and River Nore SAC is hydrologically connected to the Development to the south.

No changes to Statutory designations have occurred since the submission of the 2011 EIS or 2020 EIA and FI.

8.6 EMBEDDED MITIGATION

The following mitigation measures relating to the hydrological environment are embedded into the design and construction of the Development and were proposed as part of the Consented Wind Farm:

- 50 m buffer strips between watercourses and construction working areas will be established;
- 20 m buffer strip around mapped artificial drains; and
- Good practice methods and works for protection of hydrological receptors, to be implemented through an Environmental Management Plan (EMP) and Construction Environmental Management Plan (CEMP).

The identification of likely significant effects from the Development is considered following implementation of the measures in the CEMP.

The CEMP describes water management measures to control surface water run-off and drain hardstanding's and other structures during the construction and operation of the Development. This will form part of a Pollution Prevention Plan (PPP) to be implemented for the Development.

Good practice will be followed in all aspects of construction, operation and decommissioning, specifically through the CEMP.

8.7 ASSESSMENT OF POTENTIAL EFFECTS

The effect of the Development on hydrological receptors has been considered for the construction, operation, and decommissioning phases. Effects occurring during construction and decommissioning are short term effects, with those occurring as a result of the operational phase of the Development being considered to be long term effects.

8.7.1 Construction Phase

8.7.1.1 Surface Hydrology (including designations)

Surface hydrology, which consists of drainage channels and minor watercourses within the Core Study Area and are of medium sensitivity, have the potential to be at risk from chemical pollution (including cements and hydrocarbons), sediment pollution and disruption of flow pathways and the drainage network as a result of the construction phase of the Development.

Water Quality (Pollution and Sedimentation)

The hazards identified in the 2011 EIS (excavation seepage and sedimentation) to the surface hydrology remained valid for the Crane Hardstanding Modification. The Crane Hardstanding area was not considered to increase the potential effects on watercourses as a 50 m watercourse buffer will be instated, and no diversions of watercourses or dewatering is required.

The 2011 EIS supported the Original Wind Farm application and the Crane Hardstanding Modification was part of the Consented Modification, which together form part the

Consented Wind Farm. As the proposed Development is unchanged from the Consented Wind Farm, the determinations and mitigations, as stated, remain.

Buffer distances between watercourses and construction works have been set at 50 m to reduce the potential from chemical pollutants and sediments transferring to the water environment if released. Implementation of good practice measures outlined in the CEMP (Appendix A4.1) will minimise the release of sediments and chemical pollutants.

Material emplacement and material use on the Site will remain in line with the good practice measures outlined in the 2011 EIS, such as a 50 m buffer from watercourses, which determines materials similar to the local mineralogy to minimise alterations to baseline water quality and chemistry.

Embedded measures such as absorbent spill pads / kits and other measures highlighted within the CEMP will effectively limit the release of chemicals to minor releases. The occurrence of spills from on-site vehicles would be minimised through best practice construction methods such as vehicle speed limits and regular vehicle and machine maintenance.

Other Sustainable Drainage System (SuDS) measures, such as the use of settlement lagoons, swales and interception bunds, will effectively prevent sediment entering watercourses via drainage ditches adjacent to access tracks. As such, there will be limited potential for sediment or erosion effects on watercourses from the Development, including the hydrology and water quality of onsite watercourses.

Following implementation of embedded measures outlined in the CEMP, the magnitude of effect of chemical pollution on watercourses of high sensitivity is considered negligible.

As the River Barrow and River Nore SAC is a hydrological designation and the potential Water Quality effects are assessed as negligible, the magnitude of change on the designation will be Slight, which is considered **'not significant'** in accordance with the EIA Regulations.

Impediments to Flow

Implementation of surface water management and drainage measures, as outlined in the 2011 EIS and CEMP, maintain hydrological connectivity of drainage networks across the Site. No diversions of existing watercourses or drainage networks are required and no additional culverts are required as part of the construction of the Crane Hardstanding Modification.

All existing culverts are anticipated to be maintained. Should alterations to existing culverts be required, they will be completed in accordance with this Chapter.

A total of six existing watercourse crossings will be utilised required for the access track for the Development, however all crossings have existing culverts under the access track e.g., culverted, as shown in Plate 3.4.4. No new culverts will be required.

Plate 3.4.4: Existing access track at the Site

Soil stripping will be required for the hardstanding areas adjacent to the crossings and sedimentation effects could occur if any alteration or maintenance to the existing culverts is required. As outlined in the CEMP, any silty water generated on site will be subject to a settlement process through drainage mitigation measures (silt traps, silt fencing etc.) and channelled into vegetated areas, to allow the settlement of solids.

Measures, including silt fencing, described in the CEMP, will prevent sediment entering surface water resources.

Upgrades are required to an existing culvert on the Upgraded Access Track at S 64705 72296 to serve the Consented Wind Farm access. The culvert will be installed as per the Plate 3.4.5.

To upgrade existing culverted watercourses, detailed design will be carried out prior to the construction phase in line with good practice i.e., to accommodate the 1:100-year flow plus a peak river flow allowance of 30 % in accordance with:

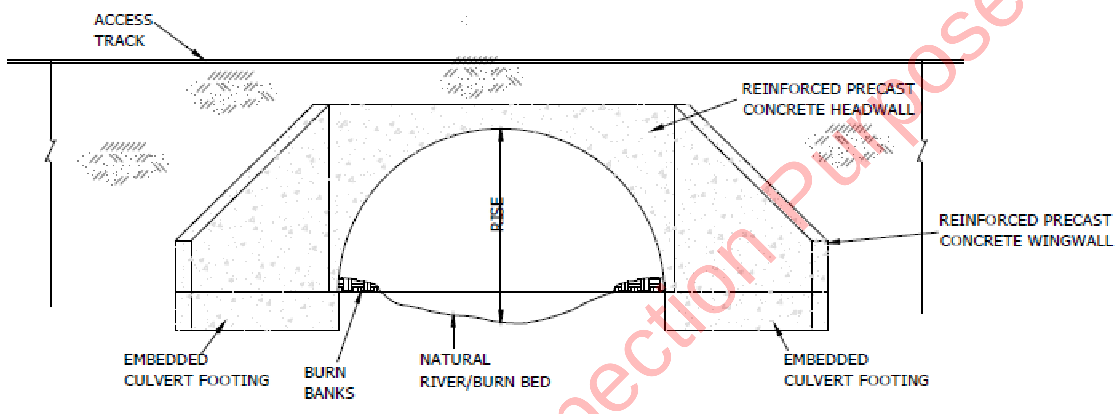
- National Roads Authority (NRA) - Guidelines for the Crossing of Watercourses During the Construction of National Road Schemes (2008)[35];
- Inland Fisheries Ireland - Guidelines on Protection of Fisheries during Construction works in and adjacent to waters (2016)[36];

[35] National Roads Authority (2008) Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes (online). Available at: https://www.tii.ie/tii-library/environment/construction-guidelines/Guidelines-for-the-Crossing-of-Watercourses-during-the-Construction-of-National-Road-Schemes.pdf (Accessed 27/06/20222)

[36] Inland Fisheries Ireland (2016) Guidelines on Protection of Fisheries during Construction Works in and adjacent to Waters (online). Available at: https://www.fisheriesireland.ie/documents/624-guidelines-on-protection-of-fisheries-during-construction-works-in-and-adjacent-to-waters/file.html (Accessed 27/06/20222)

- The Office of Public Works (OPW) - Climate Change Sectoral Adaptation Plan - Flood Risk Management (2015 – 2019)[37];
- OPW – Flood Risk Management – Climate Change Adaption Plan (2019)[38];
- OPW – The Planning System and Flood Risk Management – Guidelines for Planning Authorities – November 2009[39];
- Greater Dublin Strategic Drainage Study New Development Policy – Regional Policies – Volume 2 New Development[40]; and
- The Draft Carlow County Development Plan (DCCDP) 2022-2028[41].

Plate 3.4.5: Proposed Upgrades to Existing Culvert(s)



TYPICAL BOTTOMLESS ARCHED CULVERT ELEVATION (NTS)

Should any additional upgrades to existing culverts on the existing track to serve the wind farm be required, other than at S 64705 72296, then they would be installed as per Plate 3.4.5 above.

Whilst not anticipated, in the event that each existing culvert under the existing access track is required to be upgraded, following the embedded design measures detailed in this report and the accompanying CEMP, the magnitude and significance of effects associated with the proposed work in and near watercourses and culvert crossings are assessed as being Negligible.

This impact is not significant in terms of the EIA Regulations.

[37] OPW (2015) Climate Change Sectoral Adaptation Plan - Flood Risk Management (2015 – 2019) (online). Available at: https://www.gov.ie/pdf/?file=https://assets.gov.ie/46530/e3c0ac9faa334bb4ac1f24cc1c18fb01.pdf#page=1 (Accessed 27/06/20222)

[38] OPW (2019) Flood Risk Management – Climate Change Adaption Plan (2019) (online). Available at: https://www.gov.ie/pdf/?file=https://assets.gov.ie/46534/3575554721374f7ab6840ee11b8b066a.pdf#page=1 (Accessed 27/06/20222)

[39] OPW (2009) The Planning System and Flood Risk Management (Online). Available at: https://www.opr.ie/wp-content/uploads/2019/08/2009-Planning-System-Flood-Risk-Mgmt-1.pdf (Accessed 27/06/20222)

[40] South Dublin County Council (2005) Greater Dublin Strategic Drainage Study New Development Policy (Online). Available at: http://www.dublincity.ie/main-menu-services-water-waste-and-environment-drainage-services/new-development-policy (Accessed 27/06/20222)

[41] Carlow County Council (2021) Draft Carlow County Development Plan 2022-2028 [Online] Available at: Chapter 1: Introduction and Context | Carlow County Council's Online Consultation Portal (Accessed 27/06/20222)

This results in a magnitude of change of negligible on a medium sensitivity receptor and a potential effect of 'Imperceptible' and would therefore be **'not significant'**, in accordance with the EIA Regulations.

Hydrology Effects from Forest Removal

Removal of tree cover and forestry plantation has the potential to cause effects on water quality and quantity, resulting in increased acidification, eutrophication and/ or increased surface water run-off. A total of 18 ha of onsite forestry is to be felled to accommodate the construction of the Consented Wind Farm.

The area of tree felling within the catchment and the percentage surface water run-off increase as a result of such felling is detailed in Table 3.4.1, calculated in line with *Water yield and low flows* of the UK Forestry Standard 2017 (pages 184 to 185)[42].

Table 3.4.1: Development Run-off Increase Scenario - Tree Removal

Catchment	Catchment Area (m^2)	Area of Tree Removal (as a result of Development) (m^2)	% of Catchment	Surface Water Run-off Increase (%)
River Dinin (sub catchment)	12,478,496.6	64,235.0	0.5	0.1

The overall potential increase in surface water run-off across the catchment is 0.1 %, as a result of the felling for the new areas of hardstanding.

8.7.1.2 Groundwater

Pollutants coming into contact with bedrock have the potential to indirectly alter the pH of the groundwater resource. pH and chemical alterations to bedrock are difficult to rectify due to the fractured nature of the rock and the lengthy attenuation and dispersal of chemicals.

In areas where superficial deposits are absent and peat soils are thin (<1 m), the potential for pollutants to come into contact with groundwater is increased.

As outlined in the 2011 EIS, the low permeability and hydraulic connectivity of the groundwater units results in low potential for contaminant dispersion and attenuation in the aquifer. Any inadvertent release of chemicals or sediments to groundwater are considered to only have localised effects at the Site. Due to the nature of the Development, the potential for release of chemical substances will be low and localised to areas where cement works, oil and fuel will be used on Site.

Good construction measures such as spill pads, impermeable geotextile membranes and other measures described within the CEMP will effectively limit the uncontained release of chemicals to minor releases.

Following implementation of embedded measures outlined in the CEMP, the magnitude of effect of chemical pollution on groundwater resources from the Development is negligible. The significance of negligible magnitude on a high sensitivity receptor and is of **slight - imperceptible significance, which is 'not significant'** in terms of the EIA Regulations.

8.7.1.3 Public and Private Water Supplies

As requested by Carlow County Council, further details on Public Water Supplies from the Development are provided in this Chapter.

[42] https://www.forestresearch.gov.uk/research/the-uk-forestry-standard/

With regards to Private Water Supplies (PWS), the 2011 FI Report assessed the effects of the Consented Wind Farm on water supplies for both surface water and groundwater source. Recent consultation has shown no PWS within 1 km of the hardstanding area increase. The Crane Hardstanding Modification will not increase the excavation depths on the Site. The maximum excavation depth on the Site remains as 6 m as determined in the 2011 FI Report. The spatial extent and depth of the turbine foundations have not increased.

The Proposed Additional Felling could lead to hydrological effects on PWS, such as acidification of surface waters. Given that the PWS abstractions are from groundwater and not surface water and the distance between the abstractions and felling areas, the additional felling will not increase the potential for effects on PWS. Potential Effects on Paulstown and Bilboa Public Water Supplies, and Ballinabranna Group Water Scheme

Paulstown Public Water Supply

The Paulstown Water Supply[43] is located approximately 6.2 km south of the Development (Site Boundary) at its nearest point, as shown in Plate 3.4.1.

Plate 3.4.1: Paulstown Water Supply Source Protection Area

The abstraction is hydrologically disconnected from the Development (*i.e.* outside the catchment of the Development); as they are in separate catchments, there is no prospect of any effects from the Development on this supply. The potential effects on the Bilboa

[43] Department of Environment, Climate and Communications (2002). Paulstown Source. Available online at: https://secure.dccae.gov.ie/GSI_DOWNLOAD/Groundwater/Reports/SPZ/KK_PWSS_SPZ_Paulstown_May_2002_GSI.pdf (Accessed 27/06/20222)

public water supply are therefore negligible. This is **not significant** in terms of the EIA Regulations.

Bilboa Public Water Supply

A public water supply borehole associated with the Bilboa public water supply is located at ITM S 65258 72693. This is located 1.6 km north-east of the nearest turbine (T3) with the pump being housed within a building adjacent to Townsend Avenue, as shown in Plate 3.4.2.

Plate 3.4.2: Bilboa Public Water Supply

The GES Ltd Source Protection Assessment of the supply[44] states that the "*site is considered to be abstracting from the Clay Gall Sandstone, which is underlying the site. This comprises a feldspathic quartzitic sandstone. It is believed that the well maybe 30m deep, but may be significantly deeper and could also be tapping the underlying Moyadd Coal Formation, which comprises shales, siltstones and minor sandstones*."

Given the distance of 1.6 km between the groundwater unit and the base of turbine excavations at the Development (i.e. 3 m for turbine foundations), there is unlikely to be the potential for direct interaction with the supply source from the turbine foundations.

There could however be potential for indirect effects relating to chemical pollution from:

- Concrete pouring;
- Oil and fuel storage failure;
- Oil and fuel leakage (beyond fugitive releases) from machinery; and
- Refuelling.

For construction of the wind farm, the mitigation measures employed would be the same as outlined in Sections 7 and 8 of the CEMP. Additional mitigation measures to those outlined in the Groundwater Units section of the CEMP, include:

- Watching brief when working in close proximity to public water supply to prevent damage to infrastructure and pollution of the groundwater unit;
- No storage of hydrocarbons, fuels / oils etc. within the catchment of the supply; and
- No refuelling within the catchment of the supply.

With the measures in place the potential effects on the Bilboa public water supply is considered to be negligible. This is **not significant** in terms of the EIA Regulations.

Ballinabranna Group Water Scheme

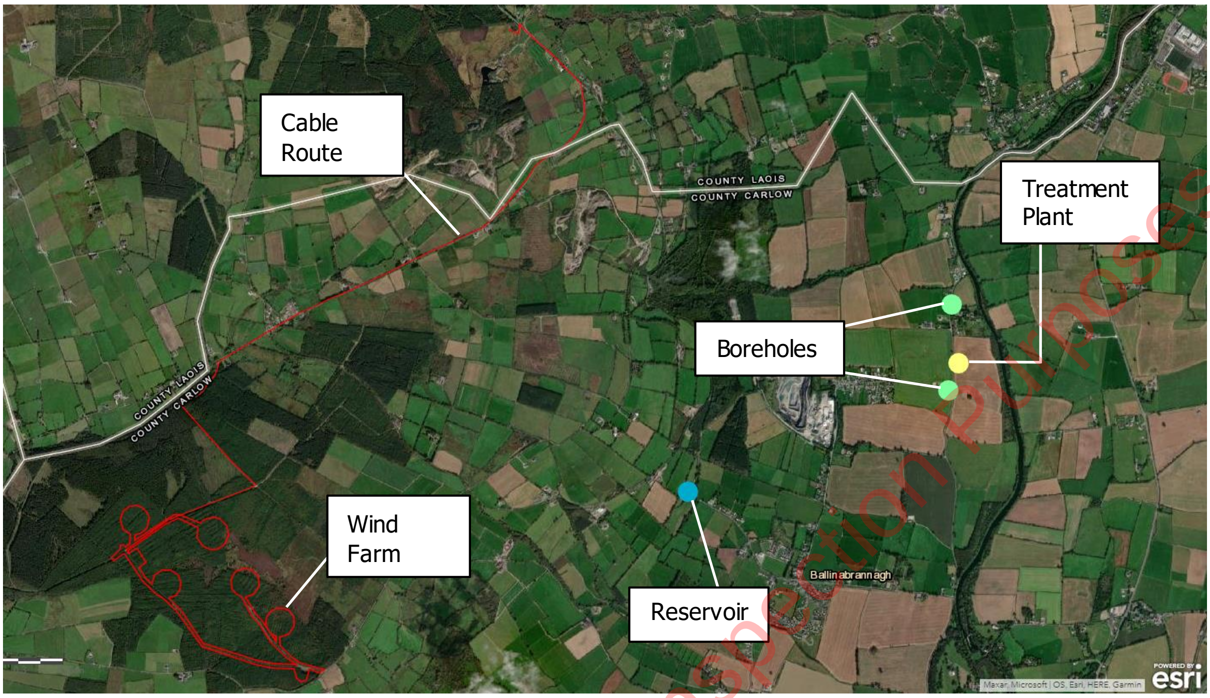
Ballinabranna Water Cooperative Society Ltd[45] outlines the location of boreholes, water treatment and reservoir infrastructure. Two boreholes are located approximately 5.0 km and 4.7 km east of the Development. Abstracted water is treated at a facility off Killeshal

[44] GES Limited Source Protection Assessment Bilboa Public Water Supply Report 05-01-04 (2008).
[45] Ballinabranna Water Cooperative Society Ltd (2021). Available online at: http://ballinabrannawater.ie/ (Accessed 27/06/20222)

road and pumped to a reservoir above Ballinabranna, approximately 2.8 km east of the Development before being distributed via a network of pipes.

The location of the Ballinabranna infrastructure is shown in Plate 3.4.3.

Plate 3.4.3: Ballinabranna Group Water Scheme Infrastructure



The boreholes are underlain by Dinantian Pure Bedded Limestones while the Development is underlain by Namurian Shales.

At these distances and the differing geology means there will be no interaction between the abstractions, treatment, distribution and the wind farm. Potential effects on the Ballinabranna water supply are considered to be Negligible. This is **not significant** in terms of the EIA Regulations.

Prior to confirmation of the source location and source water, the Development is considered to potentially reduce the yield of existing supplies and/ or deteriorate the quality slightly and as such the magnitude of effect on PWS (SPS) is considered medium. Mitigation measures outlined within Section 9.9 of the CEMP (Appendix A1) will be implemented as standard to safeguard PWS (SPS). The measures are considered to be sufficient in order to reduce the magnitude of effect on PWS (SPS) to low.

The significance of low magnitude on a medium sensitivity receptor is of **slight significance, which is 'not significant'** in terms of the EIA Regulations.

8.7.2 Operational Phase

8.7.2.1 Increased Run-off from Hardstanding

The 2011 EIS identified the potential for increased run-off during the operational phase of the Development due to the presence of permanent hardstanding and determined that an increase in surface water run-off has the potential to cause increased erosion of ditches and gullies.

The Consented Modification has increased the crane hardstanding area from approximately 30 m x 50 m to 30 m x 62.5 m, resulting in an overall hardstanding increase of 375 m^2 per hardstanding. Therefore, the potential for increased surface water run-off rates from hardstanding has increased from the Original Wind Farm.

In relation to the wider catchment (approximately 124,784,95 m^2), this increase in run-off is likely to be minimal compared to the Original Wind Farm.

Mitigation measures as proposed in the 2011 and 2020 EIS and FI remain valid, however should be sized for the increased run-off scenario. The mitigation measures are outlined in the CEMP (Appendix A1) and include silting points, swales (including vegetated ditches) and check dams to attenuate flow, reduce discharge during heavier rainfall periods and settle out any sediments.

With appropriately sized drainage management and attenuation on the Site, this would result in a magnitude of change of negligible on a medium sensitivity receptor and a potential effect of **'Imperceptible'** and would therefore be considered **'not significant'**, in accordance with the EIA Regulations.

8.8 CUMULATIVE EFFECT ASSESSMENT

The cumulative assessment takes the following into consideration:

- The Consented Grid Route; and
- Gortahile Wind Farm.

8.8.1 The Grid Route and Access Application

The Consented Grid Route for the Development is located to the immediate east and upstream of the Development, situated within the River Dinin catchment area.

As a result, there is potential for cumulative effects on the following receptors:

- Surface hydrology (River Dinin);
- Shanragh groundwater body; and
- River Barrow and River Nore SAC.

Potential short-term cumulative effects include:

- Chemical pollution and sedimentation of watercourses and the wider hydrological and hydrogeological environment as a result of construction works; and
- Impediments to watercourse and near-surface flow from cable trenches.

The greatest potential for cumulative effects arises when the construction phase of another development overlaps with the construction phase of the Development. Cumulative effects are considered to have the potential to be significant only where such an overlap may exist, as activities that could be potentially detrimental to the hydrological environment are greatly reduced during the operational phase of developments (e.g., excavation works, concrete pouring etc.).

Assuming commencement of the Development in 2022, lasting for a period of 9 months, it is likely that the Development will overlap with the construction phase of the Consented Grid Route.

The Consented Grid Route EIA Report assessed that "*embedded design measures outlined in the oCEMP and other good practice measures during construction will prevent sediment and chemicals being transferred into the water environment upstream of the SAC.*

Furthermore, the above risks of pollution are not considered to potentially influence this area of the SAC due to the distance between the Development and the SAC, allowing for dispersion and dilution within the hydrological environment.

Following implementation of embedded design measures outlined in the oCEMP, the magnitude of effect of chemical pollution on the River Barrow and River Nore SAC is considered negligible on a Very High receptor. The effect is of slight significance, which is 'not significant' in terms of the EIA Regulations."

Through implementation of measures in the CEMP, it is anticipated the magnitude of cumulative effects on the watercourses during the construction phase will be negligible and, therefore, of negligible significance. This is **not significant** in terms of the EIA Regulations.

As the River Barrow and River Nore SAC is a hydrological designation and the potential Water Quality effects are assessed as negligible, the magnitude of change on the designation will be Slight, which is considered **'not significant'** in accordance with the EIA Regulations.

Therefore, the magnitude of cumulative effects between the Development and the Consented Grid Route will be negligible for watercourses and Slight for designations. This is **'not significant'** in accordance with the EIA Regulations.

8.8.2 Gortahile Wind Farm

The Gortahile Wind Farm is an operational wind farm which consists of eight turbines located approximately 1.5 km to the north of the Development. It is partially located within the River Dinin catchment, with any run-off from the Gortahile Wind Farm discharging to the River Dinin, immediately upstream of the Development.

The greatest potential for cumulative effects arises when the construction phase of another development overlaps with the construction phase of the Development. Cumulative effects are considered to have the potential to be significant only where such an overlap may exist, as activities that could be potentially detrimental to the hydrological environment are greatly reduced during the operational phase of developments.

The wind farm has been operational since 2010 and planning consideration would have been given to it and the Consented Wind Farm at the time of its consent. As there is no change in the significance of effects from the 2011 EIS finding in regards to the Consented Wind Farm versus the Development, the cumulative effect is considered still acceptable from a planning perspective. This is **not significant** in terms of the EIA Regulations.

8.9 MITIGATION AND RESIDUAL EFFECTS

No further additional mitigation measures to those outlined in the 2011 EIS and in the CEMP (Appendix 4.1) are required, as detailed in section 8.6 of this Chapter.

No residual effects are predicted for all phases of the Development and are therefore **not significant** in terms of the EIA Regulations.

8.10 SUMMARY OF EFFECTS

Table 8.7 provides a summary of the effects detailed within this Chapter.

Table 8.7: Summary of Effects

Receptor	Potential Effect	Significance of Effect	Mitigation Proposed	Residual Effect
Construction Phase				
Surface Hydrology (watercourses and drainage)	Alterations/ deteriorations to water quality (pollution and sediment release)	Imperceptible Not significant as per the EIA Regulations.	None	Imperceptible Not significant as per the EIA Regulations.
	Impediments to flow			
	Increased run-off from forestry felling	Imperceptible	None	Imperceptible

Receptor	Potential Effect	Significance of Effect	Mitigation Proposed	Residual Effect
Construction Phase				
		Not significant as per the EIA Regulations.		Not significant as per the EIA Regulations.
Groundwater	Pollution	Slight – Imperceptible Not significant as per the EIA Regulations.	None	Slight – Imperceptible Not significant as per the EIA Regulations.
Public and Private Water Supplies	Alterations to yield from dewatering	Slight - Significance Not significant as per the EIA Regulations.	Section 9.9 CEMP	Slight - Significance Not significant as per the EIA Regulations.
Operational Phase				
Surface Hydrology (watercourses and drainage)	Increased run-off from hardstanding	Imperceptible Not significant as per the EIA Regulations.	None	Imperceptible Not significant as per the EIA Regulations.

8.11 STATEMENT OF SIGNIFICANCE

Effects are considered to be significant for the purposes of the EIA Regulations where the effect is classified as being of 'major' or 'moderate' significance.

There are no significant direct effects from the Development on the hydrological environment including surface watercourses, groundwater and third-party water supplies.

No significant cumulative indirect (setting effects) from the Development, the Consented Grid Route, and other wind farm developments is likely. All cumulative effects are considered to be not significant.

9 LAND AND SOILS

9.1 INTRODUCTION

This Chapter of the Environmental Impact Assessment Report (EIA Report) evaluates the effects of the construction, operation and decommission of Bilboa Wind Farm ('the Development') on the land and soils resource.

All elements of the proposed Bilboa Wind Farm are consistent with the Consented Wind Farm, therefore, this assessment references the previous 2011 EIS (Chapter 10: Soils and Geology and Peat), 2020 EIA Report (Chapter 9: Land and Soils) and 2021 FI Report as the basis for the determination of land and soils impacts associated with the Development.

This Chapter of the EIA Report is supported by the following Technical Appendix documents provided in Volume 3 Technical Appendices:

- Technical Appendix A9.1: Assessment of Peat Stability for Bilboa Windfarm, Agec Limited, June 2011;
- Technical Appendix A9.2 – Factual Ground Investigation Report, May 2020 – Ground Investigation Ireland; and
- Technical Appendix A9.3a-b – Further Peat Probing, Ground Investigations Ireland, August 2021.

Whilst these appendices where produced for the applications supporting the Consented Wind Farm, the information contained therein remains a relevant source of support for this Chapter.

This Chapter includes the following elements:

- Legislation, Policy and Guidance;
- Assessment Methodology and Significance Criteria;
- Baseline Conditions;
- Assessment of Potential Effects;
- Cumulative Effects Assessment;
- Mitigation and Residual Effects;
- Summary of Effects;
- Statement of Significance; and
- Glossary.

9.2 KEY FINDINGS OF EIS, EIA & FI

The ground conditions at the Consented Wind Farm Site were recorded (2011 EIS) typically as peat overlying glacial till or topsoil, and the bedrock was generally Sandstone, Siltstone with some Mudstone and Shale.

Peat at the site was generally thin recorded at thicknesses between 0 and 1.2 m in ground investigation reports. It was reported that there were no signs of past failures or instability in relation to peat. The peat slide risk assessment undertaken by AGEC Ltd for each of the turbines showed that the Factor of Safety (FoS) were greater than the required minimum value of 1.3-1.5 and therefore determined there was minimal potential for peat failure, and therefore insignificant risk.

The recommendations for control measures identified in the risk assessment should be implemented and amended as relevant throughout the construction works, minimise the risk of any construction activities that could potentially cause peat instability, and use of good practice measures throughout construction should be adhered to.

9.3 LEGISLATION, POLICY AND GUIDANCE

The following international and national legislation in relation to land and soils remains unchanged since the 2011 EIS and 2020 EIA Report:

- Geology in Environmental Impact Statements – A Guide (Institute of Geologists of Ireland (IGI), 2002[1]; and
- Wind Energy Development Guidelines (WEDG), 2006[2].

The Draft Revised Wind Energy Guidelines[3] (DWEDG) were published for public consultation in December 2019[4]. As these Draft Guidelines are in the preliminary stages and will likely be amended prior to finalisation, this Chapter has taken cognisance of them; however, the assessment primarily uses the WEDG.

Other updates to standards and guidelines relating to land and soils is the Irish Wind Energy Association (IWEA) Best Practice Guidelines for the Irish Wind Energy Industry[5] and the National Parks and Wildlife Service (NPWS) National Peatlands Strategy[6] guidance on impact of soils, geology and peat as a result of a proposed development. Additionally, the Carlow County Development Plan 2009-2015 was used to inform the land and soils assessment within the 2011 EIS. This local guidance has since been updated and superseded by the Carlow County Development Plan 2022-2028[7] (CCDP).

The EPA 'Guidelines on the Information to be Contained in Environmental Impact Assessment Reports' 2022[8] detail the framework for assessment for EIA, that is followed in this EIA Report.

9.4 ASSESSMENT METHODOLOGY AND SIGNIFICANCE CRITERIA

9.4.1 Pre-Application Consultation Responses

Consultation and responses received for this EIA Report topic was undertaken with the organisations shown in Table 9.1.

[1] IGI (2002) Geology in Environmental Impact Statements - A Guide [Online] Available at: http://igi.ie/assets/files/Codes%20and%20Guidelines/Geology_in_EIS_a_Guide.pdf (Accessed 27/06/2022)
[2] Department of Housing, Planning and Local Government (2006) Wind Energy Development Guidelines [Online] Available at: gov.ie - Wind Energy Development Guidelines (2006) (www.gov.ie) (Accessed 27/06/2022)
[3] Department of Housing, Local Government and Heritage (2019) Draft Revised Wind Energy Development Guidelines [Online] Available at: gov.ie - Public Consultation on the revised Wind Energy Development Guidelines (www.gov.ie) (Accessed 27/06/2022)
[4] Department of Housing, Local Government and Heritage (2019) Draft Revised Wind Energy Development Guidelines [Online] Available at: gov.ie - Public Consultation on the revised Wind Energy Development Guidelines (www.gov.ie) (Accessed 27/06/2022)
[5] Irish Wind Energy Association (2012) Best Practice Guidelines for the Irish Wind Energy Industry [Online] Available at: https://www.iwea.com/images/files/9660bdfb5a4f1d276f41ae9ab54e991bb600b7.pdf (Accessed 27/06/2022)
[6] NPWS (2017) National Peatlands Strategy [Online] Available at: https://www.npws.ie/sites/default/files/general/Final%20National%20Peatlands%20Strategy.pdf (Accessed 27/06/2022)
[7] Carlow County Council (2021) *Draft Carlow County Development Plan 2022–2028* [Online] Available at: https://consult.carlow.ie/en/consultation/draft-carlow-county-development-plan-2022-2028 (Accessed 27/06/2022)
[8] Environmental Protection Agency (2022) Guidelines on the Information to be Contained in Environmental Impact Assessment Reports [Online] Available at: https://www.epa.ie/publications/monitoring--assessment/assessment/EIAR_Guidelines_2022_Web.pdf (Accessed 09/06/22)

Table 9.1 Consultation Responses

Consultee	Type and Date	Summary of Consultation Response	Response to Consultee
Irish Peatland Conservation	Pre-Application consultation (30/09/2020)	None received to date	N/a

9.4.2 Scope of Assessment

The key issues for the assessment of potential land and soil effects relating to the Development are as follows:

- Potential for peat destabilisation and peat slide risk;
- Potential effects relating to peat disturbance and the subsequent effects from excavated peat and management of peat and peaty soils;
- Potential for compaction of superficial soils;
- Potential for loss of important geological minerals; and
- Indirect effects, including disturbance to sensitive receptors from as a consequence of disturbance during construction works leading to peat instability and slide.

9.4.3 Elements Scoped Out of Assessment

The findings of the 2011 EIS state that peat underlying the Consented Wind Farm Site is recorded as generally very thin (thicknesses between 0 and 1.2 m), and the stability risk assessment also concluded very low and negligible risks. The stability risk assessment is summarised in Section 9.7.2 of this EIA Chapter. The findings of the 2011 EIS were confirmed by intrusive site investigations carried out by Ground Investigations Ireland in 2020. These investigations are summarised in section 9.5 and the ground investigation report is included as Technical Appendix 9.1.

Given that the turbine locations and Site boundary has not been changed since the previously consented 2011 application and the lack of any significant stability risk, it is considered that the 2020 stability risk assessment remains valid and an update to the peat stability assessment is not required and subsequently has been scoped out of this assessment.

9.4.4 Study Area

As detailed within **Chapter 1: Introduction,** the Site red line boundary (the Site Boundary) extends to an area of approximately 25.2 hectares (ha), as detailed in Figure 1.2: Site Boundary Plan. The study area is therefore considered as the land within the site boundary.

9.4.5 Design Parameters

The parameters of the design that will influence the geology and peat assessment in relation to physical effects has been based on the turbine layout and associated infrastructure. No additional design parameters, other than those set out in **Chapter 5 - Project Description** of this EIA Report, are required for the assessment presented in this Chapter.

The turbines and associated infrastructure may be micro-sited up to 50 m, where constraints allow. Such relocations have been considered when undertaking the assessment, and mitigation recommended, where appropriate.

9.4.6 Baseline Survey Methodology

The baseline survey methodology has included review of existing published geological mapping available at Geological Survey Ireland (GSI).

This was supplemented by reviewing intrusive ground investigations, from 2011 and 2020 which comprised of peat probes in 2011 and trial pits and boreholes in 2020.

The Chapter considers data and descriptions of the soil, subsoil and land use at the Site as well as any prominent features. Data used to complete the assessment in this Chapter was taken from the 2011 EIS and Ground Investigations of 2020, a summary of which is included in Section 9.5 of this Chapter

9.4.7 Methodology for the Assessment of Effects

The assessment of effects is based on the Design Layout, as detailed in **Chapter 5 - Development Description** of this EIA Report. The assessment considers the sensitivity of the receptor and the magnitude of any potential change, to conclude whether the effect is significant.

The geology is briefly described at the local and regional level. All activities associated with the project are considered for the construction and operation phase impacts.

9.4.7.1 Sensitivity of Receptors

The sensitivity of the baseline conditions, including the importance of environmental features on or near to the Site or the sensitivity of potentially affected receptors, will be assessed in line with best practice guidance, legislation, statutory designations and / or professional judgement.

Table 9.2 details the framework for determining the sensitivity of receptors.

Table 9.2: Framework for Determining Sensitivity of Receptors

Sensitivity of Receptor	Definition
High	The receptor has low ability to absorb change without fundamentally altering its present character, is of high environmental value, or of national importance. Areas containing geological or geomorphological features considered to be of national importance (e.g. geological ASSIs). Pristine or active peat bog habitat; evidence that peat body has an intact hydrological system or possibility that peat may not recover to pristine status.
Medium	The receptor has moderate capacity to absorb change without significantly altering its present character, has some environmental value, or is of regional importance. Areas containing geological features of designated regional importance including Regionally Important Geological/geomorphological Sites (RIGS), considered worthy of protection for their historic or aesthetic importance. Pristine or active peat bog habitat; evidence that peat body has an intact hydrological system or possibility that peat could recover to pristine status.
Low	The receptor is tolerant of change without detriment to its character, is low environmental value, or local importance. Geological features or geology not protected and not considered worthy of specific protection. Degraded or inactive peat; small isolated areas of peat; soil not sensitive to change, e.g. degraded / grazed; shallow, evidence of widespread

Sensitivity of Receptor	Definition
	erosion. Significant active land drainage has occurred resulting in ongoing dewatering of peat.
Negligible	The receptor is resistant to change and is of little environmental value.

9.4.7.2 Magnitude of Change

The magnitude of potential change will be identified through consideration of the Development, the degree of change to baseline conditions predicted as a result of the Development, the duration and reversibility of an effect and professional judgement, best practice guidance and legislation.

The criteria for assessing the magnitude of change are presented in Table 9.3.

Table 9.4: Framework for Assessment of the Significance of Effects

Magnitude of Change	Definition
High	A fundamental change to the baseline condition of the asset, leading to total loss or major alteration of character. A major (greater than 50%) or total loss of a geological receptor or peat habitat site, or where there will be complete severance of a site such as to fundamentally affect the integrity of the site (e.g. blocking hydrological connectivity). A major permanent or long term negative change to geological receptor, such as the alteration of pH or drying out of peat.
Medium	A material, partial loss or alteration of character. A loss of part (approximately 5% to 50%) of a geological receptor or peat habitat site, major severance, major effects to its integrity as a feature, or disturbance such that the value of the site will be affected, but could still function. Fundamental negative changes to local habitats may occur, resulting in impaired functionality.
Low	A slight, detectable, alteration of the baseline condition of the asset. A detectable but non-material effect on the receptor (up to 5%) or a moderate effect on its integrity as a feature or where there will be a minor severance or disturbance such that the functionality of the receptor will not be affected. Small loss of soils or peatland, or where soils will be disturbed but the value not impacted. Small effect on a geological site or mineral deposit, such that the value of the site would not be affected.
Negligible	A barely distinguishable change from baseline conditions.

9.4.7.3 Significance of Effect

The sensitivity of the asset and the magnitude of the predicted effects will be used as a guide, in addition to professional judgement, to predict the significance of the likely effects. Table 9.4 summarises guideline criteria for assessing the significance of effects.

Table 9.4: Framework for Assessment of the Significance of Effects

Magnitude of Change	Sensitivity of Resource or Receptor			
	High	**Medium**	**Low**	**Negligible**
High	Profound – Very Significant	Significant - Moderate	Moderate - Slight	Slight - Imperceptible
Medium	Significant - Moderate	Moderate	Slight	Imperceptible
Low	Moderate - Slight	Slight	Slight – Not Significant	Imperceptible
Negligible	Slight - Imperceptible	Imperceptible	Imperceptible	Imperceptible

Profound – Very Significant or Significant – Moderate effects are considered to be 'significant' in the context of the EIA Regulations and are shaded in light grey in the above table.

9.4.8 Assessment Limitations

This Chapter has been limited to the information available from the 2011 EIS and supplementary ground investigations from 2020.

9.5 BASELINE CONDITIONS

9.5.1 Topography and Land Use

The Site is located along existing forestry tracks and public access roads and within forestry plantation and pasture land. The surrounding land use is a mixture of commercial forestry, semi-natural forestry, agricultural pasture and residential properties, including the village of Bilboa in County Carlow.

An area of coniferous commercial forest is present to the south of the Site, on the southern side of the River Dinin. To the north of the Site and north of the River Dinin, land use is largely agricultural arable farming.

The Site topography is illustrated in Figure 1.2: Site Boundary Plan. It is located within the River Dinin valley, with gentle inclines in elevation to the north, south and east. The Site elevation rises to 290 m above ordnance datum (AOD) in the east on the slopes of Clogrennan Hill, and 300 m AOD to the south towards Gallows Hill. The elevation slopes downgradient to the west, where the River Dinin drains.

9.5.2 Solid Geology

Published geology by (GSI) indicates the underlying geology as a heavily faulted sequence of shale, sandstone and siltstones. Faults trend north-west to south-east with bedding generally perpendicular, dipping to the north-west.

The Site is underlain by a repeating sequence of Clay Gall Sandstone, Moyadd Coal Formation, Bregaun Flagstone Formation and Killeshin Siltstone Formation, separated by three main faults and several minor faults.

The GSI identified non-metallic coal mineral localities to the immediate (approx. 100 m) to the north of the Site Boundary. It also identifies the sites of now closed mines and collieries to the immediate north of the Site.

Ground investigations were carried out across the Site in 2020 by Ground Investigations Ireland. During these investigations, a total 18 No. Trial Pits and 5 No. Rotary Core Boreholes were undertaken to a maximum depth of 4.8m and 25m below ground level, respectively. The boreholes were drilled at each turbine location with the trial pits spread across the crane hardstand areas and other infrastructure. The ground investigation location plan is included in Volume III: TA9.1 Factual Ground Investigation Report.

The boreholes recorded very weak and weak MUDSTONE at depths varying between 3.7 m and 13.9 m (T1 to T4) and weak varying to strong, with depth, SANDSTONE (T5) from 1.5 m depth.

The Ground Investigation Reports are provided as Technical Appendices to support this chapter including:

- Technical Appendix 9.2 – Factual Ground Investigation Report, May 2020 – Geotechnical Investigation Ireland.

9.5.3 Superficial Geology

Published geology available from GSI indicated the Site to be underlain by till superficial deposits, primarily in the east of the Core Study Area. The till superficial deposits are derived from sandstone, limestone and shales and (Namurian) are largely impermeable. There are areas of peat deposits in the north-east of the Site and a small area of peat deposits in the south-west of the Study Area. The western section of the Site, west of Bilboa town is largely underlain outcrop bedrock with minimal superficial deposit coverage.

Alluvium deposits are present underlying the present-day River Dinin channel.

The trial pits and boreholes recorded the superficial soils to be predominantly thin peat overlying clay described as firm varying to very stiff sandy gravelly clay.

9.5.4 Peat

Peat surveys were carried out at the Consented Wind Farm Site in 2011 which recorded peat depths between 0 and 1.2 m with the deepest peat existing in the surroundings of T4 of the Consented Wind Farm. Subsequent assessment classified the risk of peat slide at the Consented Wind Farm Site to be negligible.

Ground investigations carried out by Ground Investigations Ireland in 2020 recorded peat depths at the turbines to be between 0.45 m and 0.8 m conforming with the findings in the 2011 EIS, as detailed in Volume III: TA9.1 Factual Ground Investigation Report.

Areas within the Consented Wind Farm site and the Development Site Boundary intersect and therefore, areas of the Development Site Boundary are also classified as having a negligible peat slide risk.

Areas outwith the proposed turbine areas recorded peat depths consistent with the 2011 EIS peat surveys, with very localised areas recording peat up to 1.70 m.

Additional peat probing was undertaken by Ground Investigations Ireland Ltd. (GII) in July 2021 to support The 2021 FI, covering the Site as well as The Access Track and The Onsite Access Tracks.

A total of 221 probes were undertaken along areas of existing track, proposed track and proposed turbine locations to supplement the existing data obtained for the 2011 EIS and subsequent field investigations. The probe locations are displayed in Appendix A9.3 of this report. The inferred depth of peat ranged from no peat, up to a depth of 1.80 m below ground level (bgl) with the average depth recorded at 0.46 m bgl. The peat probe logs are provided in Appendix A9.3 of this Report.

More than 68% of probes advanced as part of the GII site works recorded peat depths of 0.5 m or less, with 93.5% of probes recording peat at 1 m or shallower. The vast majority of probes recording peat at >1.0 m bgl were recorded in an isolated area of the

Site on the section of proposed track between T2 and T3; peat depths at proposed turbines did not exceed 1.0 m.

A summary of the peat depths is provided in Table 3.5.4.

Table 3.5.4: Summary of peat depths from Additional Probing

Peat Depth	Number of probes	Percentage
0-0.5	221	68.4
0.51-1.0	81	25.1
1.01-1.5	15	4.6
1.51-2.0	6	1.9

These results are consistent with the GII investigation (the GII 2020 Investigation) included as Appendix A9.2.

Further to investigations and peat probing demonstrating that only shallow peat is present across the vast majority of the Site which reduces the likelihood of landslide, the National Landslide Susceptibility Map indicates that the Site lies in an area of low susceptibility and no landslide events have been recorded in the general area.

9.6 EMBEDDED MITIGATION

Embedded mitigation in relation to the Development are as proposed at the Consented Wind Farm (inclusive of the Consented Modification) while still lying within areas of thin peat, generally less than 1.0m, locally 1.2m, and in areas assessed to have insignificant effects. The overall site layout design has sought to avoid the deepest peat while maintaining use of the existing forestry track networks where possible, which in turn reduces volume of material and in particular peat required for excavation to enable the Development.

In addition, the best practice construction and drainage measures will be implemented during construction in line with the measures set out in the Construction Environmental Management Plan (CEMP).

9.7 ASSESSMENT OF POTENTIAL EFFECTS

9.7.1 Peat and Soil Disturbance

Peat at the Site is generally thin and infrastructure does not lie within the vicinity of any sensitive peatlands such as blanket bog. The Site is also occupied by commercial forestry.

In addition, the site layout design has endeavoured to utilise existing tracks wherever possible and avoid/limit the impact on any peat; therefore, minimising peat disturbance.

Peat depths at turbines are summarised in Table 9.5 below:

Table 9.5 Recorded Peat Depths at Turbines in 2020 Ground Investigations

Turbine No.	Recorded Peat/Peaty Soil Depths (m)
1	0.45 – 0.65
2	0.60 – 0.70
3	0
4	0.80
5	0.30 – 0.60

The sensitivity of the receptors is considered to be low. Areas of peat are present in small isolated areas, and /or soils are unlikely to be sensitive to change. Additionally, the magnitude of change is also low where small loss of soils or peatland is expected, or where soils will be disturbed but the value not impacted.

9.7.1.1 Peat Excavation

Peat and soil excavation estimations by infrastructure element, based on the site layout included in Figure 5.1 and available information on peat depths are included in Table 9.6.

Table 9.6 Estimated Peat Excavation Volumes

Infrastructure	Area of Excavation (m^2)	Average Peat Depths at Infrastructure(m)	Estimated Peat Volume (m^3)
Turbine 1	1,875	0.55	1,031
Turbine 2	1,875	0.65	1,219
Turbine 3	1,875	0	0
Turbine 4	1,875	0.80	1,500
Turbine 5	1,875	0.45	843
New Access Tracks	3,295	0.5	1,648
Upgrade to Existing Tracks	4,500 (3000 x 1.5)	0.5	2,250
Construction Compound	2,125	0.5	1,063
Substation	2,500	0.5	1,250
Sub-Total	**-**	**-**	**10,804**
10% Bulk Factor Contingency	-	-	1,080
TOTAL	**-**	**-**	**11,884**

9.7.1.2 Peat Reinstatement

The principles of re-instating peat and peat soils should be adhered to for all elements of the infrastructure, comprising the below:

- Peat and peaty soils will be reinstated on track and infrastructure verges with turves placed on the upper horizons encouraging re-vegetation;
- All peat, soil and turves excavated from beneath infrastructure will be re-instated in the vicinity of its original location; and
- Restoration activities will be overseen by the Ecological Clerk of Works (ECoW) to ensure methods are properly adhered to.

9.7.1.3 Handling and Storage of Peat

Construction methods for excavating, handling and storing peat will be based on the following principles:

- The surface layer of peat and vegetation will be stripped separately from the any catotelmic or other superficial soils. This will typically be an excavation depth of up to 0.5 m;
- Careful handling is essential to retain any existing structure and integrity of the excavated materials and thereby maximise the potential for excavated material to be re-used;
- To minimise handling and transportation of peat, acrotelmic and catotelmic will be replaced, as far as is reasonably practicable, in the locality from which it was

removed. Acrotelmic material is to be placed on the surface of reinstatement areas;

- Temporary storage of peat will be minimised, with restoration occurring in parallel with other works;
- Suitable areas should be sited in locations with lower ecological value, low stability risk and at a suitable distance from water courses;
- Reinstatement will, in all instances, be undertaken at the earliest opportunity to minimise storage of turves and other materials;
- Managing the construction work as much as possible to avoid periods when peat materials are likely to be wetter i.e. high rainfall events; and
- Temporary storage and transport of peat on site from excavations to temporary storage areas will be minimised.

On this basis, in the absence of mitigation, the Development is considered to pose a Low magnitude of change to a Low sensitivity receptor, therefore resulting in a potential effect of Slight – Not Significant. This is **not significant** in terms of the EIA Regulations in relation to Peat and Soil Disturbance.

9.7.2 Peat Destabilisation

Peat instability is generally the result of a combination of causative factors. Several construction activities have the potential to increase the likelihood of peat slides in areas where peat is present at a sufficient depth and where gradients are sufficiently steep to result in a peat slide event.

Construction activities that have the potential to increase the likelihood of peat slides include locating proposed infrastructure including track networks on sloping ground which often involves removal of surface vegetation and excavation of peat and other soils.

A Peat Stability Assessment was carried out in 2011 and it was considered that due to the findings of the baseline and conclusions in 2011 assessment, and that the supplementary ground investigations of 2020 and 2021 were consistent with the findings in 2011, the Peat Stability assessment would not require to be updated.

As detailed in Table 9.5 above, the findings of the peat stability assessment stated that all turbine bases had been placed in site areas where average peat depths were recorded to be no greater than 0.70 m and that the Factor of Safety Analysis and results indicated that all results were greater than the required minimum values of between 1.3 and 1.5 and therefore, was an insignificant risk of peat failure.

On this basis, in the absence of mitigation, the Development is considered to pose a Negligible magnitude of change to a Low sensitivity receptor, therefore resulting in a potential effect of Imperceptible. This is **not significant** in terms of the EIA Regulations in relation to Peat and Soil Disturbance.

9.7.3 'Do-Nothing' Alternative

Should the Development not be implemented, the Site is likely to remain as predominantly forestry land as a modified landscape with artificial drainage resulting in a low value habitat with regard to land and soils.

9.8 CUMULATIVE EFFECT ASSESSMENT

The cumulative assessment takes the following into consideration:

- The Grid and Access Application; and
- Gortahile Wind Farm.

9.8.1 The Grid Route and Access Application

As detailed in Section 1.2 of **Chapter 1: Introduction**, with respect to the Development and the Consented Wind Farm, a planning application was submitted to CCC and Laois County Council (LCC) in June 2020 for the installation of approximately 4.6 km of up to 38 kilovolts (kV) cables within CCC and approximately 2 km within LCC, including a new substation within LCC; the upgrading of an existing forestry track; construction of two new onsite access tracks; and the reorientation of a crane hardstanding pursuant to the Consented Wind Farm (the Grid Application).

The Grid Application is located to the immediate east of the Development.

The cable route proposed as part of the Grid Application is mainly within an existing road and small area approximately 3km north-east of the Development. The proposals for the cable route include approximately 2 km of cable within the forest rides to the immediate east of the Development. The application also included a rotation and of the crane hardstanding for T1.

Considering the extent of excavation works and soil and peat re-use at the site being limited to the width of a cable route trench, up to 1.2 m wide, the impact on soils and peat would be limited and no significant effects were predicted.

This Chapter assesses the effects of the Development on peat and soils and concludes that due to the low magnitude of change on peat and soils as a result of the Development, no significant effects would occur. Therefore, the Development in combination with the Grid Application is not considered to present a cumulative effect on Land and Soil which is **not significant** in terms of the EIA Regulations.

9.8.2 Gortahile Wind Farm

The Gortahile Wind Farm is an operational wind farm which consists of eight turbines located approximately 1.5 km to the north of the Development.

The greatest potential for cumulative effects arises when the construction phase of another development overlaps with the construction phase of the Development. Cumulative effects are considered to have the potential to be significant only where such an overlap may exist.

The wind farm has been operational since 2010 and planning consideration would have been given to it and the Consented Wind Farm at the time of its consent. As there is no change from the 2011 EIS finding in regards to cumulative impacts and the Gortahile Wind Farm is operational, the cumulative effect is still considered **not significant** in terms of the EIA Regulations.

9.9 MITIGATION AND RESIDUAL EFFECTS

The Development layout and Site area remains generally unchanged from the Consented Wind Farm with only slight enlargement of proposed turbine hardstandings to accommodate the increased rotor blade diameter. This change has been captured within the estimated peat excavation volumes with any peat excavated during construction being reused on site for reinstatement. On this basis, assessment and mitigation within the 2011 EIS remain applicable for the Development, with no significant effects identified during construction.

Mitigation from the 2011 EIS includes:

- Placement in shallow peat;
- It is proposed that peat and subsoils excavated on the site will be stored in borrow pits; and
- Implementation of appropriate drainage to attenuate drainage water.

9.10 SUMMARY OF EFFECTS

Table 9.5 provides a summary of the effects detailed within this chapter.

Table 9.5 Summary of Effects

Receptor	Potential Effect	Significance of Effect	Mitigation Proposed	Residual Effect
Construction Phase				
Peat	Peat Disturbance	Not Significant	Micro-siting to shallowest areas of peat available. Maintain hydrology of area as far as practicable.	Not Significant
Peat	Peat Destabilisation	Not Significant	Micro-siting to shallowest areas of peat available. Maintain hydrology of area as far as practicable. Implementation of appropriate drainage. Use of experienced geotechnical staff, ground work contractors and trained operators.	Not Significant
Operational Phase				
Peat	None	Not Significant	None	Not Significant
Decommissioning Phase				
Peat	None	Not Significant	None	Not Significant

9.11 STATEMENT OF SIGNIFICANCE

Effects are considered to be significant for the purposes of the EIA Regulations where the effect is classified as being of 'Significant - Moderate' or 'Profound – Very Significant' significance.

There are no significant direct effects likely on Land and Soils with best practices, implementation of drainage, micro-siting, geotechnical monitoring and the use of experienced construction personnel recommended to mitigate the potential for disturbance or destabilisation of peat.

10 CULTURAL HERITAGE AND ARCHAEOLOGY

10.1 INTRODUCTION

This Chapter of the Environmental Impact Assessment Report (EIA Report) evaluates the effects of the construction, operation and decommissioning of Bilboa Wind Farm ('the Development'), on the Cultural Heritage and Archaeology resource, considering its various components:

This chapter includes the following elements:

- Legislation, Policy and Guidance;
- Assessment Methodology and Significance Criteria;
- Baseline Conditions;
- Assessment of Potential Effects;
- Cumulative Effects Assessment; and
- Mitigation and Residual Effects.

10.2 SUMMARY OF EFFECTS; LEGISLATION, POLICY AND GUIDANCE

The following guidance, legislation and information sources have been considered in carrying out this assessment:

- UNESCO World Heritage Convention 1972[1];
- Charter for the Conservation and Restoration of Monuments and Sites (Venice) 1964[2];
- European Convention on the Protection of the Archaeological Heritage (Valetta Convention) 1992[3];
- Council of Europe Convention on the Protection of the Architectural Heritage (Grenada Convention) 1985;
- National Monuments Act 1930[4], amended 1954[5], 1987[6], 1994[7] and 2004[8];
- Heritage Act 1995[9];
- National Cultural Institutions Act 1997[10]; and
- Architectural Heritage (National Inventory) and Historic Monuments (Miscellaneous Provisions) Act 1999[11].

[1] https://whc.unesco.org/en/conventiontext/ (Accessed 27/06/2022)
[2] https://www.icomos.org/en/participer/179-articles-en-francais/ressources/charters-and-standards/157-the-venice-charter (Accessed 01/06/2022)
[3] https://www.coe.int/en/web/conventions/full-list?module=treaty-detail&treatynum=143 (Accessed 27/06/2022)
[4] Government of Ireland (1930). National Monuments Act. 1930 [Online] Available at: http://www.irishstatutebook.ie/eli/1930/act/2/enacted/en/print (Accessed 27/06/2022)
[5] Government of Ireland (1954). National Monuments (Amendment) Act. 1954 [Online] Available at: http://www.irishstatutebook.ie/eli/1954/act/37/enacted/en/print (Accessed 27/06/2022)
[6] Government of Ireland (1987). National Monuments (Amendment Act. 1987 [Online] Available at: http://www.irishstatutebook.ie/eli/1987/act/17/enacted/en/print (Accessed 27/06/2022)
[7] Government of Ireland (1994). National Monuments (Amendment) Act. 1994 [Online] Available at http://www.irishstatutebook.ie/eli/1994/act/17/enacted/en/print (Accessed 27/06/2022)
[8] Government of Ireland (2004). National Monuments (Amendment) Act. 2004 [Online] Available at: http://www.irishstatutebook.ie/eli/2004/act/22/enacted/en/print (Accessed 27/06/2022)
[9] Government of Ireland (1995). Heritage Act. 1995 [Online] Available at: http://www.irishstatutebook.ie/eli/1995/act/4/enacted/en/html (Accessed 27/06/2022)
[10] Government of Ireland (1997). National Cultural Institutions Act. 1997 [Online] Available at: http://www.irishstatutebook.ie/eli/1997/act/11/enacted/en/html (Accessed 27/06/2022)
[11] Government of Ireland (1999). Architectural Heritage (National Inventory) and Historic Monuments (Miscellaneous Provisions) Act. 1999 [Online] Available at: http://www.irishstatutebook.ie/eli/1999/act/19/section/1/enacted/en/html (Accessed 27/06/2022)

- Guidelines on the information to be contained in Environmental Impact Assessment Reports (EIAR)[12]
- Heritage Ireland 2030[13]

Since 2011, there have been updates to standards and guidelines relating to archaeology and cultural heritage in the Architectural Heritage Protection Guidelines for Planning Authorities (2011), Department of Arts, Heritage, Gaeltacht & the Islands[14] and the Draft Revised Wind Energy Development Guidelines (2019)[15]. The following standards and guidelines remain unchanged from 2011:

- Frameworks and Principles for the Protection of the Archaeological Heritage (1999), Department of Arts, Heritage, Gaeltacht & the Islands[16];
- Policy and Guidelines on Archaeological Excavation (1999), Department of Arts, Heritage, Gaeltacht & the Islands[17];
- Archaeology & Development: Guidelines for Good Practice for Developers (2000), The Heritage Council[18]; and
- Guidelines for the Assessment of Archaeological Heritage Impacts of National Road Schemes (2005), National Roads Authority[19].

10.3 ASSESSMENT METHODOLOGY AND SIGNIFICANCE CRITERIA

10.3.1 Pre-Application Consultation Responses

Consultation and the responses received for this EIA topic were undertaken with the organisations shown in Table 10.1.

[12] Guidelines on the information to be contained in Environmental Impact Assessment Reports (EIAR) [Online] Available at: https://www.epa.ie/publications/monitoring--assessment/assessment/guidelines-on-the-information-to-be-contained-in-environmental-impact-assessment.php (Accessed 27/06/2022)
[13] Heritage Ireland 2030 (February 2022) sets out the Strategy for the Protection of Irish Heritage with Joined-up Approach Across Government, Stakeholders and Communities. Available at https://www.gov.ie/en/press-release/02a15-heritage-ireland-2030-sets-out-strategy-for-the-protection-of-irish-heritage-with-joined-up-approach-across-government-stakeholders-and-communities/#:~:text=The%20Government%20has%20today%20approved,the%20next%20decade%20and%20beyond. (Accessed 27/06/2022).
[14] Department of Arts, Heritage and the Gaeltacht (2011). Architectural Heritage Protection Guidelines for Planning Authorities [Online] Available at: https://www.buildingsofireland.ie/app/uploads/2019/10/Architectural-Heritage-Protection-Guidelines-for-Planning-Authorities-2011.pdf (Accessed 27/06/2022)
[15] Government of Ireland (December 2019) Draft Revised Wind Energy Development Guidelines (Sections 5.5 and 5.6 on Archaeology and Architectural Heritage). Available at: https://www.gov.ie/en/publication/9d0f66-draft-revised-wind-energy-development-guidelines-december-2019/ (Accessed 27/06/2022)
[16] Department of Arts, Heritage, Gaeltacht and the Islands (1999). Framework and Principles for the Protection of the Archaeological Heritage [Online] Available at: https://www.archaeology.ie/sites/default/files/media/publications/framework-and-principles-for-protection-of-archaeological-heritage.pdf (Accessed 27/06/2022)
[17] Department of Arts, Heritage, Gaeltacht and the Islands (1999). Policy and Guidelines on Archaeological Excavation [Online] Available at: https://www.archaeology.ie/sites/default/files/media/publications/excavation-policy-and-guidelines.pdf (Accessed 27/06/2022)
[18] The Heritage Council (2000). Archaeology & Development: Guidelines for Good Practice for Developers [Online] Available at: https://www.heritagecouncil.ie/content/files/archaeology_development_guidelines_good_practices_for_developers_2000_1mb.pdf (Accessed 27/06/2022)
[19] National Roads Authority (2005). Guidelines for the Assessment of Archaeological Heritage Impacts of National Road Schemes [Online] Available at: https://www.tiipublications.ie/downloads/SRM/12-Archaeology-Planning-Guidelines-2005.pdf (Accessed 27/06/2022)

Table 10.1 Consultation Responses

Consultee	Type and Date	Summary of Consultation Letter	Response from Consultee
Church of Ireland Diocese of Cashel	Pre-Application Consultation Letter Sent to Consultee on 29/9/2020	Letter documenting changes to consented wind farm that proposes no change in tip height and slightly large hardstanding due to larger rotor so that findings of the original EIA and consent remain unchanged	None Received
Department of Culture, Heritage and the Gaeltacht	Pre-Application Consultation Letter Sent to Consultee on 06/10/2020	Letter documenting changes to consented wind farm that proposes no change in tip height and slightly large hardstanding due to larger rotor so that findings of the original EIA and consent remain unchanged	None Received
Carlow Historical and Archaeological Society	Pre-Application consultation Letter Sent to Consultee on 20/10/2020	Letter documenting changes to consented wind farm that proposes no change in tip height and slightly large hardstanding due to larger rotor so that findings of the original EIA and consent remain unchanged	None Received

10.3.2 Scope of Assessment

The key issues for the assessment of Archaeology and Cultural Heritage are potential direct and indirect effects relating to the construction and operational phases of the Development. There are no predicted effects on heritage assets during the decommissioning phase.

The potential effects from the Development to archaeological and cultural heritage assets are:

- Temporary indirect effects arising from the construction phase, such as noise and higher vehicular and pedestrian activity, which may cause reduced access to and / or reduced appreciation of the historical environment;
- Permanent direct effects due to land take by the foundations and access tracks; and
- Indirect effects, including changes to the settings of cultural heritage assets, which may affect their cultural significance. Setting changes are largely visual effects and are likely to occur as a consequence of the height and breadth of the Development.

10.3.3 Elements Scoped Out of Assessment

The 2011 EIS, prepared for the Consented Wind Farm by Tobar Archaeological Services, recorded no archaeological monuments within the site boundary, with only three monuments situated within the wider 2 km Study Area. The 2011 EIS concluded that the Development would have no direct effects on the recorded archaeological / architectural heritage within the 2 km study area with no visual, setting or significant effects on the archaeological, architectural or cultural heritage landscape.

The Consented Modification was supported by a new EIA Report, which assessed a revised Development that included an increase to the rotor blade diameter, although the height to tip of each turbine remained as previously consented. The Consented Modification also allowed for a marginal increased crane hardstanding at four turbine locations. This Consented Modification was granted planning consent in 2022, demonstrating an endorsement from CCC that the effects assessed in the supporting EIA Report where correct and acceptable.

The design included within the current EIA has not been altered from the previously Consented Wind Farm. As the Development is not changing, there is no change to visual setting effects identified and no change to indirect effects.

10.3.4 Study Area / Survey Area

The Study Area for the purpose of the Archaeology and Cultural Heritage assessment is the same as that within the 2011 EIS and the 2020 EIA Report. It comprised an area of 2 km in potential direct and indirect effects on Recorded Monuments, as well as on their environs, characterised as a rural landscape. These effects were assessed and considerations on the archaeological potential of the Development Site were also undertaken.

10.3.5 Design Parameters

The archaeological and cultural heritage assessment was based on the design parameters set out in **Chapter 5: Project Description** of this EIA Report. In relation to direct physical effects, the assessment was based on the most extensive construction footprint, since this determines how much an asset is directly affected.

No additional design parameters were required for the assessment presented in this Chapter.

10.3.6 Baseline Survey Methodology

The 2011 EIS and the EIA Report supporting the 2021 application revising the Development due to the inclusion of an increase to the rotor blade diameter, included a review of existing data.

The same study area and baseline was used for the assessment with a review of the following datasets to determine if there are any changes to the baseline conditions:

- National Monuments;
- Record of Monuments and Places (RMP) and Sites and Monuments Record (SMR);
- Topographic files held by the National Museum of Ireland;
- Archaeological Inventory for County Carlow;
- Carlow County Development Plan and Laois County Development Plan for Records of Protected Structures;
- Excavation Bulletins and Excavations Database; and
- National Inventory of Architectural Heritage (NIAH).

10.3.7 Methodology for the Assessment of Effects

Chapter 3 of this EIA Report offers a description of the current and relevant legislation and policy position regarding planning and development at a European, national, regional and local level referenced in its production. This EIA Report was produced in line with current EIA guidance[20].

[20] https://www.epa.ie/publications/monitoring--assessment/assessment/EIAR_Guidelines_2022_Web.pdf (Accessed 01/06/2022)

In addition, the methodology for the assessment of archaeology and cultural heritage effects follows Policy and Guidance outlined in Section 10.2 of this Chapter[21].

The assessment considers the sensitivity of a cultural heritage feature and the magnitude of any potential change, to conclude whether the effect is significant. The assessment conclusions are informed by professional judgement.

10.3.7.1 Sensitivity of Receptors

The sensitivity of the baseline conditions, including the importance of environmental features on or near to the Site or the sensitivity of potentially affected receptors, was assessed in line with best practice guidance, legislation, statutory designations and / or professional judgement. The criteria for assessing the sensitivity of Archaeology and Cultural Heritage receptors identified are presented in Table 10.2.

Table 10.2 Framework for Determining the Value (Sensitivity) of Receptors

Sensitivity of Receptor	Definition
High	The receptor has little ability to absorb change without fundamentally altering its present character, is of high environmental value, or of national importance.
Medium	The receptor has moderate capacity to absorb change without significantly altering its present character, has some environmental value, or is of regional importance.
Low	The receptor is tolerant of change without detriment to its character, is low environmental value, or local importance.
Negligible	The receptor is resistant to change and is of little environmental value.

10.3.7.2 Magnitude of Change

The magnitude of potential change was identified through consideration of the Development, the degree of change to baseline conditions predicted as a result of the Development; the duration and reversibility of an effect and professional judgement; best practice guidance and legislation.

The criteria for assessing the magnitude of change are presented in Table 10.3.

Table 10.3. Framework for Determining Magnitude of Change

Magnitude of Change	Definition
High	A fundamental change to the baseline condition of the asset, leading to a major alteration of character.
Medium	A material, partial loss or alteration of character.
Low	A slight, detectable, alteration of the baseline condition of the asset.
Negligible	A barely distinguishable change from baseline conditions.

[21] Arts, Heritage, Gaeltacht and the Islands. (1999). Framework and Principals for the Protection of the Archaeological Heritage. Dublin Stationary Office; National Roads Authority. (2005). Guidelines for the Assessment of Archaeological Heritage Impacts of National Road Schemes; National Roads Authority. (2005). Guidelines for the Assessment of Architectural Heritage Impacts of National Road Schemes. Government of Ireland (December 2019) Draft Revised Wind Energy Development Guidelines (Sections 5.5 and 5.6 on Archaeology and Architectural Heritage).

10.3.7.3 Significance of Effect

The sensitivity of the asset and the magnitude of the predicted effects will be used as a guide, in addition to professional judgement, to predict the significance of the likely effects. Table 10.4 summarises guideline criteria for assessing the significance of effects, according to the Environmental Protection Agency guidelines[22]

Table 10.4 Framework for Assessment of the Significance of Effects

Magnitude of Change	Sensitivity of Resource or Receptor			
	High	**Medium**	**Low**	**Negligible**
High	Profound – Very Significant	Significant - Moderate	Moderate - Slight	Slight - Imperceptible
Medium	Significant - Moderate	Moderate	Slight	Imperceptible
Low	Moderate - Slight	Slight	Slight – Not Significant	Imperceptible
Negligible	Slight - Imperceptible	Imperceptible	Imperceptible	Imperceptible

Effects predicted to be of a profound, very significant or significant nature are considered to be 'significant' in the context of the EIA Regulations, and are shaded in light grey in the above table.

10.3.8 Assessment Limitations

The assessment of Archaeology and Cultural Heritage was based on a desktop study of baseline conditions and previous assessments, namely the EIA 2011 and the 2020 EIA Report. No walk over survey or intrusive investigation was undertaken.

10.4 BASELINE CONDITIONS

As part of the 2011 EIS and the 2020 EIA Report, a desktop assessment and field survey was undertaken which included data from:

- Sites and Monument Record (SMR);
- Record of Monuments and Places (RMP) for County Carlow;
- Topographic files held by the National Museum of Ireland;
- Archaeological Inventory for County Carlow;
- Record of Protected Structures;
- Excavation Bulletins from 1985-2004; and
- National Inventory of Architectural Heritage (NIAH).

The 2011 EIS identified three recorded monuments within 2 km as shown on Figure 10.1, which were also considered for the 2020 EIA Report:

- CW00392 (referenced as CW011-002 in EIS), a bowl barrow located 1.5 km west;
- CW00394 (referenced as CW011-004 in EIS), an earthwork located 1.7 km south-east; and
- CW00391 (referenced as CW011-001 in EIS), a moated site located 1.8 km west.

The previous assessments also identified one structure listed in the NIAH within the 2 km study area, as shown on Figure 10.1:

[22] Guidelines on the information to be contained in Environmental Impact Assessment Reports (May 2022) [Online] Available at: https://www.epa.ie/publications/monitoring-assessment/assessment/EIAR_Guidelines_2022_Web.pdf (Accessed 27/06/2022)

- Bilboa Church of Ireland (Reg no. 10300601).

The 2011 EIS identified a number of townland boundaries within the forestry traversed by existing tracks and place names including:

- Bilboa (Biolbo) – ford of the cow;
- Ballyvannanan – *Buaile Uí Mhanannáin* - Mannanan's Booley or dairy mountain;
- Booleyrathornan or Tomard – *Buaile Ratha Charnain* – Dairy of the fort of the cairn.
- The 2020 EIA Report added only one asset to the list above, located within the 2 km study area of the Development: Three Counties Bridge (Reg no. 12400611), a single-arch rubble stone road bridge over the river, dating to circa 1800.

No other archaeology or heritage assets were noted from historic mapping, documentary and cartographic evidence, or protected structures datasets in the 2011 EIS or the 2020 EIA Report.

10.5 EMBEDDED MITIGATION

For the purposes of the archaeology and heritage assessment, the Development is not considered different from the Consented Wind Farm. As such, the parameters of the Consented Wind Farm are the same as for the present Development, and any mitigation or conditions relating to archaeology or heritage associated with the Consented Wind Farm should apply to the Development.

Mitigation proposed in the Original Wind Farm 2011 EIS and the 2020 EIA Report is detailed in section 10.8 of this Chapter.

10.6 ASSESSMENT OF POTENTIAL EFFECT

10.6.1 Construction Phase Effects

The location of turbines and associated infrastructure remained unaltered in relation to the Consented Wind Farm. The assessment and mitigation detailed in the 2011 EIS and the 2020 EIA Report did not change as a result of the Consented Modification, and no effects upon known archaeology or other heritage assets were identified as being at risk of impact.

The baseline defined in the 2022 cultural heritage assessment also remains unchanged. The 2011 EIS and the 2020 EIA Report did, however, highlight the potential for archaeological finds within peat deposits and recommended that archaeological monitoring is undertaken during construction and any geo-technical investigation, ensuring that there are no significant effects on archaeology.

10.6.2 Operational Phase Effects

The operational effects to heritage are primarily visual, and most likely to occur in close proximity to the turbines. The 2011 EIS and the 2020 EIA Report assessed the three recorded monuments within the study area:

- CW00392 (referenced as CW011-002 in 2011 EIS), a bowl barrow located 1.5 km west;
- CW00394 (referenced as CW011-004 in 2011 EIS), an earthwork located 1.7 km south-east; and
- CW00391 (referenced as CW011-001 in 2011 EIS), a moated site located 1.8 km west.

The previous 2011 and 2020 reports found no effect upon the setting of the monuments due to distance and forestry/afforestation. As there are no physical changes from the Consented Wind Farm with the perimeter of the forestry remaining as a visual barrier, there is no change to the potential visibility and the findings of the 2011 EIS remain valid for the current Development with **no significant effect** on these monuments.

The 2011 EIS found no visual effect upon any archaeological, architectural, or cultural heritage landscape or feature including:

- Bilboa Church of Ireland (Reg no. 10300601).

Considering that there are no changes proposed in relation to the Consented Wind Farm, and the visual barrier comprising the surrounding forestry perimeter, there is no change to the visibility affordances of the heritage assets identified in the 2011 EIS, whose assessments remain valid for Bilboa Church of Ireland (Reg no. 10300301), suffering **no significant effects** from the Development.

The 2020 EIA Report identified an additional asset, The Three Counties Bridge (Reg no. 12400611), an architectural feature comprising a bridge and watercourse crossing, not previously documented by the 2011 EIS. The significance of the bridge relates to its function and architectural characteristics within a landscape setting limited by the river in its immediate vicinity. The Development is not located within this setting and does not affect the bridge's association with the watercourse, therefore no change is predicted to the this feature. As an asset of medium sensitivity with negligible change the resulting significance of effect is imperceptible and **not significant.**

10.6.3 Decommissioning Phase Effects

There are no predicted effects, in relation to cultural heritage, predicted to the decommissioning phase of the Wind Farm.

10.7 CUMULATIVE EFFECT ASSESSMENT

Cumulative developments related to the Development include:

- Bilboa Wind Farm Consented Grid Route; and
- Gortahile Wind Farm.

The 2011 EIS and the 2020 EIA Report highlight the potential for archaeological finds within peat deposits and recommended that archaeological monitoring is undertaken during construction and any geo-technical investigation, ensuring that there are no significant effects on archaeology.

The implemented mitigations for unknown archaeology ensured that there was no compound effect and **no significant cumulative effects** are anticipated as a result of the Development.

The Operational Gortahile Wind Farm consists of eight turbines with a tip height of 125 m located approximately 1.5 km to the north of the Development. The wind farm has been operational since 2010 and planning consideration would have been given to it and the Consented Wind Farm at the time of its consent. As there is no change from the 2011 EIS and the EIA Report finding in regards to the Original Wind Farm versus the Consented Wind Farm/the Development, the cumulative effect is considered to result in **no significant effect.**

10.8 MITIGATION AND RESIDUAL EFFECTS

As the location of turbines and associated infrastructure remains unchanged from the Consented Wind Farm and the slight increase of the hardstanding was consented as part of the 2021 application, the assessment and mitigation within the 2011 EIS and 2020 EIA Report remains valid for the Development, with no significant effects identified during construction. Mitigation measures in the 2011 EIS and 2020 EIA Report proposed archaeological monitoring of all ground works associated with construction and this remains valid for the Development.

In order to ensure the continued preservation (either in situ or by record) of historical features and archaeological remains of interest, the following measures will be implemented during construction:

(a) The presence of a suitably qualified, licensed archaeologist, specialised in wetland archaeology assessments, to monitor all groundworks required for this Development. No groundworks or construction works are to take place in the absence of the archaeologist.

(b) Archaeological monitoring of uppermost archaeological horizons only (where they survive) and topsoil/sod layers shall only be removed using a machine with a toothless bucket. Should archaeological material be found during the course of the monitoring, all work on site must be ceased, pending a decision as to how best to deal with the discovered archaeology. All features/deposits are to be hand-cleaned and a revision to the archaeological Method Statement must be submitted to allow for the preservation *in situ* or full archaeological excavation of any identified archaeological features. It is recommended that the archaeologist has access to appropriate storage and conservation facilities for the collation and curation of organic materials/artefacts.

(c) The Developer will be advised by The National Monuments Service regarding any necessary mitigating action such as the need for redesign to allow for preservation *in situ*, and/or excavation (both may be required in terms of buffer and testing/excavation). The applicant/developer must facilitate the archaeologist in recording any material found.

(d) A report describing the results of the monitoring should be provided to The National Monument Service and the Planning Authority.

10.9 SUMMARY OF EFFECTS

Table 10.5 provides a summary of the effects detailed within this chapter.

Table 10.5 Summary of Effects

Receptor	**Potential Effect**	**Significance of Effect**	**Mitigation Proposed**	**Residual Effect**
Construction Phase				
Known archaeology	None as no archaeology identified within Site.	Not Significant	Archaeological Monitoring	Not Significant
Unknown Archaeology	Potential direct effect to unknown buried archaeology	Imperceptible to Profound	Archaeological Monitoring and Micrositing (if required)	Imperceptible to Profound
Operational Phase				
• CW00392 Bowl Barrow • CW00394 earthwork • CW00391 moated site	No visual effect	Not Significant	None	Not Significant
• Bilboa Church of Ireland	No visual effect	Not Significant	None	Not Significant

Receptor	Potential Effect	Significance of Effect	Mitigation Proposed	Residual Effect
Construction Phase				
(Reg no. 10300601) • Three Counties Bridge (Reg no. 12400611)				
Decommissioning Phase				
Known archaeology	None	Not Significant	None	Not Significant
Unknown Archaeology	None	Not Significant	None	Not Significant

11 NOISE AND VIBRATION

11.1 INTRODUCTION

This Chapter of the Environmental Impact Assessment Report (EIA Report) evaluates the effects of noise and vibration relating to the construction, operation and decommissioning of Bilboa Wind Farm ('the Development').

This Chapter of the EIA Report is supported by the following figures provided in Volume 2 EIA Report Figures:

- Figure 11.1: Noise Contour Plot; and
- Figure 11.2: Cumulative Noise Contour Plot.

This Chapter includes the following elements:

- Legislation, Policy and Guidance;
- Assessment Methodology and Significance Criteria;
- Baseline Conditions;
- Embedded Mitigation;
- Assessment of Potential Effects;
- Cumulative Effects Assessment;
- Mitigation and Residual Effects;
- Summary of Effects; and
- Statement of Significance.

The Development Site is subject to an extensive planning history, as described in Chapter 1: Introduction of this EIA Report. This Chapter draws on information from previous iterations of the Development, where relevant.

11.2 LEGISLATION, POLICY AND GUIDANCE

The following guidance, legislation and information sources have been considered in carrying out this assessment:

- 2006 Wind Energy Development Guidelines ('WEDG')[1];
- Best Practice Guidelines for the Irish Wind Energy Industry[2]; and
- A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind turbine Noise[3].

Under Section 28 of the Planning and Development Act, 2000 (As Amended)[4], the WEDG is the current Ministerial Guidance for the determination of wind energy development. Whilst a review of the Development Guidelines 'Preferred Draft Approach'[5] is ongoing, The Irish Wind Energy Association (IWEA) have published a guidance document[6], stating that the noise guidance provided in the WEDG remains valid and should be followed.

In December 2019, the Draft Revised Wind Energy Development Guidelines[7] (DWEDG) were published for consultation. At the time of writing, the DWEDG remains in draft form

[1] The Department of the Environment, Heritage and Local Government (2006). Wind Energy Development Guidelines.
[2] Best Practice Guidelines for the Irish Wind Energy Industry (2012). IWEA
[3] A Good Practice Guide to the Application of ETSU-R-97 for the Assessment and Rating of Wind turbine Noise, IOA, 2013
[4] Government of Ireland, (2000), Planning and Development Act, 2000 (As Amended).
[5] Department of Communications, Climate Change & Environment (2017) Information Note: Review of the Wind Energy Development Guideline 2006 – Preferred Draft Approach
[6] Best Practice Guidelines for the Irish Wind Energy Industry (2012). IWEA
[7] Department of Housing, Planning and Local Government (2019) Draft Revised Wind Energy Development Guidelines

and until such time as the revision is finalised, compliance with the 2006 WEDG is the guidance applicable to the determination of the Development.

Whilst not directly applicable in Ireland, the UK Institute of Acoustics published the *Good Practice Guide* (the GPG) in 2013, which provides detailed guidance on the modelling of noise from wind turbines. The advice provided in the GPG has been applied in this assessment where applicable.

The EPA 'Guidelines on the Information to be Contained in Environmental Impact Assessment Reports' 2022[8] detail the framework for assessment for EIA that is followed in this EIA Report.

11.3 ASSESSMENT METHODOLOGY AND SIGNIFICANCE CRITERIA

11.3.1 Pre-Application Consultation Responses

Consultation for this EIA Report topic was undertaken in a number of stages, as summarised in Table 11.1.

Table 11.1 Consultation Responses

Consultee	Type and Date	Summary of Consultation Response	Response to Consultee
Consultation undertaken as part of the 2020 EIA			
Carlow County Council (CCC) Environmental Health Department	Pre-Application Consultation (1 October 2020)	The consented noise limits[9], which broadly follow the 2006 Wind Energy Guidelines, should be retained.	Assessment undertaken in accordance with the WEDG.
	Pre-Application Consultation (1 October 2020)	Noise measurements shall be carried out in accordance with ISO 1996-2:2017	Background noise measurements have been undertaken in accordance with ISO 1996-2:2017 and the GPG.
	Pre-Application Consultation (1 October 2020)	The 2006 guidelines do not contain a detailed examination for tonal and impulsive noise adjustments and low frequency noise. It may be desirable to have regard to the DWEDG (or equivalent source material) in respect of these factors.	Further details on these Special Audible Characteristics are provided in Section 11.3.3.3 of this Chapter.
Consultation undertaken as part of the 2021 FEI			
CCC Environmental Health Department	FI Consultation relating to noise (25 June 2021)	Requirement for baseline monitoring and analysis in line with FI Request. Requirement for additional detail on wind turbine noise Special Audible Characteristics with reference to existing wind farms in Ireland.	Special Audible Characteristics are Discussed in Section 11.3.3.3. Background monitoring has been undertaken in line with the FI Request and discussions. See

[8] Environmental Protection Agency (2022) Guidelines on the Information to be Contained in Environmental Impact Assessment Reports [Online] Available at: https://www.epa.ie/publications/monitoring--assessment/assessment/EIAR_Guidelines_2022_Web.pdf (Accessed 09/06/22)

[9] In this context, the 'consented noise limits' to which CCC referred are those of the 2012 Consented Wind Farm (now expired)

Consultee	Type and Date	Summary of Consultation Response	Response to Consultee
		Agreement during discussions that two monitoring locations should be sufficient to characterise receiving environment.	Section 11.4 for details.

11.3.2 Scope of Assessment

The assessment of potential noise effects relating to the Development fall into the following categories:

- Effects during Construction of the Development;
- Effects during Operation of the Development; and
- Effects during Decommissioning of the Development.

11.3.3 Elements Scoped Out of Assessment

The following elements have been scoped out of this assessment:

11.3.3.1 Construction and Decommissioning Noise and Vibration

In line with the findings of the 2020 EIA, and due to the large separation distances from the Development to the nearest noise sensitive receptors, no significant construction / decommissioning effects are anticipated. Notwithstanding this, a summary of best practice construction methods, along with a commitment to adhere to best practice in controlling noise from construction / activities, as advocated by BS 5228[10], is presented in Section 11.8.1.

11.3.3.2 Operational Vibration

Research undertaken by Snow[11] found that levels of ground-borne vibration 100 m from the nearest wind turbine were significantly below criteria for 'critical working areas' given by British Standard BS6472:1992 *Evaluation of human exposure to vibration in buildings (1 Hz to 80 Hz)*, and were lower than limits specified for residential premises by an even greater margin.

Ground-borne vibration from wind turbines can be detected using sophisticated instruments several kilometres from the windfarm site as reported by Keele University[12]. This report clearly shows that, although detectable using highly sensitive instruments, the magnitude of the vibration is orders of magnitude below the human level of perception and does not pose any risk to human health.

11.3.3.3 Special Audible Characteristics

Wind turbines have the potential to emit noise with 'special audible characteristics' which typically fall into three categories: tonal noise, amplitude modulation, and low frequency noise.

Tonal Noise

Tonal noise from wind turbines arises primarily from mechanical hub components such as bearings or gearing. Improvements in modern wind turbine designs have resulted in

[10] BS 5228:2009+A1:2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites
[11] ETSU (1997), Low Frequency Noise and Vibrations Measurement at a Modern Windfarm, prepared by D J Snow.
[12] Microseismic and infrasound monitoring of low frequency noise and vibrations from Windfarms: recommendations on the siting of Windfarms in the vicinity of Eskdalemuir, Scotland". Keele University, 2005

significant reductions of tonal noise emissions and these are very rarely audible at noise-sensitive receptors.

The DWEDG states…"*the methodology to be applied in relation to quantifying tonal emissions from wind energy developments is in accordance with ISO 1996-2 third Edition 2017 Acoustics - Description, measurement and assessment of environmental noise – Part 2: Determination of sound pressure levels Annex J and ISO/PAS 20065*[13] *on an objective method for assessing the audibility of tones in noise".* The method described in ISO 1996-2 Annex J is also recommended in BS 4142[14] for the objective assessment of tonal noise.

Wexford County Council commissioned RPS Engineering in early 2016 to conduct extensive assessments of noise from Gibbet Hill, Knocknalour, Balynancoran and Ballycadden wind farms ('the RPS Assessments')[15]. These assessments included detailed assessment of potential special audible characteristics. The assessments of tonal noise did not find significant tonal noise content for any of the four wind farms.

Amplitude Modulation

In its simplest form, AM, by definition, is the regular variation in noise level of a given noise source. This variation (the modulation) occurs at a specific frequency, which, in the case of wind turbines, is defined by the rotational speed of the blades, i.e., it occurs at the rate at which the blades pass a fixed point (e.g., the tower), known as the Blade Passing Frequency. A certain level of AM is typically present in wind turbine noise and is generally referred to as 'blade swish'.

A study[16] carried out in 2007 on behalf of the Department for Business, Enterprise and Regulatory Reform (BERR) by the University of Salford investigated the incidence of noise complaints associated with windfarms and whether these were associated with excessive levels of AM. The study defined AM as aerodynamic noise from wind turbines with a greater degree of fluctuation than normal at blade passing frequency (later referred to as 'Other AM' (OAM)). The study concluded that OAM had occurred at only a small number (4 of 133) of windfarms in the UK, and only for between 7% and 15% of the time. It also stated that, the causes of OAM are not well understood and that prediction of the effect was not currently possible.

This research was updated in 2013 by an in-depth study undertaken by Renewable UK[17], which identified that many of the previously suggested causes of OAM have little or no association to the occurrence of OAM in practice. The generation of OAM is based upon the interaction of a number of factors, the combination and contributions of which are unique to each site. With the current state of knowledge, it is not possible to predict whether any particular site is more or less likely to give rise to OAM, and the incidence of OAM occurring at any particular site remains low, as identified in the University of Salford study.

In 2016, the UK Institute of Acoustics (IOA) proposed an objective measurement technique[18] to quantify the level of AM present in a sample of windfarm noise. This technique was supported by the Department of Business, Energy & Industrial Strategy (BEIS, formerly The Department of Energy & Climate Change) who have published

[13] ISO/PAS 20065:2016 Acoustics — Objective method for assessing the audibility of tones in noise — Engineering method
[14] BS 4142:2014+A1:2019. Methods for rating and assessing industrial and commercial sound.
[15] Wexford County Council – Wind farms noise report – RPS – Assessments of Gibbet Hill, Knocknalour, Ballycadden, Ballynancoran. https://www.wexfordcoco.ie/news/2017/07/14/wind-farms-noise-report
[16] University of Salford (2007). 'Research into aerodynamic modulation of wind turbine noise'. Report by University of Salford, The Department for Business, Enterprise and Regulatory Reform, URN 07/1235, July 2007.
[17] Renewable UK (2013). 'Wind Turbine Amplitude Modulation: Research to improve understanding as to its Cause and effects', Renewable UK, 2013.
[18] Institute of Acoustics, (2016) A Method for Rating Amplitude Modulation in Wind Turbine Noise,

guidance[19], which follows on from the conclusions of the IOA study in order to define an appropriate assessment method for AM, including a penalty scheme (as suggested in the DWEDG) and an outline planning condition. It should be noted that the recommendations of the report have not been implemented in the UK or Ireland, and the suggested outline planning condition remains in an unvalidated, draft form. At the time of writing, there is no consensus view among acousticians that the scheme should be adopted.

Section 7.2.1 of the GPG also remains current, stating: *"The evidence in relation to 'Excess' or 'Other' Amplitude Modulation (AM) is still developing. At the time of writing, current practice is not to assign a planning condition to deal with AM".*

Low Frequency Noise

Low frequency noise (LFN) has historically been associated with downwind rotor turbines and is less characteristic of modern upwind rotor designs. Extensive survey and analysis conducted by the South Australia Environment Protection Authority (SAEPA)[20] compared low frequency noise at several rural and urban sites, with the rural locations including sites in the vicinity of wind farms (surveyed both with turbines operating and shut down) and with no wind turbines nearby. At separation distances typical of receptor locations, no association of low-frequency noise with wind turbines was found. The study also measured infrasound levels in areas close to windfarms, finding infrasound levels similar to those found in surveyed urban areas.

A study of the human response to wind turbine infrasound was commissioned by the Finnish Government's Analysis, Assessment and Research Activities[21]. The study was conducted by VTT (the project lead, a Finnish state-owned research institution), the Finnish Institute for Health and Welfare, the Finnish Institute of Occupational Health, and the University of Helsinki. The project commenced in August 2018 with publication of the report in June 2020.

The Finnish study included questionnaire surveys of residents in the vicinity of wind farm developments, long term noise measurements (total of 308 days full-spectrum indoor and outdoor measurements), and double-blind listening tests. The indoor noise recordings obtained during the measurements which had the highest levels of infrasound and amplitude modulation were used in the double-blind listening tests, which included a control group, and a group of participants who had self-reported symptoms which they intuitively attributed to wind turbine infrasound. Important findings of the study included the following:

- Participants who had previously reported wind turbine infrasound related symptoms were not able to perceive infrasound in the noise samples;
- Participants who had previously reported wind turbine infrasound related symptoms did not find samples with infrasound more annoying than those participants without previously reported wind turbine infrasound related symptoms; and
- Wind turbine infrasound exposure did not cause physiological responses in either participant group.

[19] BEIS, (2016), Review of the evidence on the response to amplitude modulation from wind turbines,
[20] South Australia Environmental Protection Agency - Infrasound levels near windfarms and in other environments https://www.epa.sa.gov.au/files/477912_infrasound.pdf
[21] Infrasound Does Not Explain Symptoms Related to Wind Turbines - Panu Maijala, Anu Turunen, Ilmari Kurki, Lari Vainio, Satu Pakarinen, Crista Kaukinen, Kristian Lukander, Pekka Tiittanen, Tarja Yli-Tuomi, Pekka Taimisto, Timo Lanki, Kaisa Tiippana, Jussi Virkkala, Emma Stickler, Markku Sainio. https://www.semanticscholar.org/paper/Infrasound-Does-Not-Explain-Symptoms-Related-to-Maijala-Turunen/8d34db81eb3ba909ea1fb725d71d5eb18cf2cdaa#references

Modelling work conducted by Aagaard Madsen at the Technical University of Denmark[22] suggests that for modern wind turbines… *"the LFN levels are so low that it should not cause annoyance of neighbouring people".*

Assessments of LFN in the RPS Assessments did not find significant LFN content for any of the four wind farms considered. The reports note that this *"This is not surprising given the noise spectrum of the wind turbines"* and that *"Low frequency noise cannot therefore be considered a substantial issue in the overall context".*

In summary, tonal noise, amplitude modulation, low frequency noise and infrasound will not be significant at sensitive receptors, and as such have been scoped out of this assessment.

11.3.4 Study Area

The study area encompasses all noise-sensitive receptors (NSRs) within 1.5 km of a turbine within the Development. 37 residences have been identified within the Study Area. Irish Transverse Mercator (ITM) coordinates for the Study Area receivers are shown in Table 11.2.

Table 11.2: Noise Sensitive Receptor Locations

Noise Sensitive Receptor	ITM Coordinates	
	Easting	Northing
NSR01	665604	670477
NSR02	664331	670309
NSR03	664492	670258
NSR04	664766	669999
NSR05	663808	670370
NSR06	664803	669903
NSR07	663779	671995
NSR08	664729	669904
NSR09	663743	672011
NSR10	663855	672058
NSR11	663906	672074
NSR12	664035	672138
NSR13	663348	671856
NSR14	664729	669729
NSR15	664365	672238
NSR16	666014	671046
NSR17	664383	672254
NSR18	665941	671291
NSR19	664493	672315
NSR20	663073	671625
NSR21	666030	671223
NSR22	664366	672434
NSR23	662946	671494

[22] Aagaard Madsen, H. (2010). Low frequency noise from wind turbines mechanisms of generation and its modelling. Journal of Low Frequency Noise, Vibration and Active Control, 29(4), 239-251. DOI: 10.1260/0263-0923.29.4.239

Noise Sensitive Receptor	ITM Coordinates	
	Easting	Northing
NSR24	663248	670358
NSR25	664606	672434
NSR26	663154	670379
NSR27	662836	671051
NSR28	662832	671046
NSR29	662822	671026
NSR30	662811	671005
NSR31	662801	670986
NSR32	663026	670439
NSR33	662992	670442
NSR34	665857	669410
NSR35	665000	672617
NSR36	662868	670498
NSR37	664999	672658

11.3.5 Design Parameters

The GPG notes that most sites at planning stage will not have selected a preferred turbine, therefore a candidate turbine representative of a range of turbines should be selected to provide appropriate noise levels. Once noise levels have been predicted at the potentially affected properties, compliance with noise limits can be assessed and design advice provided if compliance with the limits is considered unlikely.

The Vestas V117 4.2 Megawatt (MW) wind turbine has been selected as a candidate turbine for this assessment, being representative of the turbine type and scale likely to be selected for construction. The exact make and model of the installed turbine will be dictated by a competitive tender process of the various turbines on the market at the time but will not exceed the maximum size envelope set out within the development description.

This assessment assumes the turbines are fitted with serrated trailing edge (STE) blades and is operating in Mode 2. An additional 2 dB has been included in the sound power levels in this assessment to account for uncertainty, as recommended by the GPG. The resulting sound power levels are detailed in Table 11.3.

Table 11.3: Manufacturer's Noise Emission Data, Vestas 117, 4.2 MW

	Standardised 10 m Wind Speed, m/s									
	4	5	6	7	8	9	10	11	12	>12
	Sound Power Level, dB(A)									
Sound Power Level, dB LWA	95.7	99.8	101.8	102.4	102.7	103.0	103.0	103.0	103.0	103.0
Sound Power Level, dB, LWA, inc. 2 dB allowance for uncertainty	97.7	101.8	103.8	104.4	104.7	105.0	105.0	105.0	105.0	105.0

The octave-band frequency spectrum for the maximum sound power level is detailed in Table 11.4.

Table 11.4: Octave-band Spectra

	Octave-band Centre Frequency, f, Hz							
	63	125	250	500	1000	2000	4000	8000
	Octave-band Sound Power Level, dB, $L_{WA,f}$							
Sound Power Level, dB, L_{WA}, Scaled to 105.0 dB(A)	86.0	93.6	96.5	98.5	99.6	97.7	93.6	81.8

As described in Section 11.3.3.3, in line with the vast majority of modern wind turbines, the Vestas V117 is not considered tonal or impulsive. Therefore, no additions for such effects are required. Notwithstanding this, a noise warranty will be sought from the manufacturer of the turbine ultimately selected for construction.

11.3.6 Baseline Survey Methodology

Background noise monitoring for the 2021 FI was undertaken in July and August 2021; there have been no changes to the acoustic environment since the measurements, and as such the resulting background noise levels remain appropriate for the purposes of this assessment. Section 11.4 provides further detail on the baseline conditions, including noise monitoring and subsequent analysis.

11.3.7 Noise Prediction Methodology

Noise predictions have been made using industry standard software SoundPlan, which utilises the noise propagation model ISO 9613-2[23], along with taking account of the specific data and parameters recommended in the GPG, as summarised below:

- The turbine sound power levels have been stated and include an appropriate allowance for measurement uncertainty (See Section 11.3.5 for details);
- Atmospheric absorption has been calculated based on conditions of 10°C and 70% relative humidity;

[23] ISO 9613-2:1996 Acoustics — Attenuation of sound during propagation outdoors — Part 2: General method of calculation

- The ground factor of G=0.5 (mixed ground) has been applied, except in urban areas or where noise propagates across large bodies of water, where G=0 (hard ground)[24] is assumed;
- A receiver height of 4.0 m has been assumed;
- Barrier attenuation is limited to a maximum of 2 dB, when there is no line of sight from the receptor;
- An additional 3 dB has been added to noise immission levels at properties located across a valley or with heavily concave ground between the receptor location and the wind turbine(s)[25]; and
- The predicted noise levels ($L_{A\,eq,t}$) have been converted to the required $L_{A\,90,10min}$ by subtracting 2 dB.

ISO 9613-2 provides a prediction of noise levels likely to occur under worst-case conditions; those favourable to the propagation of sound, i.e., down-wind or under a moderate, ground-based temperature inversion as often occurs at night (often referred to as stable atmospheric conditions). The specific measures recommended in the GPG as summarised above, have been shown to provide good correlation with levels of wind turbine noise measured at operational wind farms[26,27].

11.3.8 Methodology for the Assessment of Effects

The acceptable limits for wind turbine operational noise are defined in the WEDG. Therefore, this assessment determines whether the calculated immission levels at nearby noise-sensitive receptors lie below the noise limits derived in accordance with the WEDG. All noise-sensitive receptors are of equal sensitivity.

Where the noise immission levels at noise-sensitive receptors are shown to be below the respective noise limit (and thereby also complaint with the WEDG), the effects are not significant in terms of the EIA Regulations.

11.3.8.1 Assessment Criteria

The following noise criteria have been adopted in line with current guidance (i.e. the WEDG):

- 40 dB $L_{A\,90,10min}$ for daytime 'very quiet area' environments of less than 30 dB $L_{A\,90,10min}$
- 45 dB $L_{A\,90,10min}$ for daytime environments greater than 30 dB $L_{A\,90,10min}$ or a maximum increase of 5dB(A) above background noise (whichever is higher), and
- 43 dB $L_{A\,90,10min}$ or a maximum increase of 5 dB(A) above background noise (whichever is higher) for night-time periods.

11.3.9 Assessment Limitations

An assessment of noise has been undertaken based upon a candidate turbine of the type and scale likely to be selected for construction. Background noise monitoring has been undertaken at locations agreed with the Council, and noise immission levels have been calculated in full accordance with best practice guidance (i.e., the GPG).

It is therefore concluded that no significant assessment limitations exist.

[24] Not applicable to this assessment.
[25] Equation to determine concave ground as presented in Section 4.3.9 of the GPG.
[26] Bullmore *et al.,* (2009). Wind Farm Noise Predictions and Comparison with Measurements, Third International Meeting on Wind Turbine Noise, Aalborg, Denmark 17 – 19 June 2009.
[27] Cooper & Evans (2013). Effects of different meteorological conditions on wind turbine noise.

11.4 BASELINE CONDITIONS

Background noise monitoring locations have been selected in order to characterise the two broad categorisations for NSRs within the Study Area:

- Location 1 is within Bilboa village to the north of the Development, allowing characterisation of existing noise levels from both natural and anthropogenic sources in and around Bilboa village; and
- Location 2 is to the south of the Development in a secluded upland location, allowing characterisation of baseline noise levels for more rural locations within the Study Area.

Table 5: Baseline Monitoring Locations

Location	ITM Coordinates		Description of Location
	Easting	Northing	
Location 1	664623	672429	>10m to the rear of NSR25
Location 2	672782	672782	~8m in front of NSR08

In all cases the monitoring equipment was positioned at least 5 m away from the residence and any vertical reflecting surfaces, and as far away as practicable from significant vegetation around the dwellings, as required by the GPG. Photographs of the monitoring equipment installed at each location are included in Plates 11.1 and 11.2.

Plate 11.1: Location 1

Plate 11.2: Location 2

11.4.1 Noise Monitoring Equipment

Details of the noise monitoring equipment used during the baseline noise survey are provided in Table 11.6.

Table 11.6: Noise Monitoring Equipment Details

Location	Make	Serial number	Laboratory Calibration Valid Until
Location 1	Svantek 971	94098	9th April 2022
Location 2	Svantek 971	77789	23rd April 2022
Calibrator	Larson Davis CAL200	18194	17th September 2021

The Svantek 971 sound level meters are Class 1 instruments suitable for wind farm noise measurements in accordance with the GPG. A 130 mm diameter windshield was fitted to each microphone to remove influence of extraneous wind-induced noise on the microphone. The sound level meter calibration was field checked at the start and finish of the measurement periods, and no significant drift in calibration was observed for any periods used for analysis.

All items of equipment used carry a current calibration certificate from an accredited laboratory at the time of the monitoring. Copies of the calibration certificates are provided in Appendix 11.1.

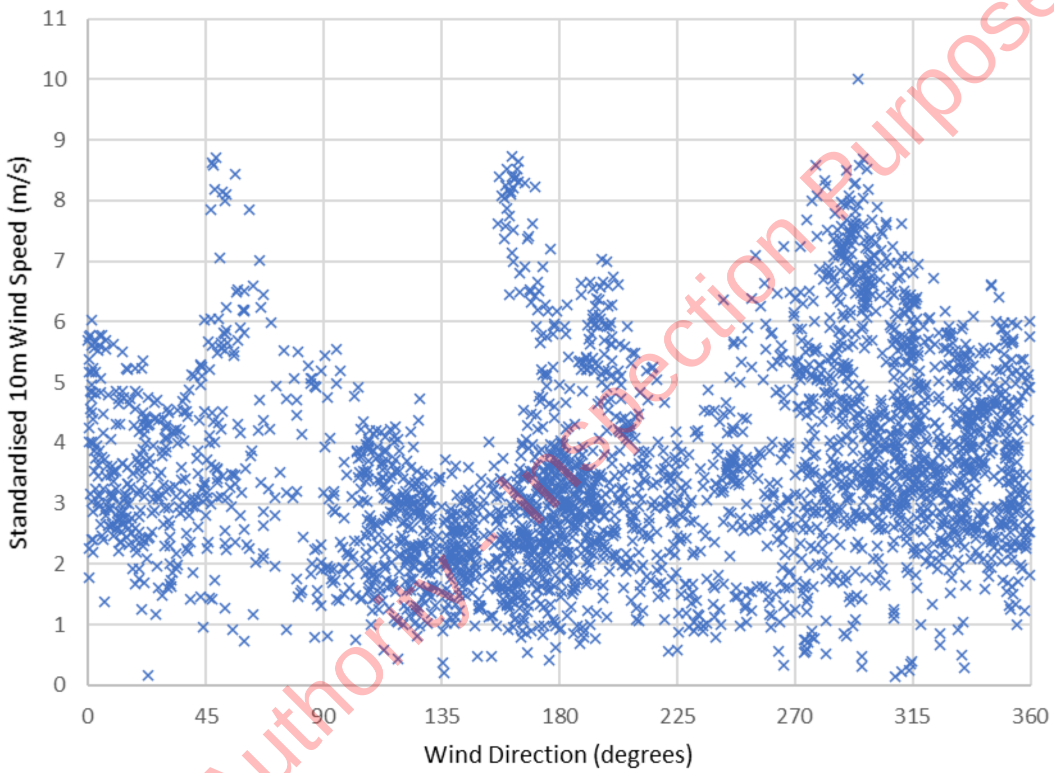
11.4.2 Wind Data

Wind data was obtained from an on-site 80 m met mast. The met mast includes multiple anemometers mounted at 80 m, 65 m, 50 m and 35 m above ground level. The standardised 10 m wind speed has been derived from these measurements in accordance with the methodology described in the GPG.

11.4.3 Background Noise Monitoring Results

Chart 11.1 shows the distribution of wind speed and direction during the survey period.

Chart 11.1: Distribution of Wind Speed and Direction during the Survey Period



The relationship between wind speed and the measured noise level was determined for the data across the night-time and daytime periods by a least-squares regression formula. The night-time and daytime periods are classified as follows:

- Night-time: 23:00 – 07:00 every day; and
- Daytime: 07:00 – 23:00 every day.

Linear and polynomial trendlines were fitted to the data in accordance with the GPG. The 'best fit' polynomial was determined as the curve that provided both a higher regression coefficient and a reasonable visual match to the data. In accordance with the GPG, measurements affected by rain have been excluded. Additional exclusions of measurements showing evidence of extraneous noise have also been made based on professional judgement, and wind direction filtering was applied to data measured at Location 1 to exclude any operational wind turbine noise from the nearby Gortahilie Wind Farm (See Section 11.7 for details).

The measured daytime background noise levels for each location are shown in Charts 11.2 to 11.5.

Chart 11.2: Location 1 – Daytime (0700 - 2300) Wind Directions 64 – 154 Degrees

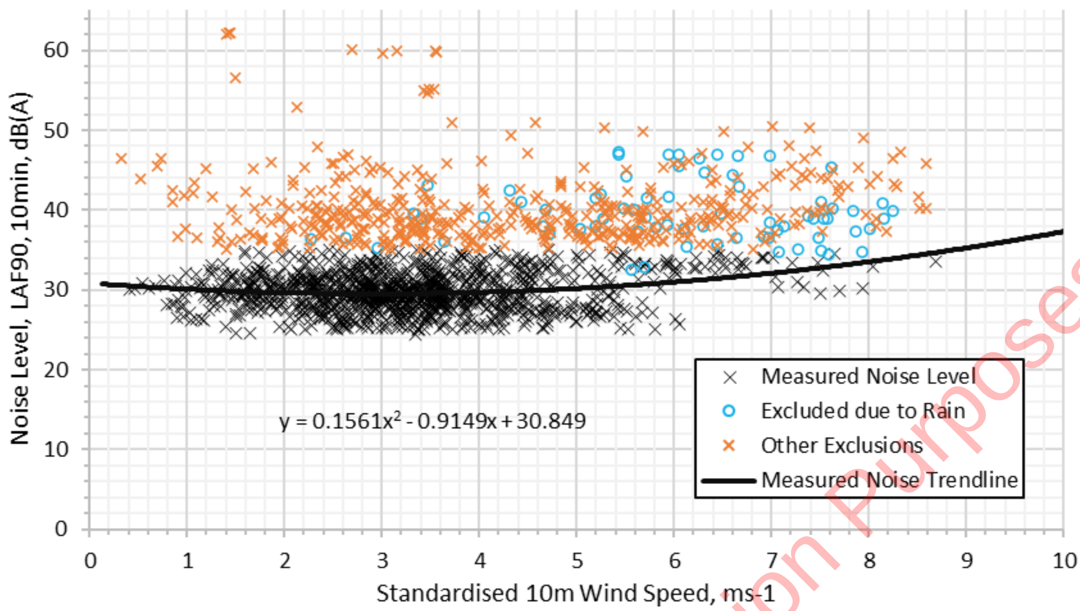


Chart 11.3: Location 1 – Night-Time (2300 – 0700) Wind Directions 64 – 154 Degrees

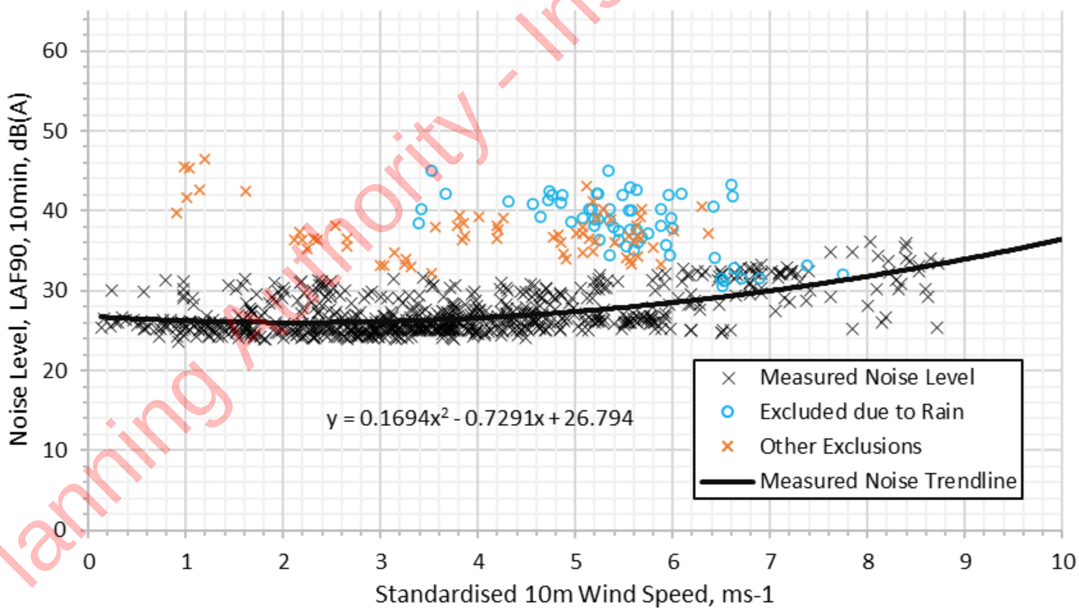


Chart 11.4: Location 2 – Daytime (0700 – 2300)

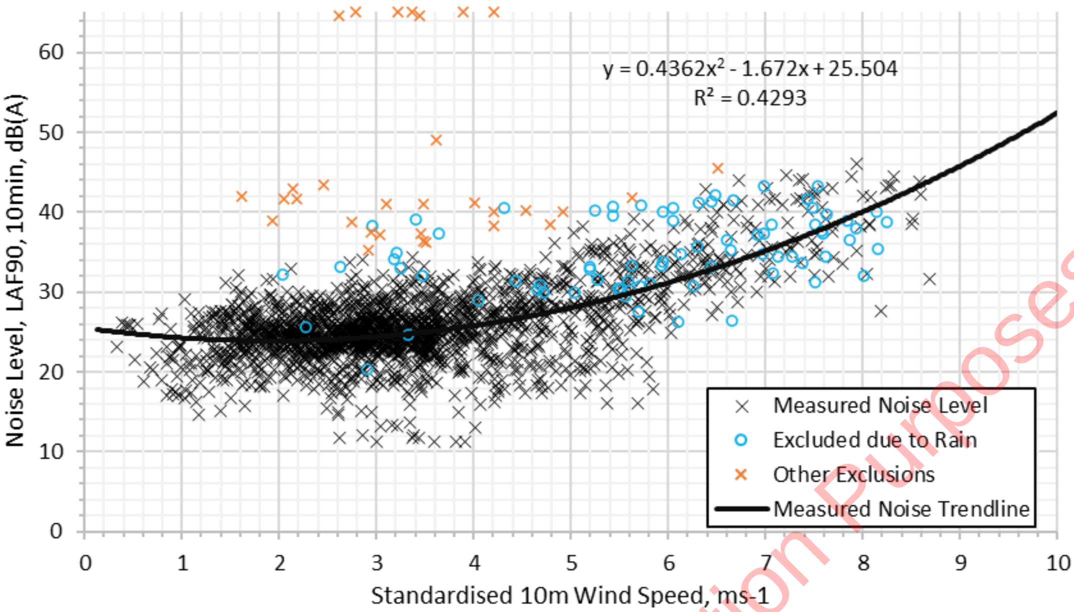
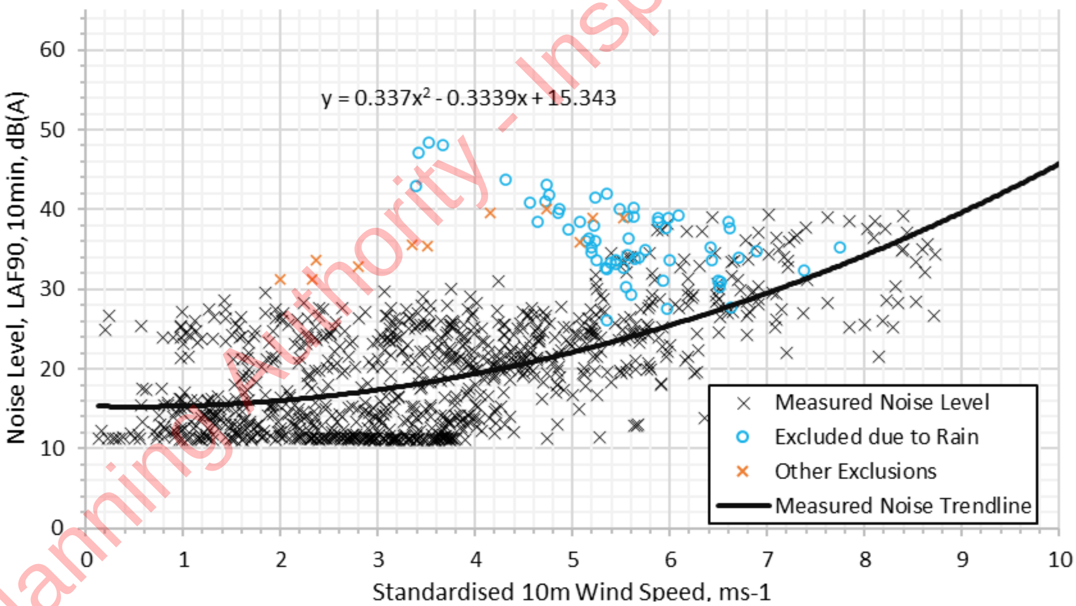


Chart 11.4: Location 2 – Night-time (2300 – 0700)



11.5 EMBEDDED MITIGATION

During the Development's design phase, the turbine and infrastructure layout was developed such that the distance from the turbines to noise sensitive receptors was maximised as far as practicable. This ensures that both construction and operational noise impacts are minimised.

11.6 ASSESSMENT OF POTENTIAL EFFECTS

11.6.1 Noise Limits

The following noise limits have been derived from the results of the background noise monitoring, in accordance with the criteria defined in Section 11.3.8.1.

Table 11.7 and 11.8 present the background noise levels for daytime and night-time periods respectively, along with noise limits up to a wind speed of 10 m/s (wind speed above which maximum turbine noise level does not increase further). In accordance with the GPG, background noise levels have been capped above 8 m/s due to insufficient datapoints at high wind speeds (see Charts 11.2 to 11.5). The capped levels are highlighted in *italics* in the Tables 11.7 and 11.8

Table 11.7: Measured Daytime Background Noise Levels and Noise Limits

Std 10 m Wind Speed, m/s	Monitoring Location 1		Monitoring Location 2	
	Background Noise Level, dB, $L_{A10,10min}$	Noise Limit, dB, $L_{A10,10min}$	Background Noise Level, dB, $L_{A10,10min}$	Noise Limit, dB, $L_{A10,10min}$
4	29.7	40.0	25.8	40.0
5	30.2	45.0	28.0	40.0
6	31.0	45.0	31.2	45.0
7	32.1	45.0	35.2	45.0
8	33.5	45.0	40.0	45.0
9	*33.5*	*45.0*	*40.0*	*45.0*
10	*33.5*	*45.0*	*40.0*	*45.0*

Table 11.8: Measured Night-time Background Noise Levels and Noise Limits

Std 10 m Wind Speed, m/s	Monitoring Location 1		Monitoring Location 2	
	Background Noise Level, dB, $L_{A10,10min}$	Noise Limit, dB, $L_{A10,10min}$	Background Noise Level, dB, $L_{A10,10min}$	Noise Limit, dB, $L_{A10,10min}$
4	26.6	43.0	19.7	43.0
5	27.4	43.0	22.4	43.0
6	28.5	43.0	25.7	43.0
7	30.0	43.0	29.6	43.0
8	31.8	43.0	34.2	43.0
9	*31.8*	*43.0*	*34.2*	*43.0*
10	*31.8*	*43.0*	*34.2*	*43.0*

11.6.2 Predicted Noise Levels at Sensitive Receptors

Table 11.9 details the predicted wind turbine noise levels due to the Development at all noise-sensitive receptors within 1.5 km of a Development turbine. The applicable noise limits have been determined for each noise sensitive location using the background noise level data measured at the most relevant (closest) noise monitoring location.

Predicted levels have then been compared to the respective noise criteria, with any excess above the limits highlighted.

Table 11.9: Predicted Development Wind Turbine Noise Levels and Assesmsent Againt Limits

Location	Description	Noise Level, dB $L_{A90,10min}$ by Standardised 10 m Wind Speed, m/s						
		4	5	6	7	8	9	10+
NSR01	Predicted Level	31.7	35.8	37.8	38.4	38.7	39.0	39.0
	Excess Day	--	--	--	--	--	--	--
	Excess Night	--	--	--	--	--	--	--
NSR02	Predicted Level	32.5	36.6	38.6	39.2	39.5	39.8	39.8
	Excess Day	--	--	--	--	--	--	--
	Excess Night	--	--	--	--	--	--	--
NSR03	Predicted Level	32.4	36.5	38.5	39.1	39.4	39.7	39.7
	Excess Day	--	--	--	--	--	--	--
	Excess Night	--	--	--	--	--	--	--
NSR04	Predicted Level	30.2	34.3	36.3	36.9	37.2	37.5	37.5
	Excess Day	--	--	--	--	--	--	--
	Excess Night	--	--	--	--	--	--	--
NSr05	Predicted Level	29.6	33.7	35.7	36.3	36.6	36.9	36.9
	Excess Day	--	--	--	--	--	--	--
	Excess Night	--	--	--	--	--	--	--
NSL06	Predicted Level	29.2	33.3	35.3	35.9	36.2	36.5	36.5
	Excess Day	--	--	--	--	--	--	--
	Excess Night	--	--	--	--	--	--	--
NSL07	Predicted Level	28.0	32.1	34.1	34.7	35.0	35.3	35.3
	Excess Day	--	--	--	--	--	--	--
	Excess Night	--	--	--	--	--	--	--
NSL08	Predicted Level	29.1	33.2	35.2	35.8	36.1	36.4	36.4
	Excess Day	--	--	--	--	--	--	--
	Excess Night	--	--	--	--	--	--	--
NSL09	Predicted Level	27.7	31.8	33.8	34.4	34.7	35.0	35.0
	Excess Day	--	--	--	--	--	--	--
	Excess Night	--	--	--	--	--	--	--
NSL10	Predicted Level	27.8	31.9	33.9	34.5	34.8	35.1	35.1
	Excess Day	--	--	--	--	--	--	--

Location	Description	Noise Level, dB $L_{A90,10min}$ by Standardised 10 m Wind Speed, m/s						
		4	5	6	7	8	9	10+
	Excess Night	--	--	--	--	--	--	--
NSL11	Predicted Level	27.9	32.0	34.0	34.6	34.9	35.2	35.2
	Excess Day	--	--	--	--	--	--	--
	Excess Night	--	--	--	--	--	--	--
NSL12	Predicted Level	27.7	31.8	33.8	34.4	34.7	35.0	35.0
	Excess Day	--	--	--	--	--	--	--
	Excess Night	--	--	--	--	--	--	--
NSL13	Predicted Level	26.0	30.1	32.1	32.7	33.0	33.3	33.3
	Excess Day	--	--	--	--	--	--	--
	Excess Night	--	--	--	--	--	--	--
NSL14	Predicted Level	27.4	31.5	33.5	34.1	34.4	34.7	34.7
	Excess Day	--	--	--	--	--	--	--
	Excess Night	--	--	--	--	--	--	--
NSL15	Predicted Level	27.2	31.3	33.3	33.9	34.2	34.5	34.5
	Excess Day	--	--	--	--	--	--	--
	Excess Night	--	--	--	--	--	--	--
NSL16	Predicted Level	26.6	30.7	32.7	33.3	33.6	33.9	33.9
	Excess Day	--	--	--	--	--	--	--
	Excess Night	--	--	--	--	--	--	--
NSL17	Predicted Level	27.0	31.1	33.1	33.7	34.0	34.3	34.3
	Excess Day	--	--	--	--	--	--	--
	Excess Night	--	--	--	--	--	--	--
NSL18	Predicted Level	26.6	30.7	32.7	33.3	33.6	33.9	33.9
	Excess Day	--	--	--	--	--	--	--
	Excess Night	--	--	--	--	--	--	--
NSL19	Predicted Level	26.5	30.6	32.6	33.2	33.5	33.8	33.8
	Excess Day	--	--	--	--	--	--	--
	Excess Night	--	--	--	--	--	--	--
NSL20	Predicted Level	24.9	29.0	31.0	31.6	31.9	32.2	32.2
	Excess Day	--	--	--	--	--	--	--
	Excess Night	--	--	--	--	--	--	--
NSL21	Predicted Level	26.0	30.1	32.1	32.7	33.0	33.3	33.3
	Excess Day	--	--	--	--	--	--	--
	Excess Night	--	--	--	--	--	--	--
NSL22	Predicted Level	25.5	29.6	31.6	32.2	32.5	32.8	32.8
	Excess Day	--	--	--	--	--	--	--

Location	Description	Noise Level, dB $L_{A90,10min}$ by Standardised 10 m Wind Speed, m/s						
		4	5	6	7	8	9	10+
	Excess Night	--	--	--	--	--	--	--
NSL23	Predicted Level	24.2	28.3	30.3	30.9	31.2	31.5	31.5
	Excess Day	--	--	--	--	--	--	--
	Excess Night	--	--	--	--	--	--	--
NSL24	Predicted Level	25.3	29.4	31.4	32.0	32.3	32.6	32.6
	Excess Day	--	--	--	--	--	--	--
	Excess Night	--	--	--	--	--	--	--
NSL25	Predicted Level	25.4	29.5	31.5	32.1	32.4	32.7	32.7
	Excess Day	--	--	--	--	--	--	--
	Excess Night	--	--	--	--	--	--	--
NSL26	Predicted Level	24.7	28.8	30.8	31.4	31.7	32.0	32.0
	Excess Day	--	--	--	--	--	--	--
	Excess Night	--	--	--	--	--	--	--
NSL27	Predicted Level	23.7	27.8	29.8	30.4	30.7	31.0	31.0
	Excess Day	--	--	--	--	--	--	--
	Excess Night	--	--	--	--	--	--	--
NSL28	Predicted Level	23.6	27.7	29.7	30.3	30.6	30.9	30.9
	Excess Day	--	--	--	--	--	--	--
	Excess Night	--	--	--	--	--	--	--
NSL29	Predicted Level	23.6	27.7	29.7	30.3	30.6	30.9	30.9
	Excess Day	--	--	--	--	--	--	--
	Excess Night	--	--	--	--	--	--	--
NSL30	Predicted Level	23.5	27.6	29.6	30.2	30.5	30.8	30.8
	Excess Day	--	--	--	--	--	--	--
	Excess Night	--	--	--	--	--	--	--
NSL31	Predicted Level	23.4	27.5	29.5	30.1	30.4	30.7	30.7
	Excess Day	--	--	--	--	--	--	--
	Excess Night	--	--	--	--	--	--	--
NSL32	Predicted Level	24.0	28.1	30.1	30.7	31.0	31.3	31.3
	Excess Day	--	--	--	--	--	--	--
	Excess Night	--	--	--	--	--	--	--
NSL33	Predicted Level	23.8	27.9	29.9	30.5	30.8	31.1	31.1
	Excess Day	--	--	--	--	--	--	--
	Excess Night	--	--	--	--	--	--	--
NSL34	Predicted Level	22.0	26.1	28.1	28.7	29.0	29.3	29.3
	Excess Day	--	--	--	--	--	--	--

Location	Description	Noise Level, dB $L_{A90,10min}$ by Standardised 10 m Wind Speed, m/s						
		4	5	6	7	8	9	10+
	Excess Night	--	--	--	--	--	--	--
NSL35	Predicted Level	23.5	27.6	29.6	30.2	30.5	30.8	30.8
	Excess Day	--	--	--	--	--	--	--
	Excess Night	--	--	--	--	--	--	--
NSL36	Predicted Level	23.1	27.2	29.2	29.8	30.1	30.4	30.4
	Excess Day	--	--	--	--	--	--	--
	Excess Night	--	--	--	--	--	--	--
NSL37	Predicted Level	23.2	27.3	29.3	29.9	30.2	30.5	30.5
	Excess Day	--	--	--	--	--	--	--
	Excess Night	--	--	--	--	--	--	--

As can be seen from Table 11.9 above, the predicted noise levels comply with limits at all sensitive receptors.

11.6.3 'Do-Nothing' Alternative

In the event that the Development does not take place, there will be no change to the existing noise environment.

11.7 ASSESSMENT OF CUMULATIVE EFFECTS

In order to demonstrate full accordance with the WEDG, the cumulative effects of the Development in combination with Gortahile Wind Farm have also been considered.

As recommended in the GPG, when assessing cumulative noise levels, consideration should be given to the noise limits applicable to the cumulative development(s) in question. Where there is no reasonable prospect of a cumulative development producing noise levels up to its respective limits, the GPG recommends that predicted noise levels are used along with an additional safety margin. This approach allows for the scenario where a development is constructed using a different turbine type to that specified in the respective planning application.

In this case, Gortahile Wind Farm has been operating since 2010, utilising Nordex N90 turbines with a hub height of 80 m. As such, the potential for differing turbine types is not applicable. Notwithstanding this, in line with best practice guidance, an additional safety margin of 1 dB has been applied to the noise emissions of that development, in order to ensure a conservative approach.

Manufacturer's noise emission data for the Nordex N90 is presented in Table 11.10. As the level of uncertainty associated with this data is not specified, a 2 dB allowance for uncertainty has been applied, in accordance with the GPG. Therefore, in combination with 1 dB safety margin described above, this results in the sound power levels applied in this assessment being 3 dB greater than the manufacturer's data.

Table 11.10: Manufacturer's Noise Emission Data, Nordex N90

	Standardised Wind Speed at 10 m, m/s									
	4	5	6	7	8	9	10	11	12	>12
	Sound Power Level, dB(A)									
Sound Power Level, dB LWA	97.5	101.0	104.0	105.0	105.5	105.5	105.5	105.5	105.5	105.5
Sound Power Level, dB LWA, including 2 dB Uncertainty	99.5	103.0	106.0	107.0	107.5	107.5	107.5	107.5	107.5	107.5
Sound Power Level, dB, LWA, inc. additional 1 dB safety margin	100.5	104.0	107.5	108.0	108.5	108.5	108.5	108.5	108.5	108.5

The octave-band frequency spectrum for the maximum sound power level is detailed in Table 11.11.

Table 11.11: Octave-band Spectra, Nordex N90

	Octave-band Centre Frequency, f, Hz							
	63	125	250	500	1000	2000	4000	8000
	Octave-band Sound Power Level, dB, LWA,f							
Sound Power Level, dB, LWA	90.7	94.8	99.2	99.6	98.1	97.0	93.0	85.4
Sound Power Level, dB, LWA, Scaled to 108.5 dB(A)	93.7	97.8	102.2	102.6	101.1	100.0	96.0	88.4

11.7.1 Predicted Cumulative Noise Levels at Sensitive Receptors

Table 11.12 overleaf presents the predicted cumulative wind turbine noise levels, calculated in accordance with the methodology described in Section 11.3.7.

Predicted levels at each receptor have then been compared to the respective noise limits, with any excess above the limits highlighted.

Table 11.12: Predicted Cumulative Wind Turbine Noise Levels and Assesmsent Againt Limits

Location	**Description**	**Noise Level, dB $L_{A90,10min}$ by Standardised 10 m Wind Speed, m/s**						
		4	**5**	**6**	**7**	**8**	**9**	**10**
NSR01	Predicted Level	32.0	36.1	38.2	38.8	39.1	39.4	39.4
	Excess Day	--	--	--	--	--	--	--
	Excess Night	--	--	--	--	--	--	--
NSR02	Predicted Level	32.9	37.0	39.1	39.7	40.0	40.3	40.3
	Excess Day	--	--	--	--	--	--	--
	Excess Night	--	--	--	--	--	--	--
NSR03	Predicted Level	32.8	36.9	38.9	39.6	39.9	40.2	40.2
	Excess Day	--	--	--	--	--	--	--
	Excess Night	--	--	--	--	--	--	--
NSR04	Predicted Level	30.5	34.6	36.7	37.3	37.6	37.9	37.9
	Excess Day	--	--	--	--	--	--	--
	Excess Night	--	--	--	--	--	--	--
NSR05	Predicted Level	30.6	34.6	36.8	37.5	37.8	38.0	38.0
	Excess Day	--	--	--	--	--	--	--
	Excess Night	--	--	--	--	--	--	--
NSL06	Predicted Level	29.5	33.6	35.7	36.3	36.6	36.9	36.9
	Excess Day	--	--	--	--	--	--	--
	Excess Night	--	--	--	--	--	--	--
NSL07	Predicted Level	32.7	36.4	39.1	40.0	40.4	40.5	40.5
	Excess Day	--	--	--	--	--	--	--
	Excess Night	--	--	--	--	--	--	--
NSL08	Predicted Level	29.5	33.5	35.6	36.2	36.6	36.8	36.8
	Excess Day	--	--	--	--	--	--	--
	Excess Night	--	--	--	--	--	--	--
NSL09	Predicted Level	32.8	36.5	39.1	40.0	40.5	40.6	40.6
	Excess Day	--	--	--	--	--	--	--
	Excess Night	--	--	--	--	--	--	--
NSL10	Predicted Level	32.9	36.6	39.3	40.2	40.6	40.7	40.7
	Excess Day	--	--	--	--	--	--	--
	Excess Night	--	--	--	--	--	--	--
NSL11	Predicted Level	32.9	36.6	39.3	40.2	40.6	40.7	40.7
	Excess Day	--	--	--	--	--	--	--
	Excess Night	--	--	--	--	--	--	--
NSL12	Predicted Level	32.8	36.5	39.2	40.1	40.5	40.6	40.6
	Excess Day	--	--	--	--	--	--	--

Location	**Description**	**Noise Level, dB $L_{A90,10min}$ by Standardised 10 m Wind Speed, m/s**						
		4	**5**	**6**	**7**	**8**	**9**	**10**
	Excess Night	--	--	--	--	--	--	--
NSL13	Predicted Level	31.3	35.0	37.7	38.6	39.0	39.1	39.1
	Excess Day	--	--	--	--	--	--	--
	Excess Night	--	--	--	--	--	--	--
NSL14	Predicted Level	27.8	31.9	34.0	34.6	35.0	35.2	35.2
	Excess Day	--	--	--	--	--	--	--
	Excess Night	--	--	--	--	--	--	--
NSL15	Predicted Level	31.8	35.5	38.1	39.0	39.4	39.5	39.5
	Excess Day	--	--	--	--	--	--	--
	Excess Night	--	--	--	--	--	--	--
NSL16	Predicted Level	27.9	31.9	34.1	34.8	35.2	35.4	35.4
	Excess Day	--	--	--	--	--	--	--
	Excess Night	--	--	--	--	--	--	--
NSL17	Predicted Level	31.7	35.4	38.1	38.9	39.4	39.5	39.5
	Excess Day	--	--	--	--	--	--	--
	Excess Night	--	--	--	--	--	--	--
NSL18	Predicted Level	28.2	32.1	34.5	35.2	35.6	35.8	35.8
	Excess Day	--	--	--	--	--	--	--
	Excess Night	--	--	--	--	--	--	--
NSL19	Predicted Level	31.2	34.9	37.6	38.5	38.9	39.0	39.0
	Excess Day	--	--	--	--	--	--	--
	Excess Night	--	--	--	--	--	--	--
NSL20	Predicted Level	29.5	33.2	35.8	36.7	37.1	37.2	37.2
	Excess Day	--	--	--	--	--	--	--
	Excess Night	--	--	--	--	--	--	--
NSL21	Predicted Level	27.8	31.7	34.0	34.7	35.1	35.3	35.3
	Excess Day	--	--	--	--	--	--	--
	Excess Night	--	--	--	--	--	--	--
NSL22	Predicted Level	32.0	35.7	38.4	39.4	39.8	39.9	39.9
	Excess Day	--	--	--	--	--	--	--
	Excess Night	--	--	--	--	--	--	--
NSL23	Predicted Level	28.6	32.3	34.9	35.8	36.2	36.3	36.3
	Excess Day	--	--	--	--	--	--	--
	Excess Night	--	--	--	--	--	--	--
NSL24	Predicted Level	27.9	31.7	34.1	34.9	35.3	35.5	35.5
	Excess Day	--	--	--	--	--	--	--

Location	Description	Noise Level, dB $L_{A90,10min}$ by Standardised 10 m Wind Speed, m/s						
		4	5	6	7	8	9	10
	Excess Night	--	--	--	--	--	--	--
NSL25	Predicted Level	30.7	34.4	37.1	38.0	38.4	38.5	38.5
	Excess Day	--	--	--	--	--	--	--
	Excess Night	--	--	--	--	--	--	--
NSL26	Predicted Level	27.6	31.4	33.9	34.7	35.1	35.2	35.2
	Excess Day	--	--	--	--	--	--	--
	Excess Night	--	--	--	--	--	--	--
NSL27	Predicted Level	26.9	30.7	33.2	34.1	34.5	34.6	34.6
	Excess Day	--	--	--	--	--	--	--
	Excess Night	--	--	--	--	--	--	--
NSL28	Predicted Level	26.9	30.7	33.2	34.0	34.5	34.6	34.6
	Excess Day	--	--	--	--	--	--	--
	Excess Night	--	--	--	--	--	--	--
NSL29	Predicted Level	26.8	30.6	33.1	34.0	34.4	34.5	34.5
	Excess Day	--	--	--	--	--	--	--
	Excess Night	--	--	--	--	--	--	--
NSL30	Predicted Level	26.7	30.5	33.0	33.8	34.3	34.4	34.4
	Excess Day	--	--	--	--	--	--	--
	Excess Night	--	--	--	--	--	--	--
NSL31	Predicted Level	26.6	30.4	32.9	33.8	34.2	34.3	34.3
	Excess Day	--	--	--	--	--	--	--
	Excess Night	--	--	--	--	--	--	--
NSL32	Predicted Level	27.3	31.1	33.6	34.5	34.9	35.0	35.0
	Excess Day	--	--	--	--	--	--	--
	Excess Night	--	--	--	--	--	--	--
NSL33	Predicted Level	27.2	31.0	33.5	34.4	34.8	34.9	34.9
	Excess Day	--	--	--	--	--	--	--
	Excess Night	--	--	--	--	--	--	--
NSL34	Predicted Level	22.4	26.5	28.6	29.2	29.6	29.8	29.8
	Excess Day	--	--	--	--	--	--	--
	Excess Night	--	--	--	--	--	--	--
NSL35	Predicted Level	28.8	32.5	35.2	36.1	36.5	36.6	36.6
	Excess Day	--	--	--	--	--	--	--
	Excess Night	--	--	--	--	--	--	--
NSL36	Predicted Level	26.9	30.7	33.2	34.1	34.5	34.6	34.6
	Excess Day	--	--	--	--	--	--	--

Location	Description	Noise Level, dB $L_{A90,10min}$ by Standardised 10 m Wind Speed, m/s						
		4	5	6	7	8	9	10
	Excess Night	--	--	--	--	--	--	--
NSL37	Predicted Level	28.8	32.5	35.2	36.1	36.5	36.6	36.6
	Excess Day	--	--	--	--	--	--	--
	Excess Night	--	--	--	--	--	--	--

It can be seen from the table that the predicted cumulative noise levels comply with limits at all sensitive receptors.

11.8 MITIGATION AND RESIDUAL EFFECTS

There is embedded mitigation in the design and layout of the Development, along with good practice measure that will be followed. No additional mitigation is required or necessary.

11.8.1 Construction and Decommissioning Phases

The Development infrastructure has been located as far as practicable from residential dwellings in order to minimise the effect of noise during construction and decommissioning.

The good practice measures detailed below will also be implemented to further manage the effects of noise during operations, and will be required of all contractors:

- Operations shall be limited to times agreed with the Council;
- Deliveries of turbine components, plant and materials by HGV to site shall only take place by designated routes and within times agreed with the Council;
- The site contractors shall be required to employ the best practicable means of reducing noise emissions from plant, machinery and activities, as advocated in BS 5228;
- Where practicable, the work programme will be phased, which would help to reduce the combined effects arising from several noisy operations;
- Where necessary and practicable, noise from fixed plant and equipment will be contained within suitable acoustic enclosures or behind acoustic screens;
- All sub-contractors appointed by the main contractor will be formally and legally obliged, and required through contract, to comply with all environmental noise conditions;
- Where practicable, night-time working will not be carried out. Local residents shall be notified in advance of any night time construction activities likely to generate significant noise levels, e.g., turbine erection; and
- Any plant and equipment normally required for operation at night (23:00 - 07:00), e.g., generators or dewatering pumps, shall be silenced or suitably shielded to ensure that the night-time lower threshold of 45 dB, $L_{A\,eq,night}$ shall not be exceeded at the nearest noise-sensitive receptors.
- Application of the above measures to manage construction / decommissioning noise will ensure that effects are minimised as far as is reasonably practicable and that the construction process is operated in compliance with the relevant legislation.

The level of noise produced during decommissioning is likely to be no greater than that during the construction phase. Any legislation, guidance or best practice relevant at the time of decommissioning would be complied with.

11.8.2 Operational Phase

No mitigation beyond the embedded mitigation set out in Section 11.5 is necessary to meet the requirements of guidance and avoid significant effects.

11.9 SUMMARY OF EFFECTS

By virtue of the distance from the Development to sensitive receptors, the effects of construction noise are considered to be within acceptable limits, subject to best practice noise management methods detailed in Section 11.8.1. In addition, and should CCC consider it necessary, the Applicant is willing to accept a planning condition limiting noise from construction activities to 65 dB, L_{Aeq} at residential dwellings as specified in BS 5228, and as commonly applied to consents for similar developments.

An assessment of operational noise effects associated with the Development has been carried out, taking account of cumulative noise effects in combination with Gortahile Wind Farm. Operational noise has been assessed against the noise limits defined in current best practice guidance (i.e. the WEDG and the GPG). It has been shown that the Development is within these limits.

11.10 STATEMENT OF SIGNIFICANCE

The effect of construction and decommissioning noise is **not significant**.

The effect of operational noise is **not significant,** both when considering the Development in isolation, and cumulatively in combination with Gortahile Wind Farm.

APPENDIX 11.1 – CALIBRATION CERTIFICATES

12 MATERIAL ASSETS – ROADS AND TRAFFIC

12.1 INTRODUCTION

This Chapter of the Environmental Impact Assessment Report (EIA Report) evaluates the effects of the proposed Bilboa Wind Farm (the Development), on the roads and traffic resource. This Chapter has been compiled using information from the previously submitted EIA Chapter 8 (2020) as well as the Further Information (FI) submitted to Carlow County Council (CC) and Laois County Council (LCC).

This Chapter of the EIA Report is supported by the following Figures provided in Volume II EIA Report Figures:

- Figure 12.1 – Route to Site;
- Figure 12.2 – Traffic Count Locations.

This Chapter of the EIA Report is supported by the following Technical Appendix documents provided in Volume III Technical Appendices:

- A12.1 – Construction Phase Programme

This chapter includes the following elements:

- Key Findings of EIS & FI;
- Changes to Legislation, Policy and Guidance;
- Assessment Methodology and Significance Criteria;
- Baseline Conditions;
- Assessment of Potential Effects;
- Cumulative Effects Assessment;
- Mitigation and Residual Effects;
- Summary of Effects;
- Statement of Significance.

12.2 KEY CONCLUSIONS OF EIS & FI

The 2011 ES and FI provided an overview of the route to site for construction traffic. A quantitative assessment of traffic generation was not undertaken.

12.3 CHANGES TO LEGISLATION, POLICY AND GUIDANCE

No legislation, policy or guidance in relation to transport was quoted in the 2011 ES and FI.

The following guidance documents have been considered in the preparation of this assessment:

- Guidelines on the information to be contained in Environmental Impact Assessment Reports[1];
- National Roads Authority (2014) – Traffic and Transportation Assessment Guidelines[2];
- Transport Infrastructure Ireland (2017) Rural Road Link Design – DN-GEO-03031[3]; and

[1] Environmental Protection Agency (2022) *Guidelines on the information to be contained in Environmental Impact Assessment Reports* [Online] Available at: EIAR_Guidelines_2022_Web.pdf (epa.ie) (27/06/2022)
[2] National Roads Authority (2014) *Traffic and Transportation Assessment Guidelines* [Online] Available at: https://www.tiipublications.ie/library/PE-PDV-02045-01.pdf (Accessed 27/06/2022)
[3] Transport Infrastructure Ireland (2017) *Rural Road Link Design – DN-GEO-03031* [Online] Available at: https://www.tiipublications.ie/library/DN-GEO-03031-10.pdf (Accessed 27/06/2022)

- 2006 Wind Energy Development Guidelines[4] and 2019 Draft Revised Wind Energy Guidelines[5].

EIAs are undertaken in response to the requirements of the European Union (EU) Directive 2014/52/EU[6] (the EIA Directive). **Chapter 2: EIA Methodology** outlines the relevant Environmental Impact Assessment (EIA) legislation including the enabling statutory instruments (S.I.) which transpose the EIA Directive into Irish law, are the European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018 (S.I. 296/2018)[7]; the Planning and Development Act 2000[8], as amended (the Planning Act); and Planning and Development Regulations 2001 (S.I. 600 of 2001)[9], as amended (the Planning Regulations); which combined, form the EIA Regulations applicable to the Development which this Chapter has been written in accordance with.

The EPA 'Guidelines on the Information to be Contained in Environmental Impact Assessment Reports' 2022 detail the framework for assessment for EIA, that is followed in this EIA Report.

12.4 ASSESSMENT METHODOLOGY AND SIGNIFICANCE CRITERIA

12.4.1 Pre-Application Consultation Responses

Consultation for this EIA Report topic was undertaken with the following organisations in October 2020 regarding the Traffic & Transport Chapter:

- Kildare County Council;
- National Transport Authority; and
- Transport Infrastructure Ireland.

At the time of writing this chapter no responses have been received from any of the above consultees.

12.4.2 Scope of Assessment

This assessment will consider the traffic effect of the Development in a cumulative context. This assessment will therefore provide a quantitative assessment of traffic effects of both in order that a conclusion as to the significance of any effects on traffic can be determined.

The key issues for the assessment are the potential traffic effects relating to the Development. The principle traffic effects will occur during construction of the Development with little or no traffic expected to be attributable to the Development during the operational phase.

[4] Department of Housing, Planning and Local Government (2006) *Wind Energy Development Guidelines* [Online] Available at: https://www.gov.ie/en/publication/f449e-wind-energy-development-guidelines-2006/ (Accessed 27/06/2022)
[5] Department of Housing, Planning and Local Government (2019) *Draft Revised Wind Energy Development Guidelines* [Online] Available at: https://www.housing.gov.ie/sites/default/files/public-consultation/files/draft_revised_wind_energy_development_guidelines_december_2019.pdf (Accessed 27/06/2022)
[6] European Commission (2014) *Directive 2014/52/EU* [Online] Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32014L0052&from=EN (Accessed 27/06/2022)
[7] Government of Ireland (2018) *European Union (Planning and Development) (Environmental Impact Assessment) Regulations* [Online] Available at: http://www.irishstatutebook.ie/eli/2018/si/296/made/en/print (Accessed 27/06/2022)
[8] Government of Ireland, (2000), *Planning and Development Act, 2000* [Online] Available at:https://www.irishstatutebook.ie/eli/2000/act/30/enacted/en/html (Accessed 27/06/2022)
[9] Government of Ireland (2001), *Planning and Development Regulations, 2001* [Online] Available at: http://www.irishstatutebook.ie/eli/2001/si/600/made/en/print (Accessed 27/06/2022)

The key issues for the assessment of potential Traffic effects relating to the Development are as follows:

- Traffic Generation;
- Driver Delay;
- Pedestrian Amenity and Safety;
- Severance;
- Accidents and Safety;
- Noise and Vibration; and
- Hazardous Loads.

12.4.3 Elements Scoped Out of Assessment

Traffic during operation of the Development is expected to be minimal and would be limited to routine maintenance and inspection. This is expected to result in around one car or van visit per day on average throughout the year. This level of traffic is negligible in terms of the existing traffic flow on routes within the vicinity of the Site and therefore, assessment of operational effects has been scoped out.

12.4.4 Study Area

The study area will consider routes likely to be affected by increased traffic flow between the site and the nearest major road, in this case the M9. The roads that will therefore be considered by this study are as follows:

- N78;
- R430;
- L3861;
- L3896; and
- L7129.

The route to site for construction vehicles as listed above is shown in Figure 12.1.

12.4.5 Baseline Survey Methodology

Baseline traffic flow data, where available, was collected from publicly available sources, namely Transport Infrastructure Ireland's (TII) data site. Due to the Coronavirus Pandemic, traffic flow data collected in the years 2020 and 2021 would not be representative of typical traffic conditions. Therefore, the most recent complete year of traffic data 2019 has been used for the purposes of this assessment.

It was not considered appropriate to apply traffic growth factors to the 2019 traffic flow data as at the time of writing (May 2022) it is not clear if travel patterns will return to their pre-pandemic norm. Not applying traffic growth factors is a conservative approach with regards to the assessment as this would result in a higher percentage increase in traffic flow being estimated.

Online mapping resources were used to identify the locations of sensitive receptors and to characterise roads.

12.4.6 Methodology for the Assessment of Effects

The significance of the potential effects of the Development has been classified by professional consideration of the sensitivity of the receptor and the magnitude of the potential effect.

The following methodology has been used during the preparation of this assessment:

- Introduction, assessment methodology and significance criteria;
- Key Conclusions of EIS & FI;

- Description of the Baseline Conditions;
- Assessment of Potential effects;
- Mitigation and Residual Effects;
- Cumulative Effects Assessment;
- Summary of Effects; and
- Statement of Significance.

A screening exercise was undertaken to establish where further assessment would be warranted. This was based upon the following criteria, further assessment would be undertaken on routes where traffic flow met or exceeded the following criteria:

- Where overall traffic flow or HGV flow is predicted to increase by 30% or more; or
- At sensitive receptors where overall traffic flow or HGV flow is predicted to increase by 10% or more.

12.4.6.1 Sensitivity of Receptors

The sensitivity of the baseline conditions, including the importance of environmental features on or near to the Site or the sensitivity of potentially affected receptors, will be assessed in line with best practice guidance, legislation, statutory designations and / or professional judgement.

Table 12.1 details the framework for determining the sensitivity of receptors.

Table 12.1 - Framework for Determining Sensitivity of Receptors

Sensitivity of Receptor	Definition
Sensitivity of Receptor	Definition
High	The receptor has little ability to absorb change without fundamentally altering its present character, is of high strategic value, or of national importance. For example: • Routes with existing high traffic levels which have little additional traffic flow capacity; • Receptors such as populated urban areas where existing traffic levels are high and there is little capacity to absorb additional traffic flow on adjacent routes; and Strategic nationally important routes with little capacity to absorb additional traffic flow
Medium	Areas where the transport network has moderate capacity to change, without significantly altering its state. For example: • Routes with existing moderate traffic levels which have some additional traffic flow capacity; • Receptors such as populated urban areas where existing traffic levels are moderate and there is some capacity to absorb additional traffic flow on adjacent routes; • Receptors such as rural roads where existing traffic levels are moderate and there is some capacity to absorb additional traffic flow on adjacent routes Strategic nationally important routes with some capacity to absorb additional traffic flow
Low	Areas where the transport network is tolerant to change without detriment to its state, for example; • Routes with existing low traffic levels which have additional traffic flow capacity; • Receptors such as populated urban areas where existing traffic levels are low and there is capacity to absorb additional traffic flow on adjacent routes;

Sensitivity of Receptor	Definition
	• Receptors such as rural roads where existing traffic levels are low and there is capacity to absorb additional traffic flow on adjacent routes; and • Strategic nationally important routes with capacity to absorb additional traffic flow

12.4.6.2 *Magnitude of Change*

The magnitude of potential change will be identified through consideration of the Development, the degree of change to baseline conditions predicted as a result of the Development, the duration and reversibility of an effect and professional judgement, best practice guidance and legislation.

The criteria for assessing the magnitude of change are presented in Table 12.2.

Table 12.2 - Framework for Determining Magnitude of Change

Magnitude of Change	Definition
High	A fundamental change to the baseline condition of the asset, leading to a major alteration of character. For example, a substantial permanent shift in traffic flow levels and near to capacity.
Medium	A material, partial loss or alteration of character. For example, a moderate short term change, or slight long term change in traffic flow levels and/or near to capacity.
Low	A slight, detectable, alteration of the baseline condition of the asset. For example, a minor, short term change to traffic flow levels unlikely to present capacity issues.
Negligible	An imperceptible change from baseline conditions and little effect on capacity.

12.4.6.3 *Significance of Effect*

The sensitivity of the asset and the magnitude of the predicted effects will be used as a guide, in addition to professional judgement, to predict the significance of the likely effects. ***Table 12.3: Framework for Assessment of the Significance of Effects***

Magnitude of Change	Sensitivity of Resource or Receptor			
	High	**Medium**	**Low**	**Negligible**
High	Profound – Very Significant	Significant - Moderate	Moderate - Slight	Slight - Imperceptible
Medium	Significant - Moderate	Moderate	Slight	Imperceptible
Low	Moderate - Slight	Slight	Slight – Not Significant	Imperceptible
Negligible	Slight - Imperceptible	Imperceptible	Imperceptible	Imperceptible

summarises guideline criteria for assessing the significance of effects.

Table 12.3: Framework for Assessment of the Significance of Effects

Magnitude of Change	Sensitivity of Resource or Receptor			
	High	**Medium**	**Low**	**Negligible**

High	Profound – Very Significant	Significant - Moderate	Moderate - Slight	Slight - Imperceptible
Medium	Significant - Moderate	Moderate	Slight	Imperceptible
Low	Moderate - Slight	Slight	Slight – Not Significant	Imperceptible
Negligible	Slight - Imperceptible	Imperceptible	Imperceptible	Imperceptible

Profound or substantial effects are considered to be 'significant' in the context of the EIA Regulations, and are shaded in light grey in the above table.

12.4.7 Assessment Limitations

Baseline traffic flow data was only available at two locations on the route to site.

12.5 BASELINE CONDITIONS

12.5.1 Characteristics of Routes Likely to be Affected

The characteristics of each route which will be affected by construction traffic were reviewed against the *TII Rural Road Link Design – Table 6.4 Recommended Rural Road Layouts*[10]. Table 12.3 presents the results of this review, outlining the Annual Average Daily Traffic (AADT) for each receptor.

Table 12.3 - Road Characteristics

Road	Type	Edge Treatment	Capacity (AADT)
N78	Type 1 Single (7.3m) Carriageway	2.5m Hard Shoulders	11,600
R430	Type 2 Single (7m) Carriageway	0.5m Hardstrips	8,600
L3861; L3896; and L7129	Type 3 Single (6m) Carriageway	N/A	5,000

12.5.2 Baseline Traffic Flow Data

Available traffic flow data was collected from Transport Infrastructure Ireland's traffic data site[11]. Two traffic counts on the N78, which forms part of the identified turbine delivery route to the Site, were identified. Figure 12.2 indicates the location of each traffic count. Table 12.4 shows the measured AADT at each of these traffic count locations in 2019.

Table 12.4 - Baseline Traffic Flow Data

Reference	Road	Location	AADT	%HGV	HGV AADT
1	N78	East of Athy	4858	4.8	233
2	N78	West of Athy, West of N80	2678	4.6	123

[10] Transport Infrastructure Ireland (2017), Rural Road Link Design – DN-GEO-03031: https://www.thenbs.com/PublicationIndex/documents/details?Pub=NRA&DocID=317395 (Accessed 27/06/2022)
[11] Transport Infrastructure Ireland, Traffic Data Site: https://trafficdata.tii.ie/publicmultinodemap.asp (Accessed 27/06/2022)

12.5.3 Receptor Sensitivity

Table 12.5 presents the identified sensitive receptors on the construction traffic route and turbine delivery route, which includes both human receptors (i.e. residential areas) and material assets (i.e. roads). The receptors are presented in the order they are found on the route from the M9 to the Site entrance.

Table 12.5 - Receptor Sensitivity

Receptor	Type	Sensitivity	Comments
N78	Road	Medium	Existing traffic flow approximately 42% of overall capacity.
Athy	Town	Medium	Town is located on a National Road (N78).
R430	Road	Low	Assumed that baseline traffic flow is less than that on N78 and anticipated to be within residual capacity available.
L3861; L3896; L7129.	Road	Low	Assumed that baseline traffic flow is less than that on N78 and anticipated to be within residual capacity available.

12.6 CONSTRUCTION PHASE TRAFFIC

The following subsections will present the anticipated construction phase traffic generation for each element of the Development. This section is supported by the construction phase programme which is included in Appendix A12.1.

12.6.1 Forestry Extraction

Forestry operations will be required in order to provide suitable working areas for construction. It is likely that felling will commence two months prior to construction site mobilisation.

At the commencement of felling operations, plant and equipment will be required to be imported to Site. This will be transported by low-loader HGVs and is likely to comprise seven deliveries, resulting in 14 vehicle movements, in the first month.

Timber extraction will require a total of 78 HGV loads resulting in 156 HGV movements over the 2-month duration of this phase of works.

Fuel deliveries to support forestry operations can be expected throughout the two-month duration of this phase of works at a rate of approximately two deliveries per week, resulting in four vehicle movements per week or 16 vehicle movements per month.

Table 12.6 indicates the anticipated number of vehicle movements associated with forestry.

Table 12.6 Forestry Extraction

Operation	Vehicle Type	Construction Months	Total	Max Monthly
Forestry Plant Delivery	HGV	1-2	28*	28*
Timber Extraction	HGV	1-2	156	156
Fuel Delivery	HGV Tanker	1-2	16	16
Sub-Total			**200**	**100**

*Includes transporter vehicle leaving and then returning to site during demobilisation.

12.6.2 Site Mobilisation and Demobilisation

HGV and other vehicle movements will be required during site mobilisation. This will comprise the erection of welfare facilities, delivery of construction site vehicles and importation of plant and equipment including borrow pit equipment. The majority of these movements will be as HGVs and low loaders which will deliver and then depart the Site empty.

During site demobilisation, the majority of this equipment will be removed from Site. Vehicle movements for demobilisation will result from empty HGVs and low loaders travelling to Site and then departing loaded. Table 12.7**Error! Reference source not found.** indicates the anticipated number of vehicle movements associated with site mobilisation and demobilisation.

Table 12.7 - Anticipated Vehicle Movements - Site Mobilisation / Demobilisation

Operation	Vehicle Type	Construction Months	Total	Max Monthly
Site Mobilisation and Demobilisation	HGV	2, 19	120	60
Sub-Total			**120**	**60**

12.6.3 Access Track and Hardstanding Construction

In order to assess the likely worst case scenario in terms of aggregate importation it has been assumed that all materials required for the construction of access tracks and hardstandings will be imported to the Site. In practice this figure is likely to be reduced as on-site borrow pits are expected to yield all of the required aggregate for this element of works.

Existing access tracks within the Site will be reused as far as possible, although these may need to be upgraded at the commencement of construction. For the purposes of this assessment, a worst case scenario assumption has been made in which all existing access tracks will require a 0.15 m layer of aggregate to be imported. The surface area of existing access tracks is approximately 15,804 m^2, therefore 2,370 m^3 of stone would be required. Assuming each HGV dump truck has a volumetric capacity of 9 m^3, this would result in 263 stone deliveries or 526 vehicle movements for existing track upgrade.

The total surface area of new tracks, hardstanding, crane pads and hardstanding for the Control Building and Substation Compound is approximately 23,557 m^2. An assumed construction depth of 0.45m across this area results in a stone volume of 10,600 m^3. This would result in 1,178 deliveries or 2,356 HGV vehicle movements.

Additionally, a number of HGV deliveries will be required for the delivery of miscellaneous items related to access track and hardstanding construction, for example geotextiles and culverts. This is estimated to result in an additional 100 deliveries or 200 vehicle movements across this phase of works. Table 12.9**Error! Reference source not found.** indicates the anticipated number of vehicle movements associated with the access tracks and hardstanding construction.

Table 12.8 - Junction, Access Track and Hardstanding Construction

Operation	Vehicle Type	Construction Months	Total	Max Monthly
Stone Delivery	HGV Tipper	2-5	2,882	722

Operation	Vehicle Type	Construction Months	Total	Max Monthly
Miscellaneous	HGV	2-5	200	50
Sub-Total			**3,082**	**772**

12.6.4 Turbine Foundation Construction

The concrete for each turbine foundation will be formed from ready-mix concrete. Each foundation will have a volume of approximately 500 m^3. Assuming a volumetric capacity of 7 m^3 per concrete wagon 72 wagons would be required to supply the required concrete for each foundation, resulting in 144 vehicle movements per foundation or 720 movements in total for foundation pouring. Assuming a 3-month period for this phase of works 240 vehicle movements per month are expected, which will occur on 5 non-consecutive days.

Each foundation is required to be poured over a continuous (approximately) 10-hour period. Foundations would be poured on non-consecutive days during this period of works with 5 days of foundation pouring required to deliver concrete for the 5 turbines. Therefore, on concrete pouring days, an additional 144 HGV vehicle movements will be experienced in addition to the deliveries experienced for other concurrent elements of work.

In addition to concrete, steel rebar will be required to be imported. It is assumed that up to 4 HGV loads per turbine will be required, therefore 20 loads will be required for the 5 turbines resulting in 40 vehicle movements. Rebar will be delivered prior to the commencement of foundation pouring.

Additional miscellaneous items will be required to be delivered to support the foundation construction phase. These include shuttering, geotextiles and equipment. It is assumed that the majority of these deliveries would occur in month 4 prior to the commencement of pouring, and if further deliveries are required during the pouring phase then these would be timed to avoid pouring days so as to lower the peak traffic flow. An allowance for 40 miscellaneous deliveries during this phase of works has been made, this would result in up to 80 HGV movements. Table 12.9 indicates the anticipated number of vehicle movements associated with the turbine foundation construction.

Table 12.9 -Anticipated Vehicle Movements - Turbine Foundation Construction

Operation	Vehicle Type	Construction Months	Total	Max Monthly
Foundation Pouring	HGV Concrete Wagon	5-7	720	240
Rebar	HGV Low-Loader	5	40	40
Miscellaneous	HGV	5	40	40
Sub-Total			**800**	**320**

12.6.5 Control Building and Substation

Material for the below ground elements of the substation compound and control building has been accounted for in Section 12.6.3. This section will therefore consider above ground material only. Preparation of the compound will commence at the start of the construction programme as indicated shown in the table in Appendix A12.1.

External works will comprise the construction of the compounds and the control building and the delivery of the transformers. Internal works will comprise the delivery of electrical components and miscellaneous items.

Two transformers will require to be delivered by ALV due to their weight. Following delivery of components, the ALVs will retract to the size of an HGV for the return journey. This will result in four vehicle movements, 2 ALV movements and 2 HGV movements. Two escort vehicles are assumed to accompany each ALV resulting in eight vehicle movements.

Concrete will be required to be imported for construction of the substation control building. This is assumed to require 10 HGV concrete wagon loads, resulting in 20 movements. An additional 20 HGV loads have been assumed for the delivery of the control building electrical components and switchgear, resulting in a further 40 HGV movements.

Table 12.10 indicates the number of vehicles associated with substation construction.

Table 12.10 - Anticipated Vehicle Movements - Substation Construction

Operation	Vehicle Type	Construction Months	Total	Max Monthly
Concrete for Control Building	HGV Concrete Wagon	4-5	20	10
Electrical Components and Switchgear Delivery	HGV	10-19	40	4
Transformer Delivery	ALV	6	2	2
	HGV	6	2	2
	Escort Car/Van	6	8	8
Overall			**72**	**10**

12.6.6 Electrical Cabling Delivery

Electrical cabling for internal wind farm power distribution will require to be delivered and will constitute 30 HGV movements over the period of delivery, cabling works have been divided into offsite works. **Error! Reference source not found.** indicates the number of vehicle movements associated with electrical cabling delivery.

It should be noted that external grid connection works are covered by a separate consented planning application, detailed further in **Chapter 1: Introduction** (the Consented Grid Route). Section 12.9 of this EIA report considers the cumulative effect of external grid connection works coinciding with construction of the wind farm.

Table 12.11 indicates the number of vehicles associated with substation construction.

Table 12.11 - Anticipated Vehicle Movements - Electrical Cabling Delivery

Operation	Vehicle Type	Construction Months	Total	Max Monthly
Electrical Cabling Delivery	HGV	12-14	30	10

12.6.7 Crane Delivery

A large crawler or track mounted crane of approximately 1,000 tonne capacity will be required for turbine erection along with an additional 160 tonne pilot crane. The crawler crane will be transported in component form and assembled on the Site, this will require approximately 54 HGV movements to be undertaken prior to the commencement of turbine delivery. The pilot crane will be self-propelled although will constitute an ALV due to its weight.

The crane will remain on-site for the duration of the turbine assembly phase. Table 12.12 indicates the number of vehicle movements associated with crane delivery.

Table 12.12 - Anticipated Vehicle Movements - Crane Delivery

Operation	Vehicle Type	Construction Months	Total	Max Monthly
Crawler Crane	HGV	15, 19	104	52
	Abnormal Load Vehicle**	15, 19	4	2
Overall			**108**	**54**

** Self-propelled vehicles which arrive in one month and depart in another

12.6.8 Turbine Delivery

Turbines will be delivered as separate components the majority of which will require to be transported by ALV. The towers will be transported in three separate sections and each blade will be transported individually. Five further abnormal load vehicles will be required to transport the nacelle and hub. For 5 turbines, 55 ALV deliveries will be required equalling 110 vehicle movements.

Following delivery of components, the ALVs will retract to the size of a standard HGV for the return journey. Two escort vehicles are likely to be required to accompany each ALV which will result in a worst-case of 220 additional vehicle movements. In practice, this figure may be reduced where ALVs approach the Site in convoy and fewer escort vehicles per ALV are required. Table 12.13 indicates the number of vehicle movements that are expected for turbine delivery.

Table 12.13 - Anticipated Vehicle Movements - Turbine Delivery

Operation	Vehicle Type	Construction Months	Total	Max Monthly
Turbine Components	ALV	16-18	110	38
	Escort Car or Van	16-18	220	76
Overall			**330**	**114**

12.6.9 Fuel Delivery

Fuel will require regular delivery to the Site throughout the construction period and is expected to total 4 HGV fuel tanker deliveries per month from site mobilisation; totalling 72 vehicle movements over the duration of construction. Table 12.14 indicates the number of vehicle movements associated with fuel delivery.

Table 12.14 - Anticipated Vehicle Movements - Fuel Delivery

Operation	Vehicle Type	Construction Months	Total	Max Monthly
Fuel Delivery	HGV Fuel Tanker	1-19	76	4

12.6.10 Construction Personnel and Staff

It is anticipated that an average of 40 staff will be required on-site per day throughout the construction phase, months 2-19. 20 staff are assumed during the forestry extraction phase in month 1.

Assuming a 26 work days per month, this will result in 1040 vehicles per month during the main phase of construction and a total of 18,720 vehicle trips for staff over the course of construction of the Development. Table 12.15 indicates the number of vehicle movements associated with staff.

This estimate represents a worst case scenario and is likely to be reduced where car sharing is implemented.

Table 12.15 - Anticipated Vehicle Movements - Staff

Operation	Vehicle Type	Construction Months	Total	Max Monthly
Staff	Car or Minibus	2-19	19,240	1040

12.6.11 Summary

Table 12.16 provides a summary of all deliveries expected throughout duration of construction.

Table 12.16 - Anticipated Vehicle Movements - Summary

Operation	Vehicle Type	Construction Months	Total	Max Monthly
Forestry Extraction				
Forestry Plant Delivery	HGV	1-2	28*	28*
Timber Extraction	HGV	1-2	156	156
Fuel Delivery	HGV Tanker	1-2	16	16
Sub-Total			**200**	**100**
Site Mobilisation/Demobilisation				
Site Mobilisation and Demobilisation	HGV	2, 19	120	60
Sub-Total			**120**	**60**
Access Track and Hardstanding Construction				
Stone Delivery	HGV Tipper	2-5	2,882	722
Miscellaneous	HGV	2-5	200	50
Sub-Total			**3,082**	**772**
Turbine Foundation Construction				
Foundation Pouring	HGV Concrete Wagon	5-7	720	240
Rebar	HGV Low-Loader	5	40	40

Operation	Vehicle Type	Construction Months	Total	Max Monthly
Miscellaneous	HGV	5	40	40
Sub-Total			**800**	**320**
Electrical Cabling Delivery				
Electrical Cabling Delivery	HGV	12-14	30	10
Substation Construction				
Concrete for Control Building	HGV Concrete Wagon	4-5	20	10
Electrical Components and Switchgear Delivery	HGV	10-19	40	4
Transformer Delivery	ALV	6	2	2
	HGV	6	2	2
	Escort Car/Van	6	8	8
Subtotal			**72**	**10**
Crane Delivery				
Crane Delivery	HGV	15, 19	104	52
	Abnormal Load Vehicle**	15, 19	4	2
Subtotal			**108**	**54**
Turbine Delivery				
Turbine Components	ALV	16-18	110	38
	Escort Car or Van	16-18	220	76
Overall			**330**	**114**
Fuel Delivery				
Fuel Delivery	HGV Fuel Tanker	1-19	76	4
Staff				
Staff	Car or Minibus	1-19	19,240	1040
Totals			**Total**	**Max Monthly**
Total HGV and Abnormal Load Movements			4,590	1,104
Total Car and Van Movements			19,240	1,040
Overall Total			**24,058**	**2,144*** **

*Includes transporter vehicle leaving and then returning to site during demobilisation

**Self-propelled vehicles which arrive in one month and depart in another

***Total flow in peak month

12.7 PREDICTED TRAFFIC INCREASE

In order to determine the percentage increase in traffic above baseline traffic flow levels it has been assumed that all traffic will pass each traffic count location. Separate increases have been calculated for non-concrete days and concrete delivery days as these will only occur on 5 non-consecutive days through this phase of works.

Month 4 has been identified as the peak month of construction. Table 12.17 and Table 12.18 show the anticipated traffic level as average daily traffic (ADT) and corresponding percentage increase in traffic above baseline predicted during month 5 of construction.

Table 12.17 - Predicted Peak Month Traffic Excluding Concrete

	Baseline		Peak Month		Percentage Increase	
Reference	**AADT**	**HGV AADT**	**ADT**	**HGV ADT**	**Total**	**HGV**
1	4858	233	4928	264	1%	13%
2	2678	123	2748	154	3%	25%

Table 12.18 - Predicted Peak Month Traffic Including Concrete

	Baseline		Peak Month		Percentage Increase	
Reference	**AADT**	**HGV AADT**	**ADT**	**HGV ADT**	**Total**	**HGV**
1	4858	233	5073	408	4%	75%
2	2678	123	2893	298	8%	142%

12.8 ASSESSMENT OF EFFECTS

In accordance with the methodology outlined in Section 12.4.6 of this chapter, a screening exercise was undertaken to identify where significant effects have the potential to occur. As no receptors of 'high' sensitivity were identified the upper 30% threshold of significance has been considered.

Reviewing the predicted percentage increases in traffic during the peak month of construction, the 30% threshold will be exceeded in the following case:

- As a result of HGV increase at both reference locations during 5 non-consecutive days of construction when concrete is being delivered.

Outside of the five non-consecutive days during the peak month the threshold of significance would not be exceeded. The increase only exceeds the threshold as a result of HGVs, the increase in total traffic during these times is 4% and 8% at each location respectively and is therefore, negligible and likely to be within the existing daily variation in traffic flow.

The following subsections will consider each potential effect in turn.

12.8.1 Traffic Generation

The increase in overall traffic is negligible in terms of existing traffic flow levels and is likely to be within the existing daily variation in traffic flow. The effect of the Development on overall traffic generation is therefore negligible and not significant in terms of the EIA regulations.

12.8.2 Driver Delay

The increase in overall traffic flow is negligible and the increase in HGV composition would not result in any significant driver delay.

Movement of ALVs may result in minor driver delay, however, these deliveries would be scheduled outside of peak hours. Any delay to drivers as a result of ALV movements would be minor, as ALV convoys can be expected to maintain a minimum average speed in excess of 20mph except at pinch points, and would allow others to pass where safe to do so. The effect of the Development on driver delay is therefore expected to be at worst low and not significant in terms of the EIA regulations.

12.8.3 Pedestrian Amenity and Safety

The increase in overall traffic is negligible in terms of the existing traffic level. An increase in HGV composition is not sufficient in itself to result in an effect on pedestrian amenity and safety. The Principal Contractor will implement policies to ensure that all drivers are adequately qualified and trained and to ensure that all relevant road regulations are adhered to. Further detail will be provided in the Construction Traffic Management Plan, Appendix 4.1: Construction Environmental Management Plan.

The effect of the Development on Pedestrian Amenity and Safety is negligible and not significant in terms of the EIA regulations.

12.8.4 Severance

Overall traffic increase is below the threshold of significance on all routes identified in the study. The effect of overall traffic increase on severance is therefore negligible and not significant in terms of the EIA regulations.

ALV convoys have the potential to cause severance as they pass through communities, however such convoys will only occur during a short three-month period of construction and would occur for only a very short period of time as convoys pass through a settlement. The effect of ALV convoys on severance is therefore predicted to be at worst low and not significant in terms of the EIA regulations.

12.8.5 Accidents and Safety

The increase in overall traffic is negligible and below the threshold of significance in all cases. An increase in HGV composition is not sufficient to result in a detrimental effect on road safety. The Principal Contractor will implement policies to ensure that all drivers are adequately qualified and trained and to ensure that all relevant road regulations are adhered to. Further detail will be provided in the Construction Traffic Management Plan, Appendix 3.1: Construction Environmental Management Plan.

The effect of the Development on accidents and safety is negligible and not significant in terms of the EIA regulations.

12.8.6 Noise and Vibration

Assessment of noise and vibration effects as a result of offsite construction vehicle has considered the following points:

- The level of detail of a noise and vibration assessment shall be proportionate to the quality of data available and the risk of likely significant effects occurring; and
- Are there any noise sensitive receptors where there would be a reasonable stakeholder expectation that a construction noise/vibration assessment would be undertaken?

It should be noted that all onsite construction noise and vibration effects and operational noise effects are considered in **Chapter 11: Noise** of the EIA Report.

Considering offsite transport related noise and vibration effects against the above points, there are a number of receptors located close to the proposed construction traffic route. However, this route is major road and there should therefore be an expectation that it is used by HGV traffic. As a result, there is no 'reasonable stakeholder expectation' that a quantitative noise and vibration assessment be undertaken for a temporary and fully reversible change in traffic flow as a result of the Development.

Furthermore, ground-borne vibration resulting from HGV and ALV movements is generally only likely to be significant where vehicles traverse discontinuities, such as rough surfaces (including potholes) or speed-humps. Effects from the temporary increase in traffic are therefore only likely to be experienced at receptors located next to such existing road defects, in which case the maintaining authority (i.e. the local authority) would be responsible for enacting repairs.

Airborne vibrations resulting from low frequency sound emitted by vehicle engines and exhausts can result in detectable vibrations in building elements such as windows and doors and cause disturbance to local people. Due to the short-term and temporary nature of these increase in traffic movements the effect of noise and vibration upon receptors along the route would be minor and not significant in terms of the EIA Regulations.

12.8.7 Hazardous Loads

Fuel will be regularly transported to the Site over the duration of construction of the Development. All fuel will be transported by suitably qualified contractors, and all regulations for the transportation and storage of hazardous substances will be observed. No other hazardous substances in significant quantities are expected to be transported to Site. Therefore, the effect of the transportation of hazardous substances is negligible and not significant in terms of the EIA Regulations.

12.8.8 Visual Effects

The movements of ALVs could be considered visually intrusive. This effect would be short-term and would only occur during the movement of abnormal loads. Therefore, the visual effect upon receptors along the routes as a result of the ALVs would be negligible and not significant in terms of the EIA Regulations.

12.8.9 Air Quality

Maintaining good local air quality is essential for the human health and overall quality of life for people living in the area. Road transport accounts for a significant proportion of emissions of a number of pollutants including carbon dioxide (CO_2), nitrogen dioxide (NO_2), and particulate matter (PM10). Nitrogen oxide emissions are also of concern for nearby vegetation and ecosystems.

Significant impacts to local air quality may be found in the following cases:

- Where the road alignment will change by 5 m or more; or
- Daily traffic flows will change by 1,000 Annual Average Daily Traffic flow (AADT) or more; or
- Heavy Duty Vehicle flows will increase by 200 AADT or more; or
- Daily average speed will change by 10 km/hr or more; or
- Peak hour speed will change by 20 km/hr or more.

Given the assessment of the expected volume of construction traffic, none of the above criteria have been met or exceeded. In addition, due to the temporary nature of the increase in vehicles using the proposed access route, any effects on local air quality will be short term and reversible due to dispersion.

Therefore, the effect of the increase in traffic on local air quality would be negligible and not significant in terms of the EIA Regulations.

12.8.10 Decommissioning Effects

Traffic and transport effects associated with decommissioning of the Development are expected to comprise removal of the turbines and all associated above ground equipment. Turbine towers and blades are likely to be dismantled into smaller sections prior to their removal to ease transport requirements.

At this stage, it is not possible to forecast quantitatively or accurately the traffic effect during decommissioning of the Development as the baseline data would no longer be valid in 30 years. It is reasonable to assume that baseline traffic would continue to increase. The implication of applying further background traffic growth would be that the proportional impact of the decommissioning traffic would reduce in comparison to the construction traffic impact that has been assessed. It is expected that traffic flow on routes within the vicinity of the Site would continue to remain well below capacity.

The decommissioning effects would also be greatly reduced as the majority of the construction traffic is created by the import of concrete for turbine foundations, which will be left in situ at depth of greater than 1 m below ground level as per current decommissioning best practice.

Prior to decommissioning of the Development, a traffic assessment would be undertaken and appropriate traffic management procedures agreed with the relevant authorities at the time.

12.9 CUMULATIVE EFFECT ASSESSMENT

The possibility of construction of the Development coinciding with the construction of other nearby developments results in the potential for cumulative transport effects to occur.

In order to identify the significance of the effect of the Consented Grid Route being constructed simultaneously to the Development it was necessary to identify a combined construction programme for each development. Appendix A12.2 contains a combined construction programme which highlights the months during which both developments will simultaneously be under construction, and the number of vehicle movements expected.

From inspection of the cumulative construction programme contained in Appendix A12.2 it can be seen that the effect of the cumulative construction traffic does not result in the peak traffic level exceeding the previously identified peak month (month 4) during concrete delivery days. However, it would result in the non-concrete delivery day peak period occurring during months 11 and 12 where cumulative effects may occur as a result of total traffic increase.

The change in traffic flow levels on routes during the non-concrete peak months during the cumulative situation is presented in Table 12.19 below.

Table 12.19 - Predicted Peak Month Traffic Excluding. Concrete with Cumulative

	Baseline		**Peak Month**		**Percentage Increase**	
Reference	**AADT**	**HGV AADT**	**ADT**	**HGV ADT**	**Total**	**HGV**
1	4858	233	4951	254	2%	9%
2	2678	123	2771	144	3%	17%

From inspection it can be seen that none of the percentage increases in traffic provided in the above table exceeds the threshold of significance, therefore no significant cumulative effects are anticipated.

The cumulative effect of the Consented Grid Route is therefore negligible and not significant in terms of the EIA regulations.

12.10 MITIGATION AND RESIDUAL EFFECTS

The phasing of construction has been planned in order to minimise the peak traffic effect on roads within the vicinity of the Development. In particular, the on-site and public road cable works have been staggered. The effect of traffic on the local road network has been minimised through the use of this embedded mitigation.

No significant effects were identified; therefore, no further specific forms of mitigation are proposed.

12.11 SUMMARY OF EFFECTS

The study identified no significant effects on Roads and Traffic as a result of the Development or as a result of cumulative effects.

12.12 STATEMENT OF SIGNIFICANCE

The effect of the Development on Roads and Traffic is considered to be low and not significant in terms of the EIA regulations.

13 AIR QUALITY AND CLIMATE

13.1 INTRODUCTION

This Chapter evaluates the effects of the Bilboa Wind Farm (the Development), combined with the Grid Application and Turbine Delivery Route, in terms of Air Quality and Climate.

This Chapter includes the following elements:

- Key Conclusions of 2011 Environmental Impact Statement (EIS) & Further Information (FI);
- Changes to Legislation, Policy and Guidance;
- Assessment Methodology and Significance Criteria;
- Baseline Conditions;
- Assessment of Potential Effects;
- Cumulative Effects Assessment;
- Mitigation and Residual Effects;
- Summary of Effects;
- Statement of Significance; and
- Glossary.

13.2 KEY FINDINGS OF EIS & FI

The 2011 EIS assessed the potential air quality and climate impacts associated with the construction and operational phases of the Original Wind Farm.

The nearest air quality monitoring location to the Site is located approximately 9.5 km from the Site in Carlow. An air quality assessment was undertaken by the Environmental Protection Agency (EPA) in Carlow Town from 12th July 2004 until 14th March 2006. No limit of emissions (in place at the time) were exceeded during this assessment. This air quality assessment concluded that the air quality at the Site is of 'Good' quality as that of the nearby monitoring locations sites at the village of Capard, County Laois situated approximately 45 km from the Site and Emo, County Laois situated approximately 35 km from the Site. Both of these monitoring locations are within similar rural surroundings as the Site.

Additionally, the Consented Wind Farm is located within a rural environment and there are no key sources of pollutants in the locality of the Site. However, particular focus was given in the 2011 EIS to potential sensitive receptors including residential areas in close proximity to the Site, to potential construction impacts from dusts and pollutants arising from construction vehicle exhausts.

The assessment in the 2011 EIS outlined a schedule of mitigation measures for both the construction and operational phases to limit air quality impact on sensitive receptors. Mitigation for dust minimisation during the construction period included implementing measures such as low drop height of excavated materials to limit fugitive dust generation and covering dust generating vehicles in strong, waterproof sheets. Following implementation of mitigation measures and as these impacts from construction were of a temporary nature, residual air quality impacts during construction were considered minimal.

Atmospheric emissions during the operational phase were considered positive through the avoidance of emissions from the use of fossil fuel energy sources. Additionally, the carbon payback from the construction of the Original Wind Farm was calculated at 17 months over the operational period, with a total of 364,296 tonnes of carbon dioxide (CO_2) avoided compared to traditional carbon-based electricity generation.

The Original Wind Farm was approved in 2012 by ABP (Planning Reference PL. 01.240245).

13.3 CHANGES TO LEGISLATION, POLICY AND GUIDANCE

13.3.1 Environmental Impact Assessment

Legislation, policy and guidance has evolved considerably since the 2011 EIS for the Original Wind Farm was drafted.

EIAs are undertaken in response to the requirements of the European Union (EU) Directive 2014/52/EU[1] (the EIA Directive). **Chapter 2: EIA Methodology** outlines the relevant Environmental Impact Assessment (EIA) legislation including the enabling statutory instruments (S.I.) which transpose the EIA Directive into Irish law which are as follows: the European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018 (S.I. 296/2018)[2]; the Planning and Development Act 2000[3], as amended (the Planning Act); and Planning and Development Regulations 2001 (S.I. 600 of 2001)[4], as amended (the Planning Regulations); which combined, form the EIA Regulations applicable to the Development which this Chapter has been written in accordance with.

As detailed in the Environmental Protection Agency's (EPA) '*Guidelines on the information to be contained in Environmental Impact Assessment Reports*' 2022[5] (The EPA Guidelines) advised the content of environmental factors to be included within this chapter, under the requirements of the European Union (EU) Directive 2014/52/EU (the EIA Directive)[6].

Additionally, the Draft Revised Wind Energy Guidelines were published for public consultation in December 2019[7]. However, these Draft Guidelines do not revise policy for air quality.

Relevant overarching planning polices for the Development are detailed in **Chapter 3: Planning and Policy**.

13.3.2 Air Quality and Climate

The Environmental Protection Agency (EPA) has primary responsibility for monitoring air quality, the nature and the extent of air pollution emissions in Ireland. Under the Air Pollution Act 1987[8], primary responsibility for addressing local instances of air pollution

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[1] European Commission (2014) Directive 2014/52/EU [Online] Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32014L0052&from=EN (Accessed 27/06/2022)
[2] Government of Ireland (2018) European Union (Planning and Development) (Environmental Impact Assessment) Regulations [Online] Available at: http://www.irishstatutebook.ie/eli/2018/si/296/made/en/print (Accessed 27/06/2022)
[3] Government of Ireland, (2000), Planning and Development Act, 2000 [Online] Available at: https://www.housing.gov.ie/planning/policy/planning-and-development-act-2000-no-30-2000 (Accessed 27/06/2022)
[4] Government of Ireland (2001), Planning and Development Regulations, 2001 [Online] Available at: http://www.irishstatutebook.ie/eli/2001/si/600/made/en/print (Accessed 27/06/2022)
[5] Environmental Protection Agency (2022) Guidelines on the information to be contained in Environmental Impact Assessment Reports [Online] Available at: https://www.epa.ie/publications/monitoring--assessment/assessment/EIAR_Guidelines_2022_Web.pdf (Accessed 27/06/2022)
[6] European Commission (2014) Directive 2014/52/EU [Online] Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32014L0052&from=EN (Accessed 27/06/2022)
[7] Department of Housing, Planning and Local Government (2019) Draft Revised Wind Energy Development Guidelines [Online] Available at: https://www.housing.gov.ie/sites/default/files/public-consultation/files/draft_revised_wind_energy_development_guidelines_december_2019.pdf (Accessed 27/06/2022)
[8] Irish Statute Book. 1987. Air Pollution Act, 1987. [Online]. Available at: http://www.irishstatutebook.ie/eli/1987/act/6/enacted/en/html. (Accessed 27/06/2022)

is assigned to local authorities. CCC do not provide specific guidance on air quality and climate assessments, and therefore methodology and baseline air quality and meteorological data is largely derived from EPA air quality guidance, as EPA is the competent authority responsible for the implementation of all Irish and EU ambient air quality legislation.

On a national level, EPA is currently working with the Department of Communications, Climate Action and Environment (DCCAE) to develop the National Clean Air Strategy[9] to reduce the threat posed to human health and the environment as a result of air pollution. Policy measures such as the National Clean Air Strategy will provide a framework for a set of cross-Governmental policies and actions to assist in meeting current EU targets such those outlined above, and any future targets that may be introduced.

The Institute of Air Quality Management (IAQM) is the professional body for air quality professionals. Their guidance on the assessment of air pollutants[10] has been used throughout this assessment.

The 2011 EIS air quality assessment was undertaken in accordance with the Air Quality Standards Regulations 2002[11], which has since been transposed by the Air Quality Standards Regulations 2011[12]. The air quality assessment in this EIA Report does not require updating as a result of this update in regulations.

Additionally, the Carlow County Development Plan 2009-2015 was used to inform the air quality assessment within the 2011 EIS. This local guidance has since been updated and superseded by the Carlow County Development Plan 2015-2021[13], which is in turn due to be superseded by the Carlow County Development Plan 2022-2028[14] imminently. The air quality assessment does not require updating as a result of this update in the County Carlow Development Plan.

The enactment of the Climate Action and Low Carbon Development Act 2015[15] (the Climate Action Act) by the Irish Government creates a long-term framework for the current and successive administrations in Ireland to ensure a successful *"transition to a low carbon, climate resilient and environmentally sustainable economy by the end of the year 2050"*. This is fundamentally a commitment from the Government to expand the renewable energy industry and move away from carbon dependency.

Published in July 2017, the first National Mitigation Plan[16] sets out the requisite measures for Ireland to achieve its decarbonisation targets, building on the commitment to reduce emissions in the National Policy Position on Climate Action and Low Carbon

[9] Department of Communications, Climate Action and Environment. 2020. National Clean Air Strategy. [Online]. Available at: https://www.dccae.gov.ie/en-ie/environment/topics/air-quality/national-clean-air-strategy/Pages/default.aspx (Accessed 27/06/2022)
[10] Institute of Air Quality Management. (2014). Guidance on the assessment of dust from demolition and construction. Available at: http://iaqm.co.uk/wp-content/uploads/guidance/iaqm_guidance_report_draft1.4.pdf. (Accessed 27/06/2022)
[11] Irish Statute (2002) Air Quality Standards Regulations [Online] Available at: http://www.irishstatutebook.ie/eli/2002/si/271/made/en/print (Accessed 27/06/2022)
[12] Irish Statute (2011) Air Quality Standards Regulations [Online] Available at: http://www.irishstatutebook.ie/eli/2011/si/180/made/en/print (Accessed 27/06/2022)
[13] Carlow County Council (2015) Carlow County Development Plan 2015-2021 [Online] Available at: carlow-county-dev-plan-2015-2021.pdf (Accessed 27/06/2022)
[14] Carlow County Council (2022) Carlow Council Development Plan 2022-28 Available at https://consult.carlow.ie/system/files/materials/5/Carlow%20County%20Development%20Plan%202022%20%E2%80%93%202028%20Issues%20Paper.pdf (Accessed 27/06/2022)
[15] Government of Ireland (2015) Climate Action and Low Carbon Development Act 2015 [Online] Available at: http://www.irishstatutebook.ie/eli/2015/act/46/enacted/en/pdf (Accessed 27/06/2022)
[16] Department of Communications, Climate Change & Environment (2017) National Mitigation Plan [Online] Available at: https://www.dccae.gov.ie/documents/National%20Mitigation%20Plan%202017.pdf (Accessed 27/06/2022)

Development[17]. This is proposed to be done through CO_2 reductions in electricity generation, the built environment and transport sectors.

The National Mitigation Plan outlines that the targets for Ireland are ambitious and challenging; noting that the target reduction in non-Emission Trading Scheme (ETS) emissions by 2020 was 20%, with likely outcome being a 4-6% reduction. With a 30% reduction target set for 2030, consenting of suitable renewable energy development is a necessity. This is acknowledged in the National Mitigation Plan, which states:

"Eirgrid estimates that a total of between 3,900MW and 4,300MW of onshore renewable generation capacity will be required to allow Ireland to achieve 40% renewable electricity by 2020. This leaves a further requirement of between 780MW and 1,180MW to be installed by 2020 if the 2020 electricity target is to be reached, requiring an increased rate of installation."

National guidance which has been published since the EIS included the Climate Action Plan 2021[18] and the 2012 Irish Wind Energy Association (IWEA) Best Practice Guidelines for the Irish Wind Energy Industry (the IWEA Guidelines)[19]. Section 6.3.6 of the Guidelines includes guidance carbon calculations a result of peat removal for a proposed development. There is no change required to the carbon assessment as a result of this guidance.

Additionally, the Draft Revised Wind Energy Guidelines were published for public consultation in December 2019[20]. As these Draft Guidelines are in the preliminary stages and will likely be amended prior to finalisation, this EIA Report has taken accordance of them; however, the assessment does not require updating as a result of the Draft Guidelines.

13.4 ASSESSMENT METHODOLOGY AND SIGNIFICANCE CRITERIA

13.4.1 Scope of Assessment

This Chapter assesses the effect of the Development on the Air Quality and Climate in the existing environment. The key issues for the assessment of potential air quality and climate effects relating to the Development are:

- Permanent effects such as long term alterations to the climate (Influence of the Development on Climate);
- Cumulative effects, including the generation of renewable energy by the Gortahile Wind Farm and the Consented Grid Route Application; and
- Cumulative temporary effects, such as short term alterations to local air quality arising from construction traffic, as a result of the Development and the Original Wind Farm.

[17] Department of Communications, Climate Change & Environment (2014) National Policy Position on Climate Action and Low Carbon Development [Online] Available at: https://www.dccae.gov.ie/en-ie/climate-action/publications/Documents/5/National%20Climate%20Policy%20Position.pdf (Accessed 27/06/2022)
[18] Department of the Environment, Climate and Communications (2021) Climate Action Plan 2021 [Online] Available at: https://www.gov.ie/en/publication/6223e-climate-action-plan-2021/ (Accessed 27/06/2022)
[19] IWEA (2012) Best Practice Guidelines for the Irish Wind Energy Industry [Online] Available at: https://www.iwea.com/images/files/9660bdfb5a4f1d276f41ae9ab54e991bb600b7.pdf (Accessed 27/06/2022)
[20] Department of Housing, Planning and Local Government (2019) Draft Revised Wind Energy Development Guidelines [Online] Available at: https://www.housing.gov.ie/sites/default/files/public-consultation/files/draft_revised_wind_energy_development_guidelines_december_2019.pdf (Accessed 27/06/2022)

13.4.1.1 Elements Scoped Out of Assessment

Aside from cumulative temporary construction traffic effects on air quality, temporary effects arising from the construction phase, such as dust produced from construction works, are scoped out of assessment.

Permanent effects such as long term alterations to the quality of air are scoped out of assessment. The Development will not alter air quality in the long term as wind turbines do not emit any emissions whilst operational.

Decommissioning of the Development is expected to give rise to similar, if not the same, effects as the construction phase effects for the Consented Wind Farm, as described in the 2011 EIS; therefore, the Development decommissioning effects on air quality and climate are scoped out of further assessment.

13.4.1.2 Summary of Scope

This Chapter will assess the influence the Development will have on climate during the operational phase, as well as cumulatively with other renewable energy projects.

This Chapter will assess cumulative temporary effects, such as short term alterations to local air quality arising from construction traffic, as a result of the Development.

13.4.2 Study Area / Survey Area

The Study Area for the assessment of the influence of the Development on climate considers greenhouse gas emissions (current levels and targets) within the Irish spatial scale. Reference is made to the global context as appropriate.

For the cumulative assessment of the effects of construction traffic on air quality, the Study Area used to identify receptors extends to 350 m from the land within Development (the Site) and 50 m from the route use by construction vehicles on the public highway, in line with IAQM 'Guidance on the assessment of dust from demolition and construction'[21].

13.4.3 Baseline Survey Methodology and Data Sources

The baseline has been used to assess the sensitivity of receptors within the Study Areas. The baseline conditions identified in this Chapter have been established through desk-based studies, including a review of the following relevant sources of information.

The baseline has been gathered using professional judgement and interpretation, drawing on the documents and resources outlined above and utilising best practice methodologies as outlined in the EPA Guidelines[22].

13.4.3.1 Air Quality

EPA is the competent authority responsible for the implementation of all Irish and EU ambient air quality legislation, therefore, much of the data and approach for this assessment was taken from the EPA Air Quality website[23].

EPA undertakes air quality monitoring of atmospheric pollutants at sites across Ireland. To construct the baseline, air quality data was taken for the two Air Quality Monitoring Stations (AQMS) that are most proximate to the Site, which are Carlow Town and

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[21] Institute of Air Quality Management. (2014). Guidance on the assessment of dust from demolition and construction. Available at: http://iaqm.co.uk/wp-content/uploads/guidance/iaqm_guidance_report_draft1.4.pdf. (Accessed 27/06/2022)

[22] Environmental Protection Agency (2017) *Guidelines on the Information to be Contained in Environmental Impact Assessment Reports* [Online] Available at: https://www.epa.ie/pubs/advice/ea/EPA%20EIAR%20Guidelines.pdf (Accessed 27/06/2022)

[23] Environmental Protection Agency. (2020). Air Quality. Available at: http://www.epa.ie/air/quality2/ (Accessed 27/06/2022)

Kilkenny. Although these are the most proximate stations, they are both located within suburban areas as opposed to rural locations. Therefore, air quality data from Emo Court AQMS was also used, which is likely to provide the most accurate representation of air quality surrounding the Site, as it is also located within a rural area.

It should be noted that the type of pollutants that are monitored vary between locations based on the type of pollutants that are at risk of breaching limits, and therefore the air quality data provided is not the same between each station.

Guidance for air quality assessment methodology was also taken from IAQM[24] including the methodology used to identify likely sensitive receptors.

13.4.3.2 Air Quality Sampling

Appropriate background Air Quality data for the Site is available from the EPA, therefore Air Quality sampling to measure existing background levels of pollutants is not required.

The Development when operational will not produce any emissions to air, therefore there will be no requirement for Air Quality sampling of emissions from the Development.

13.4.3.3 Climate

The Irish Meteorological Service, Met Éireann[25], is the national meteorological service in Ireland and provides publicly available data for stations located around Ireland. Carlow Oakpark automatic weather station (AWS) is located most proximate to the Site and therefore the available data is used to inform the climate baseline. However, the World Meteorological Organization (WMO) recommends that climate averages are computed over a 30 year period of consecutive records[26]. The available data for Carlow Oakpark does not extend to that length, and therefore the data for Kilkenny AWS is used to corroborate the historic baseline in line with WMO recommendations, which is the next most proximate station to the Site and also has historic data available for the 30-year average from 1978-2007.

13.4.4 Methodology for the Assessment of Effects

To determine whether effects are significant under the EIA Regulations, it is appropriate to consider the sensitivity of the receptor and the magnitude of the impact, taking into account uncertainty. This is based on the professional judgement of the assessor.

13.4.4.1 Sensitivity of Receptors

The sensitivity of the baseline conditions, including the importance of environmental features on or near to the Site or the sensitivity of potentially affected receptors, will be assessed in line with best practice guidance, legislation, statutory designations and / or professional judgement.

Table 13.1 details the framework for determining the sensitivity of receptors.

Table 13.1: Framework for Determining Sensitivity of Receptors

Sensitivity of Receptor	Definition
High	The receptor has little ability to absorb change without fundamentally altering its present character, is of high environmental value, or of national importance.

[24] Institute of Air Quality Management. (2014). Guidance on the assessment of dust from demolition and construction. Available at: http://iaqm.co.uk/wp-content/uploads/guidance/iaqm_guidance_report_draft1.4.pdf. (Accessed 27/06/2022)
[25] Met Eireann. (2020). 30 year averages. Available at: https://www.met.ie/ (Accessed 27/06/2022)
[26] World Meteorological Organisation. (2017). WMO Guidelines on the Calculation of Climate Normals. [Online]. Available at: https://library.wmo.int/doc_num.php?explnum_id=4166 (Accessed 27/06/2022)

Sensitivity of Receptor	Definition
Medium	The receptor has moderate capacity to absorb change without significantly altering its present character, has some environmental value, or is of regional importance.
Low	The receptor is tolerant of change without detriment to its character, is low environmental value, or local importance.
Negligible	The receptor is resistant to change and is of little environmental value.

13.4.4.2 Magnitude of Change

The magnitude of potential change will be identified through consideration of the Development, the degree of change to baseline conditions predicted as a result of the Development, the duration and reversibility of an effect and professional judgement, best practice guidance and legislation.

The criteria for assessing the magnitude of change are presented in Table 13.2.

Table 13.2: Framework for Determining Magnitude of Change

Magnitude of Change	Definition
High	A fundamental change to the baseline condition of the asset, leading to total loss or major alteration of character.
Medium	A material, partial loss or alteration of character.
Low	A slight, detectable, alteration of the baseline condition of the asset.
Negligible	A barely distinguishable change from baseline conditions.

13.4.4.3 Significance of Effect

The sensitivity of the asset and the magnitude of the predicted effects will be used as a guide, in addition to professional judgement, to predict the significance of the likely effects. Table 13.3 summarises guideline criteria for assessing the significance of effects.

Table 13.3: Framework for Assessment of the Significance of Effects

Magnitude of Change	Sensitivity of Resource or Receptor			
	High	**Medium**	**Low**	**Negligible**
High	Profound – Very Significant	Significant - Moderate	Moderate - Slight	Slight - Imperceptible
Medium	Significant - Moderate	Moderate	Slight	Imperceptible
Low	Moderate - Slight	Slight	Slight – Not Significant	Imperceptible
Negligible	Slight - Imperceptible	Imperceptible	Imperceptible	Imperceptible

Profound or substantial effects are considered to be 'significant' in the context of the EIA Regulations, and are shaded in light grey in the above table.

13.4.4.4 Climate Change

In addition to the general methodology for assessment, the assessment of the Development's impact on climate relies on a simple formula, as evidenced in the 2011

EIS, which can be used to calculate emission reductions from the renewable generation of electricity of Development, rather than carbon-based electricity generation.

The formula is detailed as follows:

$$CO_2 \text{ (in tonnes)} = \frac{(A \times B \times C \times D)}{1000}$$

A = The rated capacity of the wind energy development in MW (approximately 22.5 MW, ((dependent on final turbine selection)).

B = The capacity load factor (EIS predicted 35% (or 0.35))

C = The number of hours per year (8,760)

D = Carbon load of grams per kilowatt hour (gCO_2/kWh) of electricity generated and distributed via the national grid. The most recent data for relating to the emission factor for electricity in Ireland was published in 2020 in the Commission for Regulation of Utilities (CRU) Fuel Mix Disclosure 2019[27] is 254 gCO_2/kWh.

13.4.5 Assessment Limitations

The baseline has been compiled following a desktop study, therefore the baseline data/information is reliant on information from online sources being up-to-date and accurate.

Assessment limitations also exist in relation to the formula used to calculate emission reductions from the renewable generation of electricity of Development, rather than carbon-based electricity generation.

The formula uses as accurate data as is possible; however, as with all data there are degrees of uncertainty associated with the data.

13.5 BASELINE CONDITIONS

The Site which contains the Development is located approximately 8 km southwest from the town of Carlow, County Carlow within Carlow County Council (CCC), as shown on Figure 1.1 in Volume II: EIA Report Figures.

The Cable Route largely follows the L7129 and L3896 public roads along the Cable Route, an existing forestry track along the Upgraded Access Track, and areas of forestry plantation and heathland along the Onsite Access Tracks and Re-orientated Crane Hardstanding.

This section outlines the requirements of current air quality and climate change standards in Ireland and assesses current compliance with these standards in the surrounding area.

The Development and Grid Application are situated in a rural location, with a largely agricultural environment. There is no individual source of substantial air pollution in the Study Area.

13.5.1 Air Quality

The EU Clean Air for Europe Directive requires Member States to categorise geographic areas in terms of Zones and Agglomerations for the purpose of managing Air Quality. The zones were defined initially in the Air Quality Regulations (SI 180 of 2011). The EPA reviews the zones regularly and amends when necessary. The Site falls into the area

[27] CRU (2020) Commission for Regulation of Utilities Fuel Mix Disclosure 2019 [Online] Available at: https://www.cru.ie/document_group/fuel-mix-and-co2-emissions-disclosure-2/ (Accessed 27/06/2022)

classified as Zone D – Rural Ireland. A detailed description of the Air Quality Zones is given on the EPA website[28].

The Site is located within EPA's 'Rural East' Air Quality Index for Health (AQIH) Region[29], which is summarised as *"Towns with population less than 5,000, villages and rural areas in Counties Carlow, Cavan, Dublin, Kildare, Kilkenny, Laois, Longford, Louth, Meath, Monaghan, Offaly, Tipperary, Waterford, Westmeath"*

The nearest station is to the Site located in Carlow Town, which has been operational since September 2018, and is classified as 'Good' by EPA. Carlow Town AQS monitors particulate matter 10 micrometres of less in diameter (PM_{10}) and particulate matter 2.5 micrometres of less in diameter ($PM_{2.5}$). The most recently available air quality data recorded by this station can be seen in table 13.4, alongside data recorded in November 2020 which may be a more accurate representation of Air Quality as this was pre-covid, when typical traffic / travel / business activities could be represented:

Table 13.4: EPA Air Quality Station at Carlow Town – Air Quality Data

Pollutant	Data	Value (microgram per cubic meter, µg/m³)	AQIH
PM_{10}	18th May 2022 10:01	14.05	1 Good
$PM_{2.5}$	18th May 2022 10:01	7.14	1 Good
PM_{10}	6th November 2020 17:18	16.34	2 Good
$PM_{2.5}$	6th November 2020 17:18	14.16	2 Good

The next proximate monitoring station to the Site is located at Seville Lodge on the outskirts of Kilkenny, 22 km southwest of the Development. Monitoring is undertaken using continuous monitors for nitrogen dioxide (NO_2), ozone (O_3), and PM_{10}. The air quality at Kilkenny is defined as 'Good' by EPA. The most recently available air quality data recorded by this station can be seen in table 13.5, alongside data recorded in November 2020 which may be a more accurate representation of Air Quality as this was pre-covid, when typical traffic / travel / business activities could be represented:

Table 13.5: EPA Air Quality Station at Kilkenny – Air Quality Data

Pollutant	Data	Value (µg/m³)	AQIH
PM_{10}	18th May 2022 10:05	26.95	2 Good
O_3	18th May 2022 10:05	78.19	3 Good
NO_2	18th May 2022 10:05	2.01	1 Good
PM_{10}	6th November 2020 17:01	19.00	2 Good
O_3	6th November 2020 17:01	48.68	2 Good
NO_2	6th November 2020 17:01	7.53	1 Good

Although the Carlow Town and Kilkenny Air Quality Monitoring Stations are the closest monitoring stations to the Site, they are both located within Zone C, which represents suburban areas of large towns with populations >15,000.

The closest monitoring station to the Site which is likely to provide the most accurate representation of the air quality surrounding the Site is Emo Court in County Laois, approximately 36 km northwest of the Site. Emo Court is also located within a rural area,

[28] Environmental Protection Agency. (2020). Air quality zones. [Online] Available at: https://www.epa.ie/air/quality/zones/ (Accessed 27/06/2022)
[29] Environmental Protection Agency. (2020). What is the Air Quality Index for Health? [Online] Available at: https://www.epa.ie/air/quality/index/ . (Accessed 27/06/2022)

and the air quality data is classified by EPA as 'Good' and can be seen in table 13.6, alongside data recorded in November 2020 which may be a more accurate representation of Air Quality as this was pre-covid, when typical traffic / travel / business activities could be represented:

Table 13.6: EPA Air Quality Station at Emo Court – Air Quality Data

Pollutant	Data	Value (µg/m^3)	AQIH
NO_2	18th May 2022 03:00	1.01	1 Good
O_3	18th May 2022 03:00	76.58	3 Good
NO_2	6th November 2020 17:01	7.61	1 Good
O_3	6th November 2020 17:01	53.25	2 Good

The data from the three representative stations for the Site show that the baseline air quality is "good" as defined by AQIH.

Nitrogen dioxide levels are consistently significantly below the 200 µg/m^3 limit outlined by the EPA Air Quality Standards[30], showing concentrations below 10 µg/m^3. Ozone concentration is consistency below the 180 µg/m^3 EPA limit, PM_{10} concentrations are consistently below the 40 µg/m^3 EPA limit and $PM_{2.5}$ concentrations are below the 25 µg/m^3 EPA limit.

Given the available baseline data and the rural location of the Site, it can be concluded that the air quality at the Site will be of a similar 'Good' quality as that of the stations outlined above.

13.5.2 Climate

The closest Met Éireann operational automatic weather station (AWS) to the Development is Carlow Oakpark AWS, located approximately 12 km northeast in County Carlow at 62 m above mean sea level. Table 13.7 below provides a summary of this baseline data.

Table 13.7: Mean Climatic Data from Carlow Oakpark AWS (1981-2010)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Total rainfall (mm)	80.4	57.3	63.4	55.9	59.8	60.8	58.7	71.9	69.6	92.9	85.9	83.6
Mean air temperature (°C)	5.1	5.6	6.9	8.4	11.0	13.7	15.6	15.3	13.2	10.1	7.5	5.5
Mean soil temperature, at 10 cm (°C)	3.7	3.7	5.4	8.1	12.0	15.5	16.9	15.9	13.0	9.3	6.0	4.2

The nearest AWS that has available historic monthly air and climate data, is Kilkenny, located approximately 19 km southwest. The station closed in 2008, however, there is historic data available for the 30-year average from 1978-2007. As outlined in Section 13.4.4.3, the World Meteorological Organization (WMO) recommends that climate averages are computed over a 30 year period of consecutive records[31], therefore the data

30 Environmental Protection Agency. (2020). Air quality standards. Available at: http://www.epa.ie/air/quality/standards/. (Accessed 27/06/2022)
31 Met Eireann. (2020). 30 year averages. Available at: https://www.met.ie/climate/30-year-averages. (Accessed 27/06/2022)

for Kilkenny is provided additionally, to corroborate the baseline. This was provided in the EIA Report as Appendix A13.1.

13.5.3 Receptors

13.5.3.1 Air Quality

Receptors potentially sensitive to air pollution from the Development and Grid Development were identified within 350 m of the Site Boundary, and within 50 m of the roads likely to be used by construction traffic for the first 200 m after leaving the Site, in line with guidance set out by the IAQM. These are shown in Figure 13.1 and are predominantly private dwellings, although there are three non-residential receptors which are the Bilboa Post Office, Scoil Bhride Primary School and the Bilboa Church of Ireland. These are all considered high sensitivity receptors.

There are no ecological sites (sensitive habitats), designated statutory or non-statutory sites which may be sensitive to dust within 200 m of the Site.

Receptors also include construction workers that are working on the Development, as they will have prolonged exposure to any air pollutants released as a result of the construction period.

13.5.3.2 Climate

Ecological, ornithological, and hydrological receptors are considered to be the most sensitive environmental receptors to long term changes in climate trends.

With regards for ecological receptors, changes in temperature and shifts in seasonal weather could affect the composition and growth rates of plant communities and invertebrates, and hence protected species and habitats.

A rise in temperature has the potential to impact on ornithological habitats which in turn may affect the behaviour of bird interests.

Hydrological receptors may be affected by changes to temperature and precipitation trends. These changes could potentially lead to changes in river discharge rates and sedimentation rates.

Presence of ecological, ornithological, and hydrological receptors within the receiving environment that have the potential to be impacted by the Development are detailed in **Chapter 7: Biodiversity** and **8: Hydrology**, respectively.

13.6 EMBEDDED MITIGATION

13.6.1 Construction Environmental Management Plan (CEMP)

Construction activities associated with the Development have the potential to affect local air quality and climate during a specific period of time only. Embedded mitigation measures are set out within the CEMP (provided as Technical Appendix A4.1) which sets out specific mitigation relating to the construction of the development. These comprise good practice methods and works that are established and effective measures to which the Applicant will be committed through the planning consent.

Measures and procedures detailed in the CEMP will be adopted and incorporated into a single working document to be agreed with statutory consultees and the planning authority following consent by way of an appropriately worded planning condition. Examples of these measures include:

- Damping down of all dust activities and surfaces, particularly during dry and windy weather;
- Temporary covering of earthworks, and secure covering where possible; and
- Revegetation of earth works to stabilise surfaces.

Good practice will be followed in all aspects of construction, operation and decommissioning, specifically through a Pollution Prevention Plan (PPP), which is incorporated into a full CEMP.

The PPP sets out measures to be employed to avoid or mitigate potential effects for all phases of the Development, and will also include an Incident Plan to be followed should a pollution event occur. The Construction Project Manager will have specific responsibility for implementation of the PPP.

Accordingly, the identification of likely significant effects from the Development is considered following implementation of the measures in Technical Appendix 4.1: CEMP.

13.7 ASSESSMENT OF POTENTIAL EFFECTS

13.7.1 Air Quality

An assessment of the Development on air quality has been scoped out due the nature of the proposal, however an assessment of emissions arising from cumulative construction traffic relating to the Development is undertaken in Section 13.8.

13.7.2 Influence of the Development on Climate

13.7.2.1 Carbon Savings

Every unit of electricity produced by a wind farm development displaces a unit of electricity which would otherwise have been produced by a conventional (coal or gas) power station, and therefore presents carbon savings.

Based on the Macauley Institute model assessment and following the same methodology as used for the 2011 EIS to allow for comparison with the Consented Wind Farm;

$$CO_2 \text{ (in tonnes)} = \frac{22.5 \times 0.35 \times 8760 \times 254}{1000}$$

= 17,522 tonnes of CO_2 saved per annum

Consistent to the result presented in the 2011 EIS, the operation of the Development will result in positive climate impacts as it will displace fossil-fuel generation CO_2 emissions. There is limited proposed change to the construction of the Development when compared to the Consented Wind Farm, as the Crane Hardstanding Modification is considered to be a negligible change when compared to the Consented Wind Farm. Therefore, the calculated net loss of CO_2 due to the construction of the Development will be 22,029 tonnes of CO_2, as per the 2011 EIS. However, based on the calculation above, 17,522 tonnes of CO_2 will be avoided per annum, which throughout the 30 year operational lifetime of the Development, will offset the net loss of CO_2 as a result of the construction of the Development. Therefore, the Development will result in 525,660 tonnes of avoided CO_2 during its lifetime, based on the current grid average.

The Development will have a positive effect on carbon savings and therefore on Climate. Additionally, the Development will contribute to Ireland's climate targets through the avoidance of fossil fuel energy alternatives and the Development's operational carbon payback. Climate, as the receptor, is assessed to be of Medium sensitivity to change in greenhouse gas emissions, and the magnitude of change is assessed as negligible (in the context of Ireland's carbon emissions), the Development is therefore assessed to have an imperceptible, positive effect on climate that is **not significant** under the EIA Regulations.

13.7.3 'Do-Nothing' Alternative

Should the Development not take place, the climate would remain the same. However, it should be noted that as no significant effects are expected to arise as a result of the Development, there will be no significant changes to the climate scenario if the Development is to take place in terms of the EIA Regulations.

It should be noted that should the Development not take place, the Consented Wind Farm's opportunity to capture and export a significant part of County Carlow's valuable renewable energy resource would be lost, as would the opportunity to improve the climate and contribute to meeting Irish Government and EU's renewable energy targets and reduction of greenhouse gas emissions, as detailed in **Chapter 3: Planning and Energy Policy.**

13.8 CUMULATIVE EFFECT ASSESSMENT

13.8.1 Air Quality

Emissions of pollutants, particularly NO_2 and PM_{10}, from construction traffic arising from the Development and the Consented Wind Farm will have the potential to adversely impact upon local air quality at sensitive receptors. The predicted increase in traffic volumes resulting from the construction phase is predicted to be low and consequently it is anticipated that there will be a low magnitude of change of concentrations of pollutants.

Considering the very high sensitivity of the receptors, the effects are considered to be a **short-term moderate effect,** which is **not significant** as per the EIA Regulations.

During the operational phase, it is not expected that the Development will have any discernible effect on air quality. The design and nature of the Development are such that no pollutants would be released to the extent that they would have a discernible effect on local air quality. This is consistent with the previous assessment of the Consented Wind Farm and there are predicted to be no cumulative operational air quality effects.

13.8.2 Influence of the Development on Climate

It is critical that a cumulative assessment is undertaken in order to take a holistic approach to the assessment of environmental effects, which incorporates all related developments. A cumulative effect is considered to be an additional effect on the climate resource arising from the Development in addition to the combination of other developments that are likely to affect the climate resource. The methodology followed to assess the cumulative effects is the same as that used for the Development in isolation.

Cumulative developments related to the Development include:

- The Consented Grid Route;
- Gortahile Wind Farm (located approximately 1.5 km north); and
- All other renewable energy producing developments in the Republic of Ireland.

The Development and the Bilboa Wind Farm Grid and Access development will enhance and facilitate the operation of the Consented Wind Farm, which will result in the avoidance of 525,660 tonnes of CO_2 during its lifetime, which will be a significant positive cumulative effect with regards to climate. This will be significant when considered cumulatively with Irish-wide and EU renewable energy deployment and will contribute to Ireland's climate targets, as detailed in **Chapter 3: Planning and Policy**.

Additionally, the Gortahile Wind Farm has an installed capacity of 20 MW. These wind farms will cumulatively contribute to the displacement of fossil fuel generated electricity and the avoidance of greenhouse gases emissions. The cumulative effect of these developments in combination with other Irish renewable energy generation is considered to be a fundamental change in the climate effects of Irish energy supply, which is a

profound-substantial, positive effect, which is **significant** under the EIA Regulations.

13.9 MITIGATION AND RESIDUAL EFFECTS

An updated Construction Environmental Management Plan (CEMP) is supplied in appendix A1 of this FI Request and provides mitigation on potential emissions of construction dust. Given the temporary nature of, and lack of significant effects from emission arising as a result of construction traffic, no further mitigation is proposed.

13.10 SUMMARY OF EFFECTS

Table 13.4 provides a summary of the effects detailed within this Chapter.

Table 13.4 Summary of Effects

Receptor	Potential Effect	Significance of Effect	Mitigation Proposed	Residual Effect
Operational Phase				
Climate and carbon savings	Displacement of electricity generation from fossil fuels, production of renewable energy.	Imperceptible, positive. Positive not significant effect as per the EIA Regulations. Cumulative, profound-substantial, positive. Positive significant effect as per the EIA Regulations.	None	Imperceptible, positive. Positive not significant effect as per the EIA Regulations. Cumulative, profound-substantial, positive. Positive significant effect as per the EIA Regulations.
Air Quality	Emissions arising from cumulative construction assessment traffic relating to the Development in tandem with the Consented Wind Farm	Cumulative, moderate. Not significant in terms of the EIA Regulations.	No specific mitigation required. Appendix 4.1 provides general mitigation of potential emissions of construction dust.	Cumulative, moderate. Not significant in terms of the EIA Regulations.

13.11 STATEMENT OF SIGNIFICANCE

The Development itself will have an imperceptible effect on climate, however when considered cumulatively with the Gortahile Wind Farm and the generation of renewable electricity from other renewable energy developments in Ireland, will result in an avoidance of greenhouse gas emissions that would otherwise arise from fossil fuel power generation. This is considered a **profound-substantial positive effect** that is **significant** under the EIA Regulations.

Construction traffic arising from the Development and the Consented Grid Route cumulatively has the potential to adversely impact upon local air quality at sensitive receptors. The Development in combination with the Consented Wind Farm will have a **short-term, moderate effect** on air quality which is **not significant** in terms of the EIA Regulations.

14 POPULATION & HUMAN HEALTH

14.1 INTRODUCTION

This Chapter of the Environmental Impact Assessment Report (EIA Report) evaluates the effects of the construction, operation and decommissioning of the proposed Bilboa Wind Farm (the Development), on the Population and Human Health resource.

Population and Human Health make up a critical aspect of any environment, and any risk of significant impact to the quality of life that may be caused by a development must be comprehensively assessed.

This Chapter is supported by the following Figures provided in Volume II: EIA Report Figures:

- Figure 14.1: Local Study Area.

This Chapter includes the following elements:

- Key Conclusions of the 2011 EIS and FI;
- Legislation, Policy and Guidance;
- Assessment Methodology and Significance Criteria;
- Baseline Conditions;
- Assessment of Potential Effects;
- Mitigation and Residual Effects;
- Cumulative Effects Assessment;
- Summary of Effects; and
- Statement of Significance.

14.2 KEY CONCLUSIONS OF THE 2011 EIS AND FI

Baseline conditions relating to population and human health associated with the Consented Wind Farm were presented in Chapter 4 – 'Human Beings' of the 2011 Environmental Impact Statement (EIS). This included an assessment of the Consented Wind Farm on land-use, amenity activities, population, employment, socio-economics and health and safety assets.

The 2011 EIS concluded that at peak construction, approximately 20 – 25 jobs would be created and that the Consented Wind Farm is not expected to have any detrimental effect on employment, population, land-use or health and safety. Positive impacts were anticipated on local employment. Once operational, it is anticipated that the Consented Wind Farm will have a positive effect on other areas relating to human beings, such as an improved climate as a result of reduced emissions of greenhouse gases. Due to the impacts not being significant, no specific mitigation measures were required.

Following submission of the EIS, Further Information (FI) was submitted, responding to queries arising from the Consented Wind Farm EIS. In regards to Population and Human Health, further information was requested (Further Information Request 6) for the applicant at the time to submit details of Rights of Way, which were believed to be running through the Site, providing recreational access for the public and tourists. This request was met with an examination by the applicant of the Consented Wind Farm on the title of the lands, where it was ascertained that the previous owner, Coillte, had detailed no Rights of Way or other rights affecting the land. However, as Coillte operated an open forestry policy, members of the public and tourists were able to navigate the site under the Coillte Recreation Policy. The current owner is under no legal obligation to operate the same, or similar, open forestry policy, and subsequently chooses not to do so, therefore there was no change to the effects assessed within the 2011 EIS.

14.3 LEGISLATION, POLICY AND GUIDANCE

14.3.1 Legislation

EIAs are undertaken in response to the requirements of the European Union (EU) Directive 2014/52/EU[1] (the EIA Directive). **Chapter 2: EIA Methodology** outlines the relevant Environmental Impact Assessment (EIA) legislation including the enabling statutory instruments (S.I.) which transpose the EIA Directive into Irish law, are the European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018 (S.I. 296/2018)[2]; the Planning and Development Act 2000[3], as amended (the Planning Act); and Planning and Development Regulations 2001 (S.I. 600 of 2001)[4], as amended (the Planning Regulations). These regulations, when combined alongside the EPA 'Guidelines on the Information to be Contained in Environmental Impact Assessment Reports' 2022[5], form the EIA Regulations applicable to the Development which this Chapter has been written in accordance with.

Relevant overarching planning polices for the Development are detailed in **Chapter 3: Legislation, Energy and Planning Policy** and within the Planning Report that accompanies the planning application (the Application) for the Development.

The EIA Directive states that 'Population and Human Health' is to be assessed in an EIA Report. The recitals to the 1985[6] and 2011[7] Directives refer to 'human health' and include 'Human Beings' as the corresponding environmental factor. The EIA Directive changes the title of this factor to 'Population and Human Health'.

No specific guidance on the assessment of Human Health within the legislative context of Directive 2014/42/EU has been issued, as outlined in The EPA 2022 *'Guidelines on the Information to be Contained in Environmental Impact Assessment Reports'* (The EPA Guidelines)[8]; although, the same term is used in the European Union (EU) Strategic Environmental Assessment (SEA) Directive (2001/42/EC). The SEA Implementation Guidance states:

> *"The notion of human health should be considered in the context of the other issues mentioned in paragraph (f)".*

Paragraph (f) lists environmental factors including soils, water, air etc. This is consistent with 2002 Environmental Protection Agency (EPA) '*Guidelines on the Information to be*

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[1] European Commission (2014) Directive 2014/52/EU [Online] Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32014L0052&from=EN (Accessed 27/06/2022)
[2] Government of Ireland (2018) European Union (Planning and Development) (Environmental Impact Assessment) Regulations [Online] Available at: http://www.irishstatutebook.ie/eli/2018/si/296/made/en/print (Accessed 27/06/2022)
[3] Government of Ireland, (2000), Planning and Development Act, 2000 [Online] Available at: https://www.housing.gov.ie/planning/policy/planning-and-development-act-2000-no-30-2000 (Accessed 27/06/2022)
[4] Government of Ireland (2001), Planning and Development Regulations, 2001 [Online] Available at: http://www.irishstatutebook.ie/eli/2001/si/600/made/en/print (Accessed 27/06/2022)
[5] Environmental Protection Agency (2022) Guidelines on the Information to be Contained in Environmental Impact Assessment Reports [Online] Available at: https://www.epa.ie/publications/monitoring--assessment/assessment/EIAR_Guidelines_2022_Web.pdf (Accessed 27/06/2022)
[6] European Commission (1985) Directive 85/337/EEC [Online] Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A31985L0337 (Accessed 27/06/2022)
[7] European Commission (2011) Directive 2011/92/EU [Online] Available at: https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2012:026:0001:0021:En:PDF (Accessed 27/06/2022).
[8] Environmental Protection Agency (2022) Guidelines on the information to be contained in Environmental Impact Assessment Reports [Online] Available at: https://www.epa.ie/publications/monitoring--assessment/assessment/EIAR_Guidelines_2022_Web.pdf (Accessed 27/06/2022)

Contained in Environmental Impact Statements'[9] which provides guidance on the inclusion of these topics within the human health assessment:

> *"The evaluation of effects on these pathways is carried out by reference to accepted standards (usually international) of safety in dose, exposure or risk. These standards are in turn based upon medical and scientific investigation of the direct effects on health of the individual substance, effect or risk. This practice of reliance upon limits, doses and thresholds for environmental pathways, such as air, water or soil, provides robust and reliable health protectors [protection criteria] for analysis relating to the environment."*

The EPA Guidelines state also that the assessment of impacts on population and human health within an EIA Report should refer to the assessments of those factors under which effects to human health might occur, e.g. environmental factors of soils, water, air etc. The EPA Advice Notes (2015)[10] is a non-statutory document which goes beyond the requirements of the EPA Guidelines, and provides further discussion of how these factors can be addressed. The EPA Guidelines recommend, in line with the amended Directive, that an EIA Report should take account of the results of such assessments without duplicating them.

The EPA Guidelines state that employment, human health, and amenity and the three overarching topics that are to be addressed within the Population and Human Health chapter. The EPA Guidelines state that the legislation does not generally require assessment of land-use planning, demographic issues or detailed socio-economic analysis. Coverage of these can be provided in a separate Planning Application Report to accompany an application for planning permission. This should be avoided in an EIA Report, unless issues such as economic or settlement patterns give rise directly to specific new developments and associated effects. Regard has been given to the general approach advocated in this document when compiling this Chapter.

14.3.2 2006 Wind Energy Development Guidelines

Under Section 28 of the Planning and Development Act, 2000, the 2006 Wind Energy Development Guidelines[11] (WEDG) is the current Ministerial Guidance for the determination of wind energy development. A review of the Development Guidelines "Preferred Draft Approach"[12] is ongoing, however, until such time as a revision is completed, compliance with the 2006 guidelines is relevant to the determination of the proposed Development.

In December 2019, the Draft Revised Wind Energy Development Guidelines[13] (DWEDG) were published, and a public consultation ran until 19th February 2020. This guidance

[9] Environmental Protection Agency (2002) Guidelines on the information to be contained in Environmental Impact Statements [Online] Available at: https://www.epa.ie/pubs/advice/ea/guidelines/EPA_Guidelines_EIS_2002.pdf (Accessed 27/06/2022)

[10] Environmental Protection Agency (2015) Draft Advice Notes on Current Practice in the Preparation of Environmental Impact Statements [Online] Available at: https://www.epa.ie/pubs/consultation/reviewofdrafteisguidelinesadvicenotes/Draft%20Advice%20Notes%20for%20preparing%20an%20EIS.pdf (Accessed 27/06/2022)

[11] Department of Housing, Planning and Local Government (2006) Wind Energy Development Guidelines [Online] Available at: https://www.housing.gov.ie/sites/default/files/migrated-files/en/Publications/DevelopmentandHousing/Planning/FileDownLoad%2C1633%2Cen.pdf (Accessed 27/06/2022)

[12] Department of Communications, Climate Change & Environment (2017) Information Note: Review of the Wind Energy Development Guideline 2006 – "Preferred Draft Approach" [Online] Available at: https://www.dccae.gov.ie/documents/WEDG%20Review%20Information%20Note%20-%20Preferred%20Draft%20Approach.pdf (Accessed 27/06/2022)

[13] Department of Housing, Planning and Local Government (2019) Draft Revised Wind Energy Development Guidelines [Online] Available at: https://www.housing.gov.ie/sites/default/files/public-

does not provide specific guidance on the assessment of Population and Human Health for associated infrastructure of wind farms.

14.4 ASSESSMENT METHODOLOGY AND SIGNIFICANCE CRITERIA

14.4.1 Scope of Assessment

This Chapter considers the effect of the Development on population and human health. These will be covered under the following headings;

- Population;
- Employment; and
- Human health and amenity (including health and safety).

The population aspect will largely consider the effect of the Development against the demographic profile of the receiving environment. The principal socio-economic assessment criteria relate to the employment effects within a defined Study Area. These may be both temporary employment during the construction phase and permanent positions during the operational phase.

Potential impacts on human health are related primarily to construction and decommissioning related health and safety impacts, and operational impacts on public amenity. Human health is a broad topic with numerous inter-related aspects that are described throughout the EIA Report. This includes issues such as potential significant impacts of the Development on air quality and climate, landscape and visual impact, traffic and transport impacts, noise, archaeology and cultural heritage, material assets including tourism and utilities etc. are of intrinsic direct and indirect consequence to human health. The assessment of the Development on human health and amenity will draw together the findings of other assessments undertaken as part of the EIA process, however for detailed reference please refer to the corresponding EIA Report Chapter. Consideration will be given to the following assessments:

- **Chapter 6: Landscape and Visual Impact Assessment (LVIA);**
- **Chapter 10: Cultural Heritage and Archaeology; and**
- **Chapter 11: Noise and Vibration;**
- **Chapter 12: Material Assets – Roads and Traffic;**
- **Chapter 13: Air Quality and Climate;**
- **Chapter 15: Other Considerations.**

14.4.2 Elements Scoped in / out of the Assessment

Population

Due to the negligible magnitude of change to population that would occur as a result of the Development, there is not expected to be any significant effects on population as a result of the Development and therefore, further assessment on the effects of the Development on population is scoped out.

However, significant effects on population could occur cumulatively with the Consented Wind Farm, Grid Application and any other development in the Local Study Area (defined in Section 14.4.3) and therefore, a cumulative assessment for population is included within this Chapter

Employment

The 2011 EIS predicted that the Consented Wind Farm would make a positive contribution to the local economy both short and long term. It would provide contracting

consultation/files/draft_revised_wind_energy_development_guidelines_december_2019.pdf (Accessed 27/06/2022) and service opportunities locally during construction and deliver an income stream to the landowner and various contracting opportunities during operation.

Although the electricity generating capacity will increase and effects will remain beneficial as a result of the Development, the magnitude of change on employment will be negligible and the general pattern of predicted impacts identified are not expected to change significantly from those predicted in the 2011 EIS.

Given that the general findings of the 2011 EIS are not predicted to change significantly or result in significant effects as a result of the Development, employment is not considered further when assessing the likely effects of the Development.

However, significant effects on employment could occur cumulatively with the Consented Grid Route and any other development in the Local Study Area (defined in Section 14.4.3) and therefore, a cumulative assessment for employment is included within this Chapter.

Human Health and Amenity

Potential impacts on human health are related primarily to construction and decommissioning related health and safety impacts, and operational and decommissioning impacts on public amenity. Human health is a broad topic with numerous inter-related aspects that are described throughout the EIA Report.

The 2011 EIS assessed potential effects on noise, shadow flicker, landscape, air quality and climate, and road traffic and transportation which can have effects on the population and human health.

These potential effects upon human health and amenity were assessed under different headings in the Original Wind Farm EIS. No further assessments are required for those topics where there are no likely significant adverse effects. Relevant assessments for where there may be significant adverse effects are provided in the technical chapters. Table 14.1 below details the elements scoped in and out the assessment on human health and amenity in relation to the inter-related topics.

Table 14.1: Human Health and Amenity Scope of Assessment

Inter-related Topic	**Description**	**Scoped In/Out of the Human Health & Amenity Assessment**
Noise	Potential noise effects could occur as a result of the Development due to the alteration of the proposed turbine as a result of the Increased Rotor Diameter.	Scoped In
Shadow Flicker	Potential shadow flicker effects could occur as a result of the Development due to the alteration of the proposed turbine as a result of the Rotor Modification	Scoped In
Landscape and Visual	Significant effects could occur on visual or residential amenity on nearby residential receptors during construction as a result of the Development due to the removal of the Proposed Additional Felling.	Scoped In
Air Quality	Potential effects on human health and amenity as a result of adverse effects upon air quality during construction of the Development would be mitigated against by adhering to construction best practice and methods which were set out in the 2011 EIS and in the Construction Environmental Management Plan submitted as part of the Application and found in Volume III: EIA Technical Appendix 4.1. Wind turbines do not emit air pollutants and therefore it is concluded that there would be no significant adverse effects upon	Scoped Out

	air quality which might otherwise affect human health and amenity.	
Climate	Potential positive effects could occur on human health and amenity as a result of the Development due to the lower carbon forms of generation and a reduction in greenhouse gasses in the local study area.	Scoped In
Traffic and Transport	Potential effects on human health could occur as a result of the traffic from the Proposed Felling	Scoped In

Additionally, significant effects on human health and amenity could occur cumulatively with the Consented Grid Route and any other development in the Local Study Area (defined in Section 14.4.3) and therefore, a cumulative assessment for human health and amenity is included within this Chapter.

Health and Safety

The 2011 EIS identified a number of health and safety concerns regarding the operation of the Consented Wind Farm including electromagnetic radiation, structural integrity of turbines and hazard from falling ice. It was concluded that, following accordance with recognised best practice, effects on health and safety were not considered a significant as a result of the Original Wind Farm.

Given that the general findings of the 2011 EIS are not predicted to change or result in significant effects as a result of the Development individually or cumulatively, health and safety is not considered further when assessing the likely effects of the Development.

Summary

The following elements are scoped into the assessment:

- Population (cumulative assessment only);
- Employment (cumulative assessment only); and
- Human Health and Amenity (both an assessment on as a result of the Development and a cumulative assessment).

14.4.3 Study Area / Survey Area

The study areas used within the assessment for population and employment are as follows:

- The 'Local' study area is defined as the Electoral Divisions (EDs) of Rathornan, within which the Development Site is located;
- The 'Regional' study area is defined as County Carlow; and
- The 'National' study area is defined as the Republic of Ireland.

Figure 6.1 shows the extent of the local study area in relation to the Development red line Boundary (the Site Boundary).

It is not considered likely that there will be any significant effects on human health and health and safety beyond the local study area, therefore effects at the regional and national level for these aspects are not considered further.

14.4.4 Baseline Survey Methodology

The baseline has been used to assess the sensitivity of receptors within the study areas. The baseline conditions identified in this Chapter have been established through desk based studies, including a review of the following relevant sources of information:

- CCC website;[14]
- Central Statistics Office Census Results[15];
- A socio-demographic profile of Carlow, 2019[16];
- World Heritage Ireland[17]; and
- Tourism Ireland[18].

Other Chapters within this EIA Report also provided relevant information for the baseline e.g. local receptors and assets, including:

- **Chapter 6: Landscape and Visual Impact Assessment (LVIA);**
- **Chapter 10: Cultural Heritage and Archaeology; and**
- **Chapter 11: Noise and Vibration;**
- **Chapter 12: Material Assets – Roads and Traffic;**
- **Chapter 13: Air Quality and Climate;**
- **Chapter 15: Other Considerations.**

The baseline has been gathered using professional judgement and interpretation, drawing on the documents and resources outlined above and utilising best practice methodologies as outlined in the EPA's EIA Guidelines.

14.4.5 Methodology for the Assessment of Effects

Effects on the population, human health and socio-economics can be described as direct, indirect or cumulative. The assessment aims to predict the likely effects (both beneficial and adverse) arising from the Development; social and economic effects are divided into:

- Direct effects: socio-economic opportunities that can be created as an immediate effect of the Development;
- Indirect effects: opportunities that will be created by the Development further down the supply chain, for example, companies providing services to the Development;
- Cumulative Effects: where the combined effect of two or more developments are of greater significance than those of the Development itself.

The prediction of potential significant effects covers two phases of the Development; construction and operation, as different population, human health and socio-economic effects are likely to arise during the different stages. The effects during construction are generally considered to be short term effects, and those arising as a result of the operation of the Development are generally considered to be long term effects. The key issues for the assessment of potential effects relating to the Development are:

- Short-term direct and indirect effects arising from the construction phase e.g. reduction in amenity due to construction traffic;
- Long-term direct and indirect effects that occur during the Operational phase, but are mitigated at decommissioning e.g. reduction in amenity due to loss of greenspace to construction sites as a result of the Development; and
- Long-term direct and indirect effects that continue after decommissioning e.g. outward migration of the population from the area as a result of the Development.

The significance of effects resulting from the Development will be determined through a combination of the sensitivity of the receiving environment (the sensitivity) and the predicted degree of change (the magnitude) from the baseline state.

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[14] Carlow County Council (2020) [Online]Available at: http://www.carlow.ie/ (Accessed 27/06/2022)
[15] An Phriomh-Oifig Staidrimh [Online] Available at: https://www.cso.ie/en/census/ (Accessed 27/06/2022)
[16]Carlow County Council (2019) A socio-demographic profile of Carlow, 2019 [Online] Available at: http://www.carlow.ie/wp-content/documents/uploads/Carlow%20Socio%20Economic%20Profile%202019.pdf
[17] World Heritage Ireland (2020) Available at: http://www.worldheritageireland.ie/bru-na-boinne/ (Accessed 27/06/2022)
[18] Tourism Ireland (2020) Available at: https://www.tourismireland.com/ (Accessed 27/06/2022)

14.4.5.1 Sensitivity of Receptors

The sensitivity of the receptor/asset to an effect reflects the level of importance assigned to it. This allows the identification of key population, human health and socio-economics assets. The criteria used for defining sensitivity to effects on human health, population or socio-economic assets are as follows:

- High Sensitivity: The asset has little to low capacity to absorb change without fundamentally altering its present character, is of high socio-economic value, or of national importance to the population of Ireland and the health of the population. For example, any change to the resource could result in fundamental changes to the population, structure of community, and economic activity;
- Medium Sensitivity: The asset has moderate capacity to absorb change without substantially altering its present state, has some socio-economic value, or some importance to the population and/or the health of the population, or is of regional importance (e.g. to County Carlow and/or County Laois);
- Low Sensitivity: The asset is tolerant to change without detriment to its character, has low socio-economic value or is of low importance to the population and/or health of the population, or is of local importance (e.g. to the Local Study Area);
- Negligible Sensitivity: The asset is resistant to change and is of little socio-economic value or little importance to the population and/or health of the population.

14.4.5.2 Magnitude of Change

In determining the magnitude of change, the values of the asset affected are first defined. This provides the baseline against which the magnitude of change can be assessed; the magnitude of effect being proportional to the degree of change in the asset's baseline value. The criteria for assessing the magnitude of change are as follows:

- High Magnitude: Major alteration (positive or negative) to the population, human health or socio-economic resource, as a result of a fundamental change to the baseline condition;
- Medium Magnitude: Loss of, or alteration to (positive or negative), one of more key elements of population, human health or socio-economic baseline value;
- Low Magnitude: Slight alteration (positive or negative) of the population, human health or socio-economic resource value;
- Negligible Magnitude: Barely perceptible alteration (positive or negative) of the population, human health or socio-economic resource.

14.4.6 Assessment of Significance

The evaluation of significance presented in Table 6.1 provides a guide to decision making, but it is not a substitute for professional judgement and interpretation, particularly where the sensitivity or effect magnitude levels are not clear or are borderline between categories. Effects predicted to be of profound or substantial significance are considered to be 'significant' in the context of the EIA Regulations, and are shaded in light grey in the Table 6.1.

Table 6.1: Framework for Assessment of the Significance of Effects

Magnitude of Change	**Sensitivity of Resource or Receptor**			
	High	**Medium**	**Low**	**Negligible**
High	Profound – Very Significant	Significant - Moderate	Moderate - Slight	Slight - Imperceptible
Medium	Significant - Moderate	Moderate	Slight	Imperceptible

Low	Moderate - Slight	Slight	Slight – Not Significant	Imperceptible
Negligible	Slight - Imperceptible	Imperceptible	Imperceptible	Imperceptible

Effects can be positive, negative or neutral and these are specified where applicable in the assessment within this Chapter.

For assessing significance, consideration is given to the national, regional and local baseline situation. The magnitude of the impact is determined in proportion to the area of impact relevant to each receptor.

In terms of population and human health factors, potential effects would be significant if the Development resulted in any fundamental or material changes in population, structure of community, health of the community, and economic activity during the operational phase of the Proposed Development.

14.5 BASELINE CONDITIONS

14.5.1 Population

14.5.1.1 Local Study Area

As outlined in Section 14.4.3, the Development Site is located within ED Rathornan. The most recent Census survey was undertaken in April 2016 which provided a breakdown of the Divisions within the Census 2016 Small Area Population Statistics[19]. It details that the total population of Rathornan was 445 and the total housing stock was 136, including 8 vacant households.

14.5.1.2 Regional Study Area

The population of County Carlow in 2016[20] was 56,932, which at the time was the third lowest in the Irish State. Carlow's population increased by 13.1% between 2006 and 2016. Both the population of County Carlow and Irish State are progressively ageing.

14.5.1.3 National Study Area

According to the latest 2016 Census results, the population of Ireland stood at 4, 761,865. This was an increase of 3.8% since April 2011. It showed the average age of the population was 37.4 years, showing significant increases in both the number of males and females aged over 65 since the last Census, at 22% and 16.7% respectively, reflecting an aging population.

14.5.2 Employment

14.5.2.1 Local Study Area

There is no formal, detailed employment data for the Local Study Area, however, the CCC socio-demographic profile document[21] and LCC's LECP[22] provide a breakdown of the percentage of local employment by sector, which may be used as an indicator given the

[19] Central Statistics Office, Census 2016 Small Area Population Statistics [online] Available at: https://www.cso.ie/en/census/census2016reports/census2016smallareapopulationstatistics/ (Accessed 27/06/2022)
[20] http://www.carlow.ie/wp-content/documents/uploads/Carlow%20Socio%20Economic%20Profile%202019.pdf
[21] Carlow County Council (2019) A socio-demographic profile of Carlow, 2019 [online] Available at: http://www.carlow.ie/wp-content/documents/uploads/Carlow%20Socio%20Economic%20Profile%202019.pdf (Accessed 27/06/2022)
[22] Laois County Council (2016) Laois Local Economic and Community Plan [online] Available at: https://www.laois.ie/wp-content/uploads/Full-Adopted-LECP-Plan.pdf (Accessed 27/06/2022)

Local Study Area largely falls within this area. Additionally, the available data for the Regional and National Study Areas have been used to form the baseline.

The employment profile for CCC shows the following approximate breakdown of local jobs per respective sector:

- Agriculture, Forestry and Fishing - 2%;
- Manufacturing, Mining and Quarrying, Electricity, Gas, Water and Waste – 15.2%;
- Construction – 3.7%;
- Wholesale, Retail Trade, Transportation, Accommodation and Food – 26.2%;
- ICT, Financial, Real Estate, Professional, admin and support service activities – 16.4%;
- Public Administration – 8.6%; and
- Education, Human Health and Social Work – 24.4%;
- Other Service Activities – 2.8%; and
- Unknown – 0.5%.

LCC's LECP provides an approximate breakdown of workers by industry:

- Agriculture, Forestry and Fishing – 10%;
- Manufacturing – 9%;
- Building and construction- 3%;
- Commerce and trade – 24%;
- Professional services – 25%;
- Public administration – 11%;
- Transport and communications – 6%; and
- Other – 12%.

Following a more detailed review of the CCC and LCC's socio-demographic profile document, it is clear that within the Local Study Area, agriculture and commercial forestry are the more dominant industries in the land immediately surrounding the Development Site. There is a dominance of agricultural farm land and forestry surrounding the Development Site, and a limited presence of other industrial facilities, indicating that agriculture and forestry are key local industries.

14.5.2.2 Regional Study Area

The socio-demographic profile document produced by CCC provides an outline of employment in the County. Employment in County Carlow over the past 20 years has largely been influence by employment and migration of people from the Greater Dublin Area. The overall labour force participation rate in County Carlow is marginally below average when compared to Ireland as a whole. Carlow Town is a significant employment base within the County. The largest source of employment within the County are small enterprises with up ten employees, which account for almost half of the industrial jobs. Agriculture jobs are also a substantial percentage of employment in Carlow, accounting for over half of all jobs. Within County Carlow, the highest concentrations of unemployment are found within Carlow Town, Tullow and Hacketstown.

The Laois Local Employment and Community Plan (LECP) outlines employment percentages by industry. It shows that the highest employing industries are Professional Services and Commerce and Trade, accounting for 25% and 24% of the employment sector respectively. Agriculture is also an important sector to the County, accounting for 10% of the industry. Employment levels in the construction industry decreased significantly from 14% to 5% in 2011, which indicates that there is potentially an over-reliance on the construction industry in the County. According to the 2011 Census, unemployment in Laois was standing at 21.4% of the waged labour population, above the national average of 19%. Unemployment is seen as a critical issue within the overall socio-economic picture of the County.

14.5.2.3 National Study Area

The Central Statistics Office (CSO) Ireland produces Quarterly Labour Force Survey's every quarter, which has been used to establish the socio-economic and employment baseline for the National Study Area. The Survey for Q4 2019[23] showed that there was an annual increase of 3.5%, equating to 79,900, in the year to the fourth quarter of 2019. This brought the total employed force to 2,361,200. The increase in total employment of 79,000 in the year to Q4 of 2019 was represented by an increase in full-time employment of 49,500 (an increase of 2.7%) and an increase in part-time employment of 30,400 (an increase of 6.6%).

It is understood that within the Local Study Area, key employment sectors are manufacturing, wholesale and retail trade and agriculture.

14.5.3 Human Health and Amenity

There are no residential properties located within the Site; the nearest residential property is located approximately 0.5 km south-east of closest turbine (T1).

The Site is located in a rural setting, and the nearest village is Bilboa located 1.1 km north- of the Site. The local road network also has a relatively high density of properties.

As outlined in Section 14.4.1, the human health and amenity aspect of the assessment will draw on the findings of other assessments undertaken within this EIA in order to assess the effect of the Development on human health.

14.5.3.1 Local Study Area

Amenity assets are largely addressed in **Chapter 15: Other Considerations** with relation to tourism and associated recreational activities, and so this assessment will focus on effects on amenity for the surrounding population, primarily the residential receptors within the local study area. Where other chapters provide relevant information on the baseline for residential amenity, effects on these will be summarised in the assessment of effect.

The Local Study Area is dominated primarily with residential properties and associated farmland and forestry. Given the rural setting and natural landscape, the adjacent roads and local area may be used for recreational activities such as walking and cycling.

The Slieve-Margy Way, a local level walking route promoted in County Carlow[24], passes through the Development Site at the L7129 public road.

14.6 ASSESSMENT OF POTENTIAL EFFECTS

14.6.1 Population

As detailed in Section 14.4.1.1, an assessment on the effects of the Development on population has been scoped out; however, an assessment on cumulative effects on population has been undertaken in Section 14.7.

14.6.2 Employment

As detailed in Section 14.4.1.1, an assessment on the effects of the Development on employment has been scoped out due to a negligible magnitude of change; however, an assessment on cumulative effects on employment has been undertaken in Section 14.7

[23] Central Statistics Office. (2020). Labour Force Survey (LFS). Available at: https://www.cso.ie/en/releasesandpublications/er/lfs/labourforcesurveylfsquarter42019/ (Accessed 27/06/2022)
[24] Carlow Tourism. (2020). The Slieve-Margy Way [online]. Available at: https://carlowtourism.com/the-slieve-margy-way-2/ (Accessed 27/06/2022)

14.6.3 Human Health and Amenity

Human health and amenity encompass a range of experiential factors, including visual pleasure, a sense of space, exercise, fresh air, light, company or solitude, tranquillity, appreciating wildlife and other factors, which may include subjective factors. It is not necessarily the case that a significant visual effect (or other type of effect) leads to a significant amenity effect, although it may, and this is considered in the following assessments.

No significant effects were identified with regards to the other assessments that may have an impact on human health and amenity, for any phase of the Development. This includes noise, air quality and climate, LVIA (including residential amenity), traffic and transport, and material assets (including shadow flicker).

14.6.3.1 Construction Effects

The Site is wholly located on private forestry land, existing forestry tracks. The Site is of low sensitivity for amenity as it comprises mainly private land, has no areas of public access and does not contain any paths or recreational facilities which are of importance at a regional or national level.

As detailed in Section 14.6.3, no significant effects were identified with regards to the other assessments that may have an impacts during construction. Table 14.3 summarises the conclusion of assessment of these inter-related topics included within this EIA Report.

Table 14.3: Summary of Inter-Related Topic/EIA Report Chapter

Inter-Related Topic & EIA Report Chapter	**Summary of Assessment within EIA Report**
Chapter 6: LVIA	Chapter concludes that no significant visual or residential amenity effects will occur as a result of the construction of the Development.
Chapter 10: Material Assets – Roads and Traffic	Chapter concludes that the Proposed Felling would result in a short-term, direct effect on the local roads during construction due to increased construction felling traffic using the local road. The public roads have a low sensitivity, as they are of local importance and transport routes will generally be available from other locations surrounding the Development.
Chapter 11: Noise and Vibration	Chapter concludes that there will be no significant effects as a result of construction noise on residential receptors due to the temporary nature of the construction works for the Development.

There is potential for inter-related effects from the aforementioned topics to impact upon human health. Overall, it is quantitatively demonstrated through the conclusions of each of the aforementioned topics summarised in Table 14.3, that the Development result in a negligible magnitude of change with no significant effects on these topic areas. When considering the potential for in-combination construction effects on human health and amenity to occur from the aforementioned topics, given the limited individual magnitude of change identified in each chapter, the combined magnitude of change of these impacts on health human health and amenity, is a slight-imperceptible effect which is **not significant** in terms of the EIA regulations.

14.6.3.2 Operational Effects

As detailed in Section 14.6.3, no significant effects were identified with regards to the other assessments that may have an impacts during the operational phase of the Development. Table 14.4 summarises the conclusion of assessment of these inter-related topics included within this EIA Report.

Table 14.4: Summary of Inter-Related Topic/EIA Report Chapter

Inter-Related Topic & EIA Report Chapter	**Summary of Assessment within EIA Report**
Chapter 6: LVIA	Chapter concludes that no significant visual or residential amenity effects will occur as a result of the construction of the Development.
Chapter 13: Air Quality and Climate	Chapter concludes a positive, not significant effect on climate as a result of increased carbon savings.
Chapter 15: Other Considerations (Shadow Flicker)	Chapter concludes that the level of shadow flicker effects on residential receptors within the study area as a result of the Rotor Modification is not significant.

As detailed in Section 14.6.3.1, there is potential for inter-related effects from the aforementioned topics to impact upon human health. Overall, it is quantitatively demonstrated through the conclusions of each of the aforementioned topics summarised in Table 14.4, that the Development result in a negligible magnitude of change with no significant effects on these topic areas during the operational phase. However, a positive non-significant effect was predicted on climate as a result of carbon savings.

When considering the potential for in-combination operational effects on human health to occur from the aforementioned topics, given the limited individual magnitude of change identified in each chapter, the combined magnitude of change of these impacts on human health and amenity, a high sensitivity receptor, will be negligible. This will result in a slight-imperceptible effect which is **not significant** in terms of the EIA regulations.

14.6.3.3 Decommissioning Effects

Effects on human health and amenity during the decommissioning phase are anticipated to be of a similar nature and scale as construction effects and are therefore, **not significant.**

14.7 CUMULATIVE EFFECT ASSESSMENT

It is critical that a cumulative assessment is undertaken in order to take a holistic approach to the assessment of environmental effects, which incorporates all related development. A cumulative effect is considered to be an additional effect arising from the Development in addition to the combination of other developments that are likely to affect the population and human health resource. The methodology followed to assess the cumulative effects is the same as that used for the Development in isolation.

Cumulative developments related to the Development include:

- The Consented Grid Route; and
- Gortahile Wind Farm (located approximately 1.5 km north).

14.7.1 Population

14.7.1.1 Construction Effects

A search for or developments requiring substantial construction works was undertaken to a distance of 5 km from the Development. No such developments were found with the exception of the Grid Application.

Gortahile Wind Farm, located approximately 1.5 km north of the Development is constructed and been fully operational since 2010. Cumulative construction effects could occur with the Development and Gortahile Wind Farm if decommissioning was to occur on Gortahile at the same time as the Development was being constructed; however, Gortahile Wind Farm is not anticipated to be decommissioned until 2035 based on its 25 year operational period and therefore, there is no prospect of the construction or decommissioning of Gortahile Wind Farm coinciding with the construction of the Development. Thus, no significant population effects are predicted as a result of the construction of the Development with Gortahile Wind Farm.

It is anticipated that the Development and the Grid Application construction will be undertaken as part of the wider Consented Wind Farm construction programme. Therefore, construction of Consented Wind Farm with the Development and the Grid Application will require approximately 19 months to complete.

Given that the construction of the Development will facilitate the construction of the Wind Farm and Grid Connection Route, the effects of construction workers temporarily migrating into the area will be increased and extended to the construction period of the Consented Wind Farm and Grid Application. As detailed in Section 15.5.1.1, the total population of Rathornan was 445 and the total housing stock was 136, including 8 vacant households.

At a local level, there may be a short term increase in population as a result of construction workers temporarily migrating into the area for the duration of the construction period, staying in accommodation within the area in order to be close to the Development, Consented Wind Farm and the Consented Grid Route. Combined, there will be approximately 40 job roles across the Development and the Consented Grid Route. Therefore, at maximum, there would be up to 40 as an increase of the population for a temporary period of up to 19 months. This small increase (e.g. ~2% increase for 19 month) in population does not constitute as significant, as the magnitude of change will be negligible in terms of the long term population of the area, on a local level, given the short-term nature of the intensive construction period.

These effects, when considered cumulatively are considered a negligible magnitude of change. The construction of the Development and the Consented Grid Route will occur during at a local level and will be short-term in nature. This does not constitute as significant change in the long-term population of the area, and therefore would be a short-term, direct, slight-imperceptible effect which is **not significant** in terms of the EIA Regulations.

14.7.1.2 Operational Effects

The key potential effect in the cumulative assessment is that population levels may change as a result of outward migration if the local area were to change to a significant degree as a result of the cumulative developments. This is strongly linked to visual, traffic and noise effects, for example changes in the residential environment that would make the surrounding area an unpleasant place to live. The EIS for the Original Wind Farm concluded that the development would not contribute towards cumulative landscape and visual, traffic or noise effects. Likewise, the EIA Report for the Consented Grid Route concluded the same.

In terms of population, the magnitude of change as a result of the Development is not expected to contribute to any significant, negative cumulative effects on other existing and proposed developments in the vicinity. It is expected that the effects would be imperceptible, which is **not significant** in terms of the EIA Regulations.

14.7.2 Employment

14.7.2.1 Construction Effects

The construction of the Development along with the Consented Grid Route means that the local area can benefit more greatly from indirect supply chain opportunities and direct employment opportunities. For example, the greater the capacity of consented and constructed developments in the area, the more likely it is that the local area can benefit from supply chain opportunities.

Gortahile Wind Farm, located approximately 1.5 km north of the Development is fully constructed and operational and therefore, no cumulative construction effects will occur on employment during the construction of the Development with Gortahile Wind Farm.

As stated in the section 14.7.1.1, approximately 40 jobs could be created during the peak construction phase as a result of the Development and the Consented Grid Route, with indirect effects likely arising from the manufacturing of required building materials and construction equipment. In addition to this direct effect, there is likely to be an increased indirect effect on supply chains when considering all cumulative developments; establishments such as local cafes etc. may see an increased level of business during construction and subsequently employ further members of staff. These effects, direct and indirect, represent a short term, slight, positive effect on the construction, energy generation, and local amenity sectors. This would be **not significant** under the EIA Regulations.

The potential exists in the future, should a large enough number of wind farms and other developments be consented in the area, for job creation to occur to support the industry. However, at a regional level, the sustaining of jobs, in construction in particular, is considered to be **not significant.**

14.7.2.2 Operational Effects

The positive employment effects would be increased as a result of the operation of the Wind Farm and Gortahile Wind Farm, however the Development and the Consented Grid Route would not result in any change to the operational employment effects of the Consented Wind Farm.

Chapter 4 of the EIS for the Original Wind Farm identified that there would likely be at least one long-term position available for employment, and potentially an additional 2- 3 permanent positions for maintenance work created during the operational phase. It is likely that operations and maintenance operations of the cumulative developments (including Grid Application) will also provide 2-3 long-term positions; however, this is **not significant** in terms of the EIA Regulations.

This would constitute a long term, slight, positive effect, which is **not significant** in terms of the EIA Regulations.

14.7.2.3 Decommissioning Effects

Cumulative effects on population during the decommissioning phase are anticipated to be of a similar nature and scale as construction effects thereby resulting in an imperceptible effect which is **not significant** in terms of the EIA Regulations.

14.7.3 Human Health and Amenity

14.7.3.1 Construction Effects

The EIS for the Original Wind Farm assessed potential effects of traffic, noise and visual impact effects. No significant effects were identified with regards to these assessments, nor were significant effects identified within the assessment for human health. The negligible magnitude of change from the Development would not alter the conclusions of the 2011 EIS, and no significant cumulative effects on human health and amenity will occur as a result of the Development.

When considered cumulatively, while the Development construction programme which will occur concurrently with the Consented Grid Route construction, where possible, resulting in a slight extension to the programme, ensuring works on public roads are not being undertaken when turbine deliveries are occurring. This was considered within the

EIA Report for the Consented Grid Route submitted in June 2020 and despite this extended programme, **no significant cumulative effects** were predicted as a result of this extended construction period.

The Development would result in a negligible magnitude of change and would not alter the conclusions of the Grid Application EIA as that EIA took account of the Consented Wind Farm construction. Therefore, **no significant cumulative effects** will occur as a result of the Development and the Consented Grid Route.

14.7.3.2 Operational Effects

Following the outlined mitigation, no significant effects were identified with relation to human amenity in the EIS for the Original Wind Farm. The negligible magnitude of change of the Development will not alter the conclusions of the Consented Wind Farm EIS and EIA Report, and no significant cumulative effects will occur from the Development.

Additionally, no significant cumulative effects have been identified within the EIA for the Grid Connection Route in relation to human amenity in the respective chapters. Therefore, the negligible magnitude of change that would occur as a result of the Development will not alter these conclusions and therefore, **no significant cumulative operational effects** are predicted from the Development and the Consented Grid Route in terms of the EIA Regulations. Therefore, the effects of the Development when assessed cumulatively is not considered to have a long- or short-term effect on human health and amenity levels during operation.

14.7.3.3 Decommissioning Effects

Cumulative effects on human health and amenity during the decommissioning phase are anticipated to be of a similar nature and scale as construction effects thereby resulting in **no significant effects.**

14.8 'DO-NOTHING' ALTERNATIVE

Should the Development not take place, the baseline scenario for population and human health would remain the same as outlined in Section 14.5**.** However, it should be noted that as no significant effects are expected to arise as a result of the Development, there will be no significant changes to the baseline scenario if the Development is to take place in terms of the EIA Regulations.

14.9 MITIGATION AND RESIDUAL EFFECTS

As per the 2011 EIS, no specific mitigation was required for population, employment and socio-economic effects as impacts on these are anticipated to be not significant. Health and safety provisions will be in accordance with recognised best practice. General health and safety procedures will include, but will not be limited to, those stated in the 2011 EIS, including:

- Site access will be restricted to authorised construction personnel only;
- A secure Site will be maintained at all times with restricted areas being clearly marked;
- All appropriate safety regulation signage will be displayed at the Site entrance and elsewhere as appropriate; and
- All construction works will be to codes of practice and certified standards set by the various construction trades, such as electricians, excavators, etc.

14.10 SUMMARY OF EFFECTS

Table 14.6 provides a summary of the effects detailed within this Chapter.

Table 14.6 Summary of Effects

Receptor	Potential Effect	Significance of Effect	Mitigation Proposed	Residual Effect
Construction Phase				
Local population	Increase to population on a local level over a the construction period	Imperceptible Not significant as per the EIA Regulations.	None	Imperceptible Not significant as per the EIA Regulations.
Employment	Increase in employment opportunities throughout the construction period	Slight Not significant as per the EIA Regulations.	None	Slight Not significant as per the EIA Regulations.
Employment	Construction related skills development	Slight Not significant as per the EIA Regulations.	None	Slight Not significant as per the EIA Regulations.
Local residents	Adverse effects on local amenity	Slight Not significant as per the EIA Regulations.	None	Slight Not significant as per the EIA Regulations.
Public people and construction workers	Risk to safety	Negligible Not significant as per the EIA Regulations.	None	Negligible Not significant as per the EIA Regulations.
Operational Phase				
Employment	Employment and business opportunities	Slight-imperceptible Not significant as per the EIA Regulations.	None	Slight-imperceptible Not significant as per the EIA Regulations.
Health and safety	Risk to human safety	Imperceptible Not significant as per the EIA Regulations.	None	Imperceptible Not significant as per the EIA Regulations.

14.11 STATEMENT OF SIGNIFICANCE

No significant effects in terms of the EIA Regulations are predicted on population, employment, human health and amenity, including health and safety, during the construction or operation phases of the Development.

15 OTHER CONSIDERATIONS

15.1 INTRODUCTION

This Chapter of the Environmental Impact Assessment Report (EIA Report) evaluates the effects of the Bilboa Wind Farm (the Development), on the other considerations, not covered in Chapters 6 – 14. This assessment was undertaken by Arcus Consultancy Services Limited (Arcus).

This Chapter includes an assessment on the following topics:

- Tourism and Recreation;
- Electromagnetic Interference, Television and Communication Signals;
- Air Navigation; and
- Shadow Flicker.

This Chapter includes the following elements:

- Key Conclusions of 2011 EIS & FI;
- Changes to Legislation, Policy and Guidance;
- Assessment Methodology;
- Baseline Conditions;
- Assessment of Potential Effects; and
- Cumulative Effects Assessment.

15.2 OVERARCHING LEGISLATION, POLICY AND GUIDANCE

The enabling Statutory Instruments (S.I.) which transpose the EIA Directive into Irish law are the European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018 (S.I. 296/2018)[1]; the Planning and Development Act 2000[2], as amended (the Planning Act); and Planning and Development Regulations 2001 (S.I. 600 of 2001)[3], as amended (the Planning Regulations). These regulations, when combined alongside the EPA 'Guidelines on the Information to be Contained in Environmental Impact Assessment Reports' 2022[4], form the EIA Regulations applicable to the Development.

15.3 TOURISM AND RECREATION

15.3.1 Key Conclusions of the EIS, EIA & FI

The Original Wind Farm Environmental Impact Statement (the 2011 EIS) and the Consented Modification Environmental Impact Assessment (the 2020 EIA) assessed the impact of the Consented Wind Farm on tourism receptors; the 2011 EIS and the 2020 EIA concluded there were no negative significant effects on tourism anticipated.

FI Request 6 requested that the applicant at the time submit details of Rights of Way, which were believed to be running through the Site, providing recreational access for the

[1] Government of Ireland (2018) European Union (Planning and Development) (Environmental Impact Assessment) Regulations [Online] Available at: http://www.irishstatutebook.ie/eli/2018/si/296/made/en/print (Accessed 27/06/2022)
[2] Government of Ireland, (2000), Planning and Development Act, 2000 [Online] Available at: https://www.housing.gov.ie/planning/policy/planning-and-development-act-2000-no-30-2000 (Accessed 27/06/2022)
[3] Government of Ireland (2001), Planning and Development Regulations, 2001 [Online] Available at: http://www.irishstatutebook.ie/eli/2001/si/600/made/en/print (Accessed 27/06/2022)
[4] Environmental Protection Agency (2022) Guidelines on the Information to be Contained in Environmental Impact Assessment Reports [Online] Available at: https://www.epa.ie/publications/monitoring--assessment/assessment/EIAR_Guidelines_2022_Web.pdf (Accessed 27/06/2022)

public and tourists. This request was met with an examination by the applicant of the Consented Wind Farm on the title of the lands, where it was ascertained that the previous owner, Coillte, had detailed no Rights of Way or other rights affecting the land. However, as Coillte operated an open forestry policy, members of the public and tourists were able to navigate the site under the Coillte Recreation Policy. The current owner is under no legal obligation to operate the same, or similar, open forestry policy, and subsequently chooses not to do so, therefore there was no change to the effects assessed within the 2011 EIS.

15.3.2 Changes to Legislation, Policy and Guidance since EIS, EIA & FI

National guidance which has been published since the 2011 EIS included the 2012 Irish Wind Energy Association (IWEA) Best Practice Guidelines for the Irish Wind Energy Industry[5] (the IWEA Guidelines). Section 6.3.12 of the IWEA Guidelines includes guidance on the impact of tourism and recreation as a result of a proposed developments. There is no change required to the tourism and recreation as a result of this guidance.

Additionally, the Carlow County Development Plan 2009-2015 was used to inform the assessment within the 2011 EIS. This local guidance has since been updated and superseded by the Carlow County Council Development Plan 2022-2028[6]. The tourism and recreation assessment does not require updating as a result of this update in the County Carlow Development Plan.

Additionally, the Draft Revised Wind Energy Development Guidelines were published for public consultation in December 2019[7]. As these Draft Guidelines are in the preliminary stages and will likely be amended prior to finalisation, this Chapter has taken accordance of them; however, the assessment does not require updating as a result of the Draft Guidelines.

The EPA 'Guidelines on the Information to be Contained in Environmental Impact Assessment Reports' 2022[8] were published in May 2022 and will be used to determine the significance of effect.

Chapter 3: Planning and Energy Policy of this Report contains full details of current planning policy.

15.3.3 Assessment Methodology

The significance of the potential effects of the Development has been classified by professional consideration of the sensitivity of the receptor and the magnitude of the potential effect.

15.3.3.1 Study Area / Survey Area

For tourism, the study area comprises the land within the Development's red line boundary (Site Boundary) in considering direct effects, and within 5 km of the Development in considering indirect effects.

[5] IWEA (2012) Best Practice Guidelines for the Irish Wind Energy Industry [Online] Available at: https://www.iwea.com/images/files/9660bdfb5a4f1d276f41ae9ab54e991bb600b7.pdf (Accessed 27/06/2022)
[6] Carlow Council (2022) Carlow Council Development Plan 20122-28. Available at https://consult.carlow.ie/system/files/materials/5/Carlow%20County%20Development%20Plan%202022%20%E2%80%93%202028%20Issues%20Paper.pdf (Accessed 27/06/2022)
[7] Department of Housing, Planning and Local Government (2019) Draft Revised Wind Energy Development Guidelines [Online] Available at: https://www.housing.gov.ie/sites/default/files/public-consultation/files/draft_revised_wind_energy_development_guidelines_december_2019.pdf (Accessed 27/06/2022)
[8] Environmental Protection Agency (2022) Guidelines on the Information to be Contained in Environmental Impact Assessment Reports [Online] Available at: https://www.epa.ie/publications/monitoring--assessment/assessment/EIAR_Guidelines_2022_Web.pdf (Accessed 27/06/2022)

15.3.3.2 Sensitivity of Receptors

The sensitivity of the baseline conditions, including the importance of environmental features on or near to the Development Site or the sensitivity of potentially affected receptors, will be assessed in line with best practice guidance, legislation, statutory designations and / or professional judgement.

Table 15.1 details the framework for determining the sensitivity of receptors.

Table 15.1: Framework for Determining Sensitivity of Receptors

Sensitivity of Receptor	Definition
High	The receptor has little ability to absorb change without fundamentally altering its present character, is of high environmental value, or of national importance.
Medium	The receptor has moderate capacity to absorb change without significantly altering its present character, has some environmental value, or is of regional importance.
Low	The receptor is tolerant of change without detriment to its character, is low environmental value, or local importance.
Negligible	The receptor is resistant to change and is of little environmental value.

15.3.3.3 Magnitude of Change

The magnitude of potential change will be identified through consideration of the Development, the degree of change to baseline conditions predicted as a result of the Development, the duration and reversibility of an effect and professional judgement, best practice guidance and legislation.

The criteria for assessing the magnitude of change are presented in Table 15.2.

Table 15.2: Framework for Determining Magnitude of Change

Magnitude of Change	Definition
High	A fundamental change to the baseline condition of the asset, leading to major alteration of character.
Medium	A material, partial loss or alteration of character.
Low	A slight, detectable, alteration of the baseline condition of the asset.
Negligible	A barely distinguishable change from baseline conditions.

15.3.3.4 Significance of Effect

The sensitivity of the asset and the magnitude of the predicted effects will be used as a guide, in addition to professional judgement, to predict the significance of the likely effects. Table 15.3 summarises guideline criteria for assessing the significance of effects.

Table 15.3: Framework for Assessment of the Significance of Effects

Magnitude of Change	Sensitivity of Resource or Receptor			
	High	**Medium**	**Low**	**Negligible**
High	Profound – Very Significant	Significant - Moderate	Moderate - Slight	Slight - Imperceptible
Medium	Significant - Moderate	Moderate	Slight	Imperceptible

Low	Moderate - Slight	Slight	Slight – Not Significant	Imperceptible
Negligible	Slight - Imperceptible	Imperceptible	Imperceptible	Imperceptible

Effects predicted to be of profound or substantial significance are considered to be 'significant' in the context of the EIA Regulations, and are shaded in light grey in the above table.

15.3.4 Baseline Conditions

Tourism is considered as being of vital importance to Ireland's economy, in terms of job provision and providing income indirectly through other assets such as hotels, restaurants, and entertainment and arts facilities.

Section 12.3 of the 2011 EIS stated that the area surrounding the Site, and thus, the Development, is not an important tourism area and that there are no major tourism attractions in the Consented Wind Farm site or in its vicinity.

A desk-based search was carried out in June 2022 to identify any new potential sensitive receptors within the tourism Study Area. No further formal tourist attractions within the Site or within the Study Area were identified. On a local level, tourism assets are largely centred around cultural heritage and the natural landscape, although the Site and surrounding area is primarily residential and agricultural land, and not promoted for any tourism activities. No tourism activities are currently promoted on the Site, and there are no designated footpaths within the Site.

15.3.5 Assessment of Potential Effects

The 2011 EIS for the Original Wind Farm identified no direct or indirect effects on tourism or recreation. The Applicant will maintain the same approach as accepted for the Consented Wind Farm, and not propose an open forestry policy on site.

All tourism assets within the Study Area are considered low sensitivity as they are of local importance. The Development would result in a negligible magnitude of change and therefore, the effects on tourism and recreation are considered to be imperceptible which is not significant in terms of the EIA Regulations. This is consistent with the findings of the 2011 EIS

15.3.6 Cumulative Effect Assessment

The 2011 EIS for the Original Wind Farm, the EIA Report for the Consented Modification and EIA Report for the Consented Grid Route did not identify any significant adverse effects with regards to tourism and recreation. The Development is considered to have a negligible magnitude of change to the cumulative baseline and therefore, when considering the effects of Development cumulatively with other developments, the negligible magnitude of change as a result of the Development would not result in a significant cumulative effect on tourism and recreation receptors. No significant cumulative effects are predicted as a result of the Development, and the Consented Grid Route.

There is the potential for significant cumulative effects to occur on tourism and recreation as a result of the Development and Consented Wind Farm in combination with other wind farms. The only other cumulative wind farm within the 5 km study area is Gortahile Wind Farm, located approximately 1.5 km north from the Development. Cumulative effects on the amenity of tourism and recreation receptors with other wind developments are strongly linked to visual effect during operation. As set out in Section 13.3.1.1 of the Consented Wind Farm 2011 EIS, there is no evidence that tourism is adversely impacted by wind farms. In 2012, Fáilte Ireland, Ireland's National Tourism Development Authority, commissioned an updated survey on the effect that onshore wind turbines have on visitors to Ireland[9]. The study found that 71% of visitors claimed that a greater number of wind farms in Ireland would either have no impact or a positive impact on their likelihood to visit Ireland; the study found that this opinion was based on the principal that visitors largely supported the generation of renewable energy and subsequent carbon emission reductions.

Most recently, a poll recently undertaken by IWEA, of 1,015 members of public of the Irish public surveyed, 83% support wind power in the Republic of Ireland. Another study undertaken by Fáilte Ireland '*Protecting the Irish Environment and Landscape: A Critical Issue for Irish Tourism' Report'*[10] 'points to 'beautiful and unspoilt scenery' as being the top priority reason for tourists visiting Ireland. However, the Fáilte Ireland Report notes that *"that a majority of tourists did not find that either their experience of Ireland or their sightseeing was negatively affected by the presence of wind farm"*. Therefore, when considered with the Consented Wind Farm, the Development will have a negligible magnitude of change to the cumulative scenario (i.e. no additional turbines or increase of visibility). Therefore, the Development will not result in increased cumulative effects with Gortahile Wind Farm.

15.4 ELECTROMAGNETIC INTERFERENCE, TELEVISION AND COMMUNICATION SIGNALS

15.4.1 Key Conclusions of the EIS and FI

The Previous Consented Wind Farm 2011 EIS assessed the impact of the Original Wind Farm on Electromagnetic Interference, Television and Communication Signals.

The 2011 EIS stated that wind turbines can contribute to scattering effects associated with television reception, this is known to cause double imaging on television screens. This occurs largely when large structures, such as wind turbines, are located in an area which has weak Television Signals; the 2011 EIS stated that the implementation of digital broadcasting removes the stated issues; however, if a digital television is already receiving a weak signal, blocking or reflections from wind developments may cause the signal to drop. To mitigate against these issues, an agreement was reached with Raidió Teilifís Éireann (RTÉ) which guaranteed that the developer would fix any problems which arise from the Consented Wind Farm with regard to television reception by simple measures e.g. signal boosters through an improved receiver.

In terms of Communication Signals, the 2011 EIS noted that Dublin Fire Brigade expressed concern that the Original Wind Farm would impact on fire communications equipment. In order to address these concerns, and mitigate against them, the Consented Wind Farm was redesigned, resulting in turbine relocation, in order to remove the impact on Dublin Fire Brigade's communication equipment.

No FI was submitted in regard to Electromagnetic Interference, Television and Communication Signals

15.4.2 Changes to Legislation, Policy and Guidance Since EIS & FI

The National IWEA Guidelines have been published since the 2011 EIS which includes guidance on the impact from proposed developments on Electromagnetic Interference,

[9] Fáilte Ireland (2012) Visitor Attitudes on the Environment [Online] Available at: https://www.failteireland.ie/FailteIreland/media/WebsiteStructure/Documents/3_Research_Insights/4_Visitor_Insights/WindFarm-VAS-(FINAL)-(2).pdf?ext=.pdf (Accessed 27/06/2022)
[10] Fáilte Ireland (2011) Guidelines on the treatment of tourism in an Environmental Impact Statement

and Television and Communication Signals. There is no change required to the assessment as a result of this guidance.

15.4.3 Study Area / Survey Area

For electro utilities, the study area comprises solely of the land within the Development's Site Boundary.

15.4.4 Assessment Methodology

Should the construction and operation of the Development materially affect the operation of electrical utilities, such as through the degradation of the service it provides to the extent that it warrants an objection from the utility operator, this would be considered a significant effect. Mitigation is generally available either through rerouting of any affected links or upgrades to the apparatus.

15.4.5 Baseline Conditions

A desk-based search and consultation was undertaken with ESB and GNI during the EIA process for the Development to identify any changes to the baseline from the Consented Wind Farm. The consultation identified no gas utilities or overhead lines within the Site.

15.4.6 Assessment of Potential Effects

The findings contained within the 2011 EIS stated no significant effects are predicted as a result of the Original Wind Farm; this remains valid and applicable to the Development. The Applicant remains committed to the mitigation outlined in the 2011 EIS to ensure mitigation measures will alleviate any effects on infrastructure, as detailed in Section 15.3.1 of this Chapter. The agreement with RTÉ detailed in Section 15.3.1 is still valid.

Prior to construction, a further search for all television and communication links and utilities would take place to identify any new or updated services. Adverse effects would be avoided through the implementation of safe systems of work, which would include consideration of any additional identified electricity lines and cables.

There will therefore be no significant effects as a result of the Development.

15.4.7 Cumulative Effect Assessment

The principle cumulative effect that would occur as a result of operation of the Development and Gortahile Wind Farm is the potential for disruption to television signals, as identified in the Original Wind Farm 2011 EIS. The 2011 EIS for the Original Wind Farm did not identify any significant adverse effects with regards to electrical utilities, therefore it is not expected that any significant adverse effects will arise cumulatively with the Development provided the mitigation outlined in the 2011 EIS for the Original Wind Farm is followed with regards to effects on television signals, it is not expected that any significant adverse effects will arise cumulatively with the Development.

In regards to the Consented Grid Route, the EIA Report did not identify any significant adverse effects on electromagnetic interference, television and communication signals, or cumulatively with any wind farm. These conclusions would not change as a result of the Development as the Development will result in a negligible magnitude of change to the Original Wind Farm. Therefore, the effects when considered cumulatively, would not constitute as a significant impact on electromagnetic interface, television and communication links.

15.5 AIR NAVIGATION

15.5.1 Key Conclusions of the EIS and FI

The 2011 EIS assessed the impact of the Original Wind Farm on air navigation; the 2011 EIS concluded there were no negative impacts on air navigation foreseen as the Site is not located within zones that require the application and enforcement of Irish Aviation Authority (IAA) guidelines. The IAA confirmed that the Original Wind Farm would not have any consequences for the safety of air navigation if all IAA requirements were met in full. No FI was submitted in regards to Air Navigation.

15.5.2 Changes to Legislation, Policy and Guidance since EIS and FI

Since the 2011 EIS, in 2012 the national IWEA Guidelines have been published. Section 6.3.10 of the Guidelines includes guidance on the impact on aviation as a result of a proposed development. There is no change required to air navigation as a result of this guidance.

15.5.3 Assessment Methodology

Where a desk-based search has highlighted potential impacts, an assessment has been undertaken to quantify the predicted effects and assess the resulting significance. Where impacts are significant, mitigation will be applied.

The process for determining impact significance is by:

- Determining the receptor sensitivity;
- Determining the magnitude of change; and
- Combining the above to determine the significance of effects.

The search for aviation assets included all assets across Ireland to ensure all potentially affected assets are identified. The Study Area is therefore defined as Ireland.

If the Development is found to have any adverse impacts on stakeholders' operations, for example the safeguarding of a civilian airport, or if the Development is found to be located within an area of high priority military aviation activities, this would be considered a significant effect and mitigation would be required.

15.5.4 Baseline Conditions

As detailed in Section 12.4.3.2 of the Original Wind Farm 2011 EIS, the Development is not located within any areas or zones identified by the Irish Aviation Authority. An updated des-based search has been undertaken which highlighted no changes to the air navigation baseline in the Original Wind Farm 2011 EIS.

15.5.5 Assessment of Potential Effects

The 2011 EIS identified no direct or indirect effects, and as the Development does not result in any changes to the locations of the turbines or tip heights, the assessment of direct and indirect effects within the previous 2011 EIS remains valid. Therefore, no significant effects are predicted on air navigation as a result of the Development.

15.5.6 Cumulative effects Assessment

The Development will not result in any cumulative effects on air navigation.

There is no cumulative impact to take into account on other wind developments including Gortahile.

The Consented Grid Route did not assess air navigation within its EIA Report as there is no possibility of the Grid Route interacting with air navigation receptors. The negligible magnitude of change from the Development would not alter the conclusions that the Grid Route will not affect air navigation receptors and therefore, no significant cumulative effects on air navigation will occur as a result of the Development.

15.5.7 Mitigation and Residual Effects

As detailed in Section 15.4.1, the IAA confirmed that the Development would not have any consequences for the safety of air navigation if all IAA requirements were met in full. The Applicant has since consulted with the IAA who confirmed that in the interests of air navigation safety, turbines marked T1, T3 and T5 of the Development will require to be fitted with Type C, Medium Intensity, Fixed Red Obstacle lighting with a minim output of 2,000 candelas to be visible in all directions at all times.

IAA also confirmed that the Development should be fitted with incandescent (or of a similar type of night vision lighting) obstruction lighting.

All IAA mitigation requirements will be designed and complied with to ensure that adverse impacts are remedied such that any residual effects will be non-existent or insignificant. Specifically, the lighting scheme will be designed in accordance with the IAA requirements such that safety is maintained in the area.

15.6 SHADOW FLICKER

15.6.1 Key Conclusions of the EIA and FI

No significant effects were identified within the Original Wind Farm 2011 EIS and the Consented Modification 2020 EIA in regard to shadow flicker.

All properties were assessed as experiencing effects below the 2006 Wind Energy Development Guidelines, and therefore no significant effects were anticipated.

A cumulative shadow flicker assessment was also undertaken, using the same range, and found that the cumulative effects of Bilboa Wind Farm and Gortahile found no cumulative effect upon any property.

15.6.2 Change to Legislation, Policy and Guidance since EIA and FI

The guidance on shadow flicker remains the same as the 2011 EIS, i.e. the 2006 *Wind Energy Development Guidelines*. In 2012, the *Best Practice Guidelines for the Irish Wind Energy Industry*[11] was published and follows the same criteria as documented in the *Wind Energy Development Guidelines.*

Additionally, the Draft Revised Wind Energy Development Guidelines (DWEDG) were published for public consultation in December 2019[12]. As the DWEDG are in the preliminary stages and will likely be amended prior to finalisation, this Report has taken accordance of them; however, the assessment does not require updating as a result of the DWEDG.

[11] Irish Wind Energy Association (2012) Best Practice Guidelines for the Irish Wind Energy Industry [Online] Available at: https://www.iwea.com/images/files/9660bdfb5a4f1d276f41ae9ab54e991bb600b7.pdf (Accessed 27/06/2022)

[12] Department of Housing, Planning and Local Government (2019) Draft Revised Wind Energy Development Guidelines [Online] Available at: https://beta.courts.ie/view/judgments/1ae60f5d-baba-4658-a27d-f950a3f078e2/2c6c8641-f4dc-4089-94fe-12035686ae3c/2019_IEHC_825_1.pdf/pdf (Accessed 27/06/2022)

The EPA 'Guidelines on the Information to be Contained in Environmental Impact Assessment Reports' 2022[13] were published in May 2022 and will be used to determine the significance of effect.

15.6.3 Assessment Methodology

Following the guidelines and methodology used in the 2011 EIS, this assessment follows the Wind Energy Development Guidelines. The guidelines state that:

'It is recommended that shadow flicker at neighbouring offices and dwellings within 500 m should not exceed 30 hours per year or 30 minutes per day.'

This assessment predicts the theoretical maximum effects, along with a likely maximum duration for effects once prevailing weather conditions are taken into account. Although the Republic of Ireland guidance states that the threshold (i.e. 30 hours per year or 30 minutes per day) should apply to neighbouring offices and dwellings within 500 m, all residential receptors within 10 rotor diameters of the Development have been considered as a conservative approach.

In accordance with the *Wind Energy Development Guidelines and the Best Practice Guidelines for the Irish Wind Energy Industry*, a study area of 1,170 m (i.e. 10 times the proposed rotor diameter) from each turbine was employed during the calculation.

Assessment of shadow flicker effects on receptors within the study area will be completed using a recognised computer software package[14].

Updated baseline data has been gathered for this FI Report. For much of a given year, weather conditions will be such that shadows would not be cast or would be weak and thus would not give rise to shadow flicker effects. From August 2020 to August 2021, cloud cover at nearby Kilkenny typically occurred for 69% of the time, resulting in bright sunshine occurring for around 31% of daylight hours. As requested by the FI Report, Appendix A16 includes an extract from the weather data source to demonstrate the sunshine hours recorded at Kilkenny, the nearest weather station to the Site with recorded, available data.

This factor of 31% of daylight hours will be used to calculate the likely hours of shadow flicker occurrence which will then be used as the basis for the assessment of significance effects.

Should the reduced rotor of the alternative turbine option (115 m compared to 117 m) be implemented, effects would be equal to or lesser than those assessed for the 117 m rotor diameter. The study area would be reduced for the 115 m rotor; in line with guidance this would be reduced to 1,150 m so this assessment of the 117 m rotor presents an environmental worst-case.

15.6.4 Baseline Conditions

Information from the 2011 EIS was initially used to confirm the locations and names of permanent dwellings within the study area. The 2011 EIS assessed shadow flicker effects on 34 houses within a 1.3 km radius of the Original Wind Farm.

A desk-based search was carried out in October 2020 to identify any new potential sensitive receptors within the study area as shown in FI Figure 4, using aerial imagery. A total of 25 potential dwellings were identified within the shadow flicker study area. It should be noted that the new potential sensitive receptors identified have not been

[13] Environmental Protection Agency (2022) Guidelines on the Information to be Contained in Environmental Impact Assessment Reports [Online] Available at: https://www.epa.ie/publications/monitoring--assessment/assessment/EIAR_Guidelines_2022_Web.pdf (Accessed 27/06/2022)
[14] Resoft WindFarm 4.2.1.7

confirmed as habitable dwellings via a site visit. However, as a precautionary approach, all potential receptors have been included in this assessment.

Table 15.4 details the locations of the properties identified within the study area. The nearest residential property to the Development is Assessment Location 14 (H4 in the 2011 EIS), situated approximately 520 m south east of T1.

Table 15.4: Shadow Flicker Assessment Locations

Assessment Location	Easting	Northing
1	663855	672058
2	664492	670258
3	664803	669903
4	664729	669729
5	666014	671045
6	666030	671223
7	664493	672315
8	663779	671995
9	664366	672434
10	664035	672138
11	663743	672011
12	664365	672238
13	664383	672254
14	665604	670477
15	665941	671291
16	664766	669999
17	663348	671856
18	663813	670370
19	664246	672198
20	664268	672212
21	663903	672075
22	664304	672227
23	664733	669909
24	664330	670317
25	663066	671628

15.6.5 Assessment of Potential Effects

15.6.5.1 Construction Effects

Shadow flicker is a phenomenon that only occurs once the turbines are installed and operational and thus no shadow flicker effects are anticipated during the construction phase of the Development, until turbine construction has been completed.

15.6.5.2 Operational Effects

Table 15.5 details the results of the calculations carried out for the 25 properties located within the study area, using a recognised computer software package[15], showing the predicted likely number of hours of shadow flicker per annum (assuming 31% per annum bright sunshine[16]).

Of the 25 properties within the study area, 11 properties have been assessed to experience zero shadow flicker effects. FI Figure 4 shows all potential sensitive receptors identified, which have been included in the investigation, along with the predicted shadow flicker casting across the Site.

Shadow flicker has been assessed as likely to occur at the 14 remaining properties within the study area which have been individually assessed.

The shadow flicker results for each property (all 25 for completeness) are shown in Table 15.5.

A conservative approach has been taken, whereby the screening effects provided by trees or other buildings have not been taken into account, nor has any account been taken of which building facades actually have windows in practice (it has been assumed that all facades have windows). The actual level of shadow flicker experienced will depend on a number of factors, including but not limited to the precise position of windows facing the proposed turbines and the precise location of screening, which itself may change over time as existing vegetation grows or is removed, or new vegetation is planted. In addition, wind speed, wind direction and cloud cover will further reduce the effects experienced in practice. As a result, this assessment therefore considers a worst-case approach.

Table 15.5: Potential Shadow Flicker Effects

Assessment Location*	Window Orientation	Days per year	Theoretical Maximum Minutes per Day	Likely Minutes per Day[17]	Theoretical Maximum Hours per Annum	Likely Hours per Annum
1	North	0	0	0	0	0
	East	87	30.0	9.3	36.1	11.2
	South	87	30.6	9.5	36.2	11.2
	West	0	0	0	0	0
2	North	69	42.6	13.2	40.6	12.6
	East	69	42.6	13.2	40.8	12.6
	South	0	0	0	0	0
	West	0	0	0	0	0
3*	North	-	-	-	-	-
	East	-	-	-	-	-
	South	-	-	-	-	-
	West	-	-	-	-	-

[15] Resoft WindFarm 4.2.1.7
[16] Actual sunshine hours based on 2020/2021 records from the meteorological station in Kilkenny, the same station as used in the 2011 EIS.
[17] Average Sunshine hours based on 69 % cloud cover at Glenrothes, recorded from September 2020 to September 2021. Available at: https://www.worldweatheronline.com/kilkenny-weather-averages/kilkenny/ie.aspx (Accessed 27/06/2022)

Assessment Location*	Window Orientation	Days per year	Theoretical Maximum Minutes per Day	Likely Minutes per Day[17]	Theoretical Maximum Hours per Annum	Likely Hours per Annum
4*	North	-	-	-	-	-
	East	-	-	-	-	-
	South	-	-	-	-	-
	West	-	-	-	-	-
5	North	0	0	0	0	0
	East	0	0	0	0	0
	South	73	29.4	9.1	26.6	8.2
	West	74	29.4	9.1	26.8	8.3
6	North	0	0	0	0	0
	East	0	0	0	0	0
	South	47	27.6	8.6	16.8	5.2
	West	48	27.6	8.6	16.9	5.2
7*	North	-	-	-	-	-
	East	-	-	-	-	-
	South	-	-	-	-	-
	West	-	-	-	-	-
8	North	0	0	0	0	0
	East	103	36.0	11.2	49.6	15.4
	South	103	36.0	11.2	49.7	15.4
	West	0	0	0	0	0
9*	North	-	-	-	-	-
	East	-	-	-	-	-
	South	-	-	-	-	-
	West	-	-	-	-	-
10	North	0	0	0	0	0
	East	57	28.2	8.7	22.5	7.0
	South	57	28.8	8.9	22.5	7.0
	West	0	0	0	0	0
11	North	0	0	0	0	0
	East	67	34.8	10.8	34.4	10.7
	South	67	34.8	10.8	34.5	10.7
	West	0	0	0	0	0
12*	North	-	-	-	-	-
	East	-	-	-	-	-
	South	-	-	-	-	-
	West	-	-	-	-	-

Assessment Location*	Window Orientation	Days per year	Theoretical Maximum Minutes per Day	Likely Minutes per Day[17]	Theoretical Maximum Hours per Annum	Likely Hours per Annum
13*	North	-	-	-	-	-
	East	-	-	-	-	-
	South	-	-	-	-	-
	West	-	-	-	-	-
14	North	141	82.8	25.7	118.1	36.6
	East	0	0	0	0	0
	South	0	0	0	0	0
	West	141	82.8	25.7	118.4	36.7
15	North	0	0	0	0	0
	East	0	0	0	0	0
	South	101	28.8	8.9	36.0	11.2
	West	101	28.8	8.9	36.1	11.2
16*	North	-	-	-	-	-
	East	-	-	-	-	-
	South	-	-	-	-	-
	West	-	-	-	-	-
17	North	0	0	0	0	0
	East	46	31.2	9.7	18.8	5.8
	South	46	31.2	9.7	18.8	5.8
	West	0	0	0	0	0
18	North	87	27.0	8.4	28.0	8.7
	East	87	27.0	8.4	28.1	8.7
	South	0	0	0	0	0
	West	0	0	0	0	0
19*	North	-	-	-	-	-
	East	-	-	-	-	-
	South	-	-	-	-	-
	West	-	-	-	-	-
20*	North	-	-	-	-	-
	East	-	-	-	-	-
	South	-	-	-	-	-
	West	-	-	-	-	-
21	North	0	0	0	0	0
	East	81	29.4	9.1	34.1	10.6
	South	81	29.4	9.1	34.1	10.6
	West	0	0	0	0	0

Assessment Location*	Window Orientation	Days per year	Theoretical Maximum Minutes per Day	Likely Minutes per Day[17]	Theoretical Maximum Hours per Annum	Likely Hours per Annum
22*	North	-	-	-	-	-
	East	-	-	-	-	-
	South	-	-	-	-	-
	West	-	-	-	-	-
23*	North	-	-	-	-	-
	East	-	-	-	-	-
	South	-	-	-	-	-
	West	-	-	-	-	-
24	North	80	36.0	11.2	36.6	11.3
	East	80	36.6	11.3	36.7	11.4
	South	0	0	0	0	0
	West	0	0	0	0	0
25	North	0	0	0	0	0
	East	35	27.0	8.4	12.1	3.8
	South	35	27.0	8.4	12.0	3.7
	West	0	0	0	0	0
* Receptors marked with dashes receive no shadow flicker effects from the Development.						

The theoretical maximum number of minutes per day and hours per annum, as shown in Table 15.5, are for all windows and accounts for any overlap where effects may be experienced at different windows or from different turbines simultaneously. As such, shadow flicker effects are calculated as being possible for up to a theoretical maximum of 82.8 minutes per day and 118.4 hours per annum at the nearest residential property (Assessment Location 14).

However, based upon sunshine occurring for only 31% of the time, the likely number of hours per year where shadow flicker could potentially occur is reduced to 25.7 minutes per day and 36.7 hours per annum at the nearest property (Assessment Location 14). No other properties located within the study area exceed the 30 hours per year or 30 minutes per day identified within the *Wind Energy Development Guidelines*.

15.6.5.3 Mitigation and Residual Effects

It should be noted that the number of hours in which shadow flicker is predicted to occur is above the 30-hour per annum threshold within the recommended guidelines. Whilst this is likely to comprise an over-estimate of actual effects, for the reasons described above, the Applicant is committed to mitigate shadow flicker effects at Assessment Location 14 to ensure compliance with the Wind Energy Development Guidelines. The Applicant will install appropriate equipment and / or software to mitigate effects on Assessment Location 14. The final mitigation scheme will be agreed with the Carlow County Council prior to operation of the Development and may include control at source e.g. turbine software controls, or other measures agreed suitable with Carlow County Council.

Following mitigation, the Development will operate within the *Wind Energy Development Guidelines* for shadow flicker and residual shadow flicker effects will not be significant in terms of the EIA Regulations.

15.6.5.4 Assessment of Cumulative Effects

The nearest wind energy development, either existing or proposed, within the vicinity of the Development is the operational Gortahile wind farm, which is a 90 m rotor diameter wind farm development located in County Laois, approximately 2 km north of the nearest turbines associated with the Development. Given the large separation distances to other cumulative wind farms, and therefore the unlikely occurrence of shadow flicker effects from further cumulative wind farms, only the cumulative effects from Gortahile have been considered in this cumulative assessment.

As requested by CCC, Table 15.6 presents the shadow flicker effects on properties within the Study Area (e.g. 1,170 m of the Development) from Gorthaile Wind Farm only.

Table 15.6: Potential Shadow Flicker Effects from Gortahile Wind Farm

Assessment Location **	Window Orientation	Days per year	Theoretical Maximum Minutes per Day	Likely Minutes per Day	Theoretical Maximum Hours per Annum	Likely Hours per Annum
1**	North	-	-	-	-	-
	East	-	-	-	-	-
	South	-	-	-	-	-
	West	-	-	-	-	-
2**	North	-	-	-	-	-
	East	-	-	-	-	-
	South	-	-	-	-	-
	West	-	-	-	-	-
3**	North	-	-	-	-	-
	East	-	-	-	-	-
	South	-	-	-	-	-
	West	-	-	-	-	-
4**	North	-	-	-	-	-
	East	-	-	-	-	-
	South	-	-	-	-	-
	West	-	-	-	-	-
5**	North	-	-	-	-	-
	East	-	-	-	-	-
	South	-	-	-	-	-
	West	-	-	-	-	-
6**	North	-	-	-	-	-
	East	-	-	-	-	-
	South	-	-	-	-	-
	West	-	-	-	-	-

Assessment Location **	Window Orientation	Days per year	Theoretical Maximum Minutes per Day	Likely Minutes per Day	Theoretical Maximum Hours per Annum	Likely Hours per Annum
7	**North**	**86**	**31.2**	**9.7**	**37.9**	**11.7**
	East	**0**	**0**	**0**	**0**	**0**
	South	**0**	**0**	**0**	**0**	**0**
	West	**86**	**31.2**	**9.7**	**38.0**	**11.8**
8**	North	-	-	-	-	-
	East	-	-	-	-	-
	South	-	-	-	-	-
	West	-	-	-	-	-
9	**North**	**100**	**46.8**	**14.5**	**61.7**	**19.1**
	East	**0**	**0**	**0**	**0**	**0**
	South	**0**	**0**	**0**	**0**	**0**
	West	**100**	**46.8**	**14.5**	**61.9**	**19.2**
10**	North	-	-	-	-	-
	East	-	-	-	-	-
	South	-	-	-	-	-
	West	-	-	-	-	-
11**	North	-	-	-	-	-
	East	-	-	-	-	-
	South	-	-	-	-	-
	West	-	-	-	-	-
12	**North**	**38**	**24.6**	**7.6**	**12.5**	**3.9**
	East	**0**	**0**	**0**	**0**	**0**
	South	**0**	**0**	**0**	**0**	**0**
	West	**38**	**24.6**	**7.6**	**12.6**	**3.9**
13	**North**	**50**	**30.0**	**9.3**	**20.0**	**6.2**
	East	**0**	**0**	**0**	**0**	**0**
	South	**0**	**0**	**0**	**0**	**0**
	West	**50**	**30.0**	**9.3**	**20.1**	**6.2**
14**	North	-	-	-	-	-
	East	-	-	-	-	-
	South	-	-	-	-	-
	West	-	-	-	-	-
15**	North	-	-	-	-	-
	East	-	-	-	-	-
	South	-	-	-	-	-
	West	-	-	-	-	-

Assessment Location **	Window Orientation	Days per year	Theoretical Maximum Minutes per Day	Likely Minutes per Day	Theoretical Maximum Hours per Annum	Likely Hours per Annum
16**	North	-	-	-	-	-
	East	-	-	-	-	-
	South	-	-	-	-	-
	West	-	-	-	-	-
17**	North	-	-	-	-	-
	East	-	-	-	-	-
	South	-	-	-	-	-
	West	-	-	-	-	-
18**	North	-	-	-	-	-
	East	-	-	-	-	-
	South	-	-	-	-	-
	West	-	-	-	-	-
19**	North	-	-	-	-	-
	East	-	-	-	-	-
	South	-	-	-	-	-
	West	-	-	-	-	-
20**	North	-	-	-	-	-
	East	-	-	-	-	-
	South	-	-	-	-	-
	West	-	-	-	-	-
21**	North	-	-	-	-	-
	East	-	-	-	-	-
	South	-	-	-	-	-
	West	-	-	-	-	-
22**	North	-	-	-	-	-
	East	-	-	-	-	-
	South	-	-	-	-	-
	West	-	-	-	-	-
23**	North	-	-	-	-	-
	East	-	-	-	-	-
	South	-	-	-	-	-
	West	-	-	-	-	-
24**	North	-	-	-	-	-
	East	-	-	-	-	-
	South	-	-	-	-	-
	West	-	-	-	-	-

Assessment Location **	Window Orientation	Days per year	Theoretical Maximum Minutes per Day	Likely Minutes per Day	Theoretical Maximum Hours per Annum	Likely Hours per Annum
25**	North	-	-	-	-	-
	East	-	-	-	-	-
	South	-	-	-	-	-
	West	-	-	-	-	-
**Receptors marked with dashes receive no shadow flicker effects from the Gortahile Wind Farm turbines.						

Table 15.7 presents the results of a cumulative shadow flicker assessment, which shows the total extent of shadow flicker from the Development and Gortahile combined for all properties within the study area for the Development.

Table 15.7: Potential Cumulative Shadow Flicker Effects from the Development and Gortahile Wind Farm

Assessment Location***	Window Orientation	Days per year	Theoretical Maximum Minutes per Day	Likely Minutes per Day	Theoretical Maximum Hours per Annum	Likely Hours per Annum
1	North	0	0	0	0	0
	East	87	30.0	9.3	36.1	11.2
	South	87	30.6	9.5	36.2	11.2
	West	0	0	0	0	0
2	North	69	42.6	13.2	40.6	12.6
	East	69	42.6	13.2	40.8	12.6
	South	0	0	0	0	0
	West	0	0	0	0	0
3***	North	-	-	-	-	-
	East	-	-	-	-	-
	South	-	-	-	-	-
	West	-	-	-	-	-
4***	North	-	-	-	-	-
	East	-	-	-	-	-
	South	-	-	-	-	-
	West	-	-	-	-	-
5	North	0	0	0	0	0
	East	0	0	0	0	0
	South	73	29.4	9.1	26.6	8.2
	West	74	29.4	9.1	26.8	8.3
6	North	0	0	0	0	0
	East	0	0	0	0	0
	South	47	27.6	8.6	16.8	5.2

Assessment Location***	Window Orientation	Days per year	Theoretical Maximum Minutes per Day	Likely Minutes per Day	Theoretical Maximum Hours per Annum	Likely Hours per Annum
	West	48	27.6	8.6	16.9	5.2
7	**North**	**86**	**31.2**	**9.7**	**37.9**	**11.7**
	East	**0**	**0**	**0**	**0**	**0**
	South	**0**	**0**	**0**	**0**	**0**
	West	**86**	**31.2**	**9.7**	**38.0**	**11.8**
8	North	0	0	0	0	0
	East	103	36.0	11.2	49.6	15.4
	South	103	36.0	11.2	49.7	15.4
	West	0	0	0	0	0
9	**North**	**100**	**46.8**	**14.5**	**61.7**	**19.1**
	East	**0**	**0**	**0**	**0**	**0**
	South	**0**	**0**	**0**	**0**	**0**
	West	**100**	**46.8**	**14.5**	**61.9**	**19.2**
10	North	0	0	0	0	0
	East	57	28.2	8.7	22.5	7.0
	South	57	28.8	8.9	22.5	7.0
	West	0	0	0	0	0
11	North	0	0	0	0	0
	East	67	34.8	10.8	34.4	10.7
	South	67	34.8	10.8	34.5	10.7
	West	0	0	0	0	0
12	**North**	**38**	**24.6**	**7.6**	**12.5**	**3.9**
	East	**0**	**0**	**0**	**0**	**0**
	South	**0**	**0**	**0**	**0**	**0**
	West	**38**	**24.6**	**7.6**	**12.6**	**3.9**
13	**North**	**50**	**30.0**	**9.3**	**20.0**	**6.2**
	East	**0**	**0**	**0**	**0**	**0**
	South	**0**	**0**	**0**	**0**	**0**
	West	**50**	**30.0**	**9.3**	**20.1**	**6.2**
14	North	141	82.8	25.7	118.1	36.6
	East	0	0	0	0	0
	South	0	0	0	0	0
	West	141	82.8	25.7	118.4	36.7
15	North	0	0	0	0	0
	East	0	0	0	0	0
	South	101	28.8	8.9	36.0	11.2

Assessment Location***	Window Orientation	Days per year	Theoretical Maximum Minutes per Day	Likely Minutes per Day	Theoretical Maximum Hours per Annum	Likely Hours per Annum
	West	101	28.8	8.9	36.1	11.2
16***	North	-	-	-	-	-
	East	-	-	-	-	-
	South	-	-	-	-	-
	West	-	-	-	-	-
17	North	0	0	0	0	0
	East	46	31.2	9.7	18.8	5.8
	South	46	31.2	9.7	18.8	5.8
	West	0	0	0	0	0
18	North	87	27.0	8.4	28.0	8.7
	East	87	27.0	8.4	28.1	8.7
	South	0	0	0	0	0
	West	0	0	0	0	0
19***	North	-	-	-	-	-
	East	-	-	-	-	-
	South	-	-	-	-	-
	West	-	-	-	-	-
20***	North	-	-	-	-	-
	East	-	-	-	-	-
	South	-	-	-	-	-
	West	-	-	-	-	-
21	North	0	0	0	0	0
	East	81	29.4	9.1	34.1	10.6
	South	81	29.4	9.1	34.1	10.6
	West	0	0	0	0	0
22***	North	-	-	-	-	-
	East	-	-	-	-	-
	South	-	-	-	-	-
	West	-	-	-	-	-
23***	North	-	-	-	-	-
	East	-	-	-	-	-
	South	-	-	-	-	-
	West	-	-	-	-	-
24	North	80	36.0	11.2	36.6	11.3
	East	80	36.6	11.3	36.7	11.4
	South	0	0	0	0	0

Assessment Location***	Window Orientation	Days per year	Theoretical Maximum Minutes per Day	Likely Minutes per Day	Theoretical Maximum Hours per Annum	Likely Hours per Annum
	West	0	0	0	0	0
25	North	0	0	0	0	0
	East	35	27.0	8.4	12.1	3.8
	South	35	27.0	8.4	12.0	3.7
	West	0	0	0	0	0

*All receptors in bold are those affected by shadow flicker effects from Gortahile Wind Farm. None of these receptors are affected by shadow flicker effects from the Development and thus there are no cumulative effects.

***Receptors marked with dashes receive no shadow flicker effects from either of the Development turbines, or the Gortahile Wind Farm turbines.

Table 15.8 summarises the properties and where shadow flicker would occur as a result of the Development and / or Gortahile.

Table 15.8: Summary if Shadow Flicker Effects occur from the Development and / or Gortahile

Assessment Location	Effects from the Development	Effects from Gortahile	Cumulative Effects from Both Wind Farms
1	Yes	No	No
2	Yes	No	No
3	No	No	No
4	No	No	No
5	Yes	No	No
6	Yes	No	No
7	No	Yes	No
8	Yes	No	No
9	No	Yes	No
10	Yes	No	No
11	Yes	No	No
12	No	Yes	No
13	No	Yes	No
14	Yes	No	No
15	Yes	No	No
16	No	No	No
17	Yes	No	No
18	Yes	No	No
19	No	No	No
20	No	No	No
21	Yes	No	No

22	No	No	No
23	No	No	No
24	Yes	No	No
25	Yes	No	No

As there are no properties likely to experience shadow flicker effects from both the Development and another wind farm, there is no prospect of any cumulative effect occurring.

As a result, **no significant cumulative effects** are predicted in accordance with the EIA Regulations.

16 INTERACTIONS AND INTER-RELATIONSHIPS

16.1 INTRODUCTION

The preceding Chapters 6-15 of the Environmental Impact Assessment (EIA Report) assess potential effects on: Landscape and Visual (LVIA); Biodiversity; Hydrology; Land and Soil; Cultural Heritage and Archaeology; Noise and Vibration; Roads and Traffic; Air Quality and Climate; Population and Human Health; and Other Considerations. Effects and their significance are assessed within the frame of singular resource assessment; however, all environmental factors are intrinsically linked to each other, potentially resulting in positive or negative impacts with varying level of significance.

This Chapter of the EIA Report identifies and assess which environmental resources have the potential to have interaction of share inter-relationships as a result of the construction operation and decommissioning of Bilboa Wind Farm (the Development).

Table 16.1 displays a matrix which shows, by mark '✓', which environmental resources have the potential to have interaction or share inter-relationships.

Table 16.1: Interactions/Inter-Relationship Matrix

	Landscape and Visual	Biodiversity	Hydrology	Land and Soil	Cultural Heritage and Archaeology	Noise and Vibration	Material Assets – Roads and Traffic	Air Quality and Climate	Population and Human Health	Other Considerations
Landscape and Visual					✓				✓	✓
Biodiversity			✓	✓				✓		
Hydrology		✓		✓					✓	
Land and Soil		✓	✓							
Cultural Heritage and Archaeology	✓								✓	
Noise and Vibration							✓		✓	
Material Assets – Roads and Traffic						✓		✓	✓	✓
Air Quality and Climate		✓					✓		✓	
Population and Human Health	✓		✓		✓	✓	✓	✓		✓
Other Considerations	✓						✓		✓	

The following sections address each interaction / inter-relationship identified in Table 16.1, and provides an assessment on whether there is potential for significant effects to occur as a result of such interactions and inter- relationships.

16.2 LANDSCAPE AND VISUAL

As outlined in Table 16.1, the following technical areas have the potential to result in interactive effects on landscape and visual (LV) or landscape and visual impact assessment (LVIA):

- Archaeology and Cultural Heritage;
- Population and Human Health; and
- Other Considerations.

16.2.1 Potential Interactions

16.2.1.1 Archaeology and Cultural Heritage

Impacts on the archaeology and cultural heritage resource within the construction and operational phases of the Development have the potential to interact with effects on the visual amenity of archaeological or heritage sites (receptors).

The LVIA within the EIA Report concluded that the operation of the Development will result in visual effects which are not significant; archaeological and cultural heritage receptors were assessed as receiving no visual effect, and therefore effects were assessed as not significant.

As there will be no visual effect of the Development on archaeological and heritage receptors, the Development will not result in any significant effects, in terms of interactions and inter-relationships, between landscape and visual and archaeology and cultural heritage

16.2.1.2 Population and Human Health

Impacts on the landscape and visual resource of the Development have the potential to impact upon population and human health due to disruption associated with the Development. The Development can impact upon population and human health receptors, including residences, settlements and humans located within the vicinity of the Development.

The 2011 EIS identified construction effects as temporary and negligible, therefore not significant. The LVIA chapter within this EIA Report determined that any visual construction effects would be negligible.

With regards to visual effects, the LVIA concluded that Development's operational effects (visual effects) on human receptors, such as residences and recreational receptors, were not significant. The population and human health assessment, assessed human health and amenity effects, which were also assessed as not significant.

Considering the negligible nature of the visual effects during construction and that no visual significant effects have been identified as a result of the Development in operation, including on residential receptors, no significant effects from visual impact in combination with population or human health effects will occur.

16.2.1.3 Other Considerations

Impacts on the landscape and visual resource of the Development have the potential to impact upon other considerations (tourism), including recreational attraction/activities and humans, due to disruption of recreational activities as a result of the Development.

The LVIA assessed the operational effects of the Development and concluded no significant visual effects; additionally, the other considerations (tourism) assessment concluded that the area was of low sensitivity for tourism, therefore concluded that the Development had no significant effects of tourism.

As a result of the lack of visual significant effects and the low sensitivity of the study area identified for tourism, the Development will not result in any significant effects, in terms of interactions and inter-relationships, between landscape and visual and other considerations (tourism).

16.2.2 Summary of Potential Interactive Effects on Landscape and Visual

The principal receptors considered within landscape and visual topic areas are the human population, residences, and settlements, on which a number of effects could interact. However, effects identified within this EIA Report are not significant; construction effects, where assessed, have been assessed as temporary and operational effects identified as not significant. Despite no significant effects identified, best practice mitigation measures will ensure effects are further minimised. As a result of these mitigation measures, all effects identified are considered to be of a limited magnitude of change which are unlikely to interact with other effects on landscape and visual to result in a significant effect.

No significant effects are anticipated as a result of interactive effects

16.3 BIODIVERSITY

As outlined in Table 16.1, the following technical areas have the potential to result in interactive effects on Biodiversity:

- Land and Soils;
- Hydrology; and
- Air Quality and Climate

16.3.1 Potential Interactions

16.3.1.1 Land and Soils

Impacts on the land and soils resource within the construction phase of the Development have the potential to impact upon biodiversity due to peat disturbance and peat-related pollution/contamination of water environments, as a result of Development construction activities, specifically peat removal/disturbance. These construction activities can impact upon ecological receptors, including those specifically assessed within **Chapter 7: Biodiversity.**

The land and soils assessment within the EIA Report concluded that the construction of the Development will result in peat and soil disturbance, and peat destabilisation effects, deemed slight imperceptible, or imperceptible, and therefore not significant. Additionally, the biodiversity assessment concluded that following mitigation, construction effects, relating to peat disturbance, on identified biodiversity receptors are not significant.

Given that land and soils construction effects are all assessed as not significant, with low/negligible magnitudes of change, and biodiversity construction effects, following mitigation, are assessed as not significant, the Development will not result in any significant effects, in terms of interactions and inter-relationships, between land and soils, and biodiversity.

No potential effects were identified during the operational and decommissioning phases of the Development in relation to the land and soils resource and therefore there are no effects are predicted in relation to the interaction and inter-relationships with land and soils

16.3.1.2 Hydrology

Impacts on the hydrology resource within the construction phase of the Development have the potential to impact upon biodiversity due to potential pollution, contamination, and changes to the water environment as a result of Development construction activities.

These construction activities can impact upon ecological receptors, including those specifically assessed within **Chapter 7: Biodiversity.**

The hydrology assessment within the EIA Report concluded that the construction of the Development will result in effects, deemed not significant, on surface hydrology, groundwater, and public and private water supplies. Whilst all hydrology effects are assessed as not significant, the Construction Environmental Management Plan (CEMP) (Technical Appendix 4.1) presents best practice and standard mitigation to further ensure no significant hydrology effects occur; the CEMP outlines a number of measures which further reduces the likelihood and severity of pollution of hydrology receptors, including surface hydrology and groundwater. Additionally, the biodiversity assessment also concluded that, following appropriate construction effects mitigation, there will be no significant construction effects on biodiversity, including hydrology-related effects on biodiversity receptors.

Therefore, given that hydrology construction effects are all assessed as not significant, with low/negligible magnitudes of change, and biodiversity construction effects, following mitigation, are assessed as not significant, the Development will not result in any significant effects, in terms of interactions and inter-relationships, between hydrology and, biodiversity.

No potential effects were identified during the operational and decommissioning phases of the Development in relation to the hydrology resource and therefore there are no effects are predicted in relation to the interaction and inter-relationships with hydrology.

16.3.1.3 Air Quality and Climate

Impacts on the air quality and climate resource within the construction phase of the Development have the potential to impact upon biodiversity due to increased air pollution and emissions as a result of Development construction activities. These construction activities can impact upon ecological receptors, including those specifically assessed within **Chapter 7: Biodiversity;** for example, ecological designations.

Construction traffic air quality effects were assessed cumulatively with the Consented Grid Route; the assessment deemed that due to a low magnitude of change and the short-term nature of construction traffic, that cumulative construction traffic effects on air quality are not significant. Any effects are further reduced through standard best practice mitigation within the CEMP.

Therefore, given the short-term, temporary nature of the construction works, the low magnitude of change, and effects being assessed as not significant, the Development will not result in any significant effects, in terms of interactions and inter-relationships, between biodiversity, and air quality and climate.

The air quality and climate assessment concluded that the construction air quality and climate effects on receptors are temporary in nature and not significant.

No air quality-relevant potential effects were identified during the operational phase of the Development in relation to the air quality and climate resource, and decommissioning would be assessed nearer the time, but effects are expected to be greatly reduced; therefore, there are no effects are predicted in relation to the interaction and inter-relationships with biodiversity.

16.3.2 Summary of Potential Interactive Effects on Biodiversity

The principal receptors considered within biodiversity topic areas are ecological designations, habitats, flora, and fauna, on which a number of effects could interact.

However, effects, following mitigation, identified within this EIA Report are not significant; best practice and mitigation measures will ensure effects are not significant. As a result of these mitigation measures, all effects identified are considered to be of a limited magnitude of change which are unlikely to interact with other effects on biodiversity to result in a significant effect.

No significant effects are anticipated as a result of interactive effects.

16.4 HYDROLOGY

As outlined in Table 16.1, the following technical areas have the potential to result in interactive effects on Hydrology:

- Biodiversity;

- Land and Soil; and
- Population and Human Health.

Interactions and effects between Hydrology, and Biodiversity are outlined in Section 16.3.1.2.

16.4.1 Potential Interactions

16.4.1.1 Land and Soil

Impacts on the land and soil resource within the construction and operational phases of the Development have the potential to interact with effects upon hydrology due to potential pollution of hydrological receptors as result of Development construction activities. Construction activities can impact upon hydrology receptors, including surface hydrology, groundwater, public and private water supplies, and other hydrological designations.

The hydrology assessment within the EIA Report concluded that the construction of the Development will result in effects, deemed not significant, on surface hydrology, groundwater, and public and private water supplies. Whilst all hydrology effects are assessed as not significant, the CEMP (Technical Appendix 4.1) presents best practice and standard mitigation to further ensure no significant hydrology effects occur; the CEMP outlines a number of measures which further reduces the likelihood and severity of pollution of hydrology receptors, including public and private water supplies. The land and soils assessment identified construction effects as not significant. The construction effect of peat and soil disturbance is relevant to hydrology due to the potential for peat and soil disturbance to cause hydrological pollution. The construction effect of peat and soil disturbance assessment considered peat excavation, peat reinstatement, and the handling and storage of peat; collectively, peat and soil disturbance effects are assessed as slight-imperceptible and therefore not significant, and embedded mitigation further ensures the effect is not significant. Land and soils operational effects were also assessed as not significant.

Therefore, given that hydrology, and land and soils, construction effects are all assessed as not significant, with low/negligible magnitudes of change, the Development will not result in any significant effects, in terms of interactions and inter-relationships, between hydrology and, land and soil.

No potential effects were identified during the operational and decommissioning phases of the Development in relation to the hydrology resource and therefore there are no effects are predicted in relation to the interaction and inter-relationships with land and soil.

16.4.1.2 Population and Human Health

Impacts on the hydrology resource within the construction phase of the Development have the potential to impact upon population and human health due to potential contamination of public water supplies and private water supplies as a result of Development construction activities. These construction activities can impact upon population and human health receptors, including residences and humans located within the vicinity of the Development.

The hydrology assessment within the EIA Report concluded that the construction effect on public and private water supplies, and subsequent receptors, is imperceptible and therefore not significant; and no mitigation is required.

Therefore, given the short-term, temporary nature of the construction works, and relevant hydrology effects being assessed as imperceptible and not significant, the Development will not result in any significant effects, in terms of interactions and inter-relationships, between hydrology and population and human health.

No significant effects were identified during the operational and decommissioning phases of the Development in relation to the hydrology resource and therefore there are no effects are predicted in relation to the interaction and inter-relationships with population and human health.

16.4.2 Summary of Potential Interactive Effects on Hydrology

The principal receptors considered within hydrology topic areas are surface hydrology, groundwater, private and public water supplies, and other hydrological designations, on which a number of effects could interact. However, all effects identified within this EIA Report are not significant; all construction effects have been assessed as temporary, with limited operational effects identified and assessed as not significant. Despite no significant effects identified, best practice mitigation measures will ensure effects are further minimised. As a result of these mitigation measures, all effects identified are considered to be of such a limited magnitude and temporary period that they are unlikely to interact with other effects on hydrology to result in a significant effect.

No significant effects are anticipated as a result of interactive effects

16.5 LAND AND SOIL

As outlined in Table 16.1, the following technical areas have the potential to result in interactive effects on Land and Soil:

- Biodiversity
- Hydrology; and
- Air Quality and Climate.

Interactions and effects between Land and Soil, and Biodiversity are outlined in Section 16.3.1.1.

Interactions and effects between Land and Soil, and Hydrology are outlined in Section 16.4.1.1.

16.5.1 Potential Interactions

16.5.1.1 Air Quality and Climate

Impacts on the land and soil resource within the construction phase of the Development have the potential to impact upon air quality and climate due to potential for dust pollution of air quality as a result of Development construction activities. However, the air quality and climate assessment scoped out the assessment of dust pollution. Despite no need for the assessment of dust pollution, the CEMP still includes best practice mitigation measures, as standard, for dust suppression which will ensure no significant effects.

Consequently, no interaction and inter-relationships are identified between land and soil, and air quality and climate

16.5.2 Summary of Potential Interactive Effects on Land and Soil

The principal receptors considered within land and soil topic areas are peat and soil, on which a number of effects could interact. However, all effects identified within this EIA Report are not significant; all construction effects have been assessed as temporary, with limited operational effects identified. Despite no significant effects identified, best practice mitigation measures will ensure effects are further minimised. As a result of these mitigation measures, all effects identified are considered to be of such a limited magnitude and temporary period that they are unlikely to interact with other effects on land and soil to result in a significant effect.

No significant effects are anticipated as a result of interactive effects

16.6 CULTURAL HERITAGE AND ARCAEOLOGY

As outlined in Table 16.1, the following technical areas have the potential to result in interactive effects on Cultural Heritage and Archaeology:

- Landscape and Visual; and
- Population and Human Health.

Interactions and effects between Cultural Heritage and Archaeology, and Landscape and Visual are outlined in Section 16.2.1.1.

16.6.1 Potential Interactions

16.6.1.1 Population and Human Health

Impacts on the archaeology and cultural heritage resource within the construction and operational phases of the Development have the potential to impact upon population and human health. The Development's construction activity and the operational disruption can, for example, cause the interruption of views or setting; therefore, disrupting views and setting experienced by the population. These impacts on archaeology and cultural heritage via construction activities and operation of the Development can impact upon population and human health receptors, including residences and humans located within the vicinity of the Development.

The archaeology and cultural heritage assessment within the EIA Report concluded that the construction effects on receptors are not significant for known archaeology and unknown archaeology; and that there were no construction effects on known heritage assets. Despite no significant effects identified, best practice mitigation measures will ensure effects are further minimised. As there are no significant construction effects on known and unknown archaeology and cultural heritage assets, there will no effect to the population visiting known assets.

Additionally, the archaeology and cultural heritage assessment within the EIA Report concluded that the operational effects on receptors (identified heritage assets) are not significant. Despite no significant effects identified, best practice mitigation measures will ensure effects are further minimised. As a result of the lack of significant effects to the setting of identified heritage assets, the population visiting these assets would not experience significant effects.

Therefore, given the short-term, temporary nature of the construction works and effects being assessed as not significant, the Development will not result in any significant effects, in terms of interactions and inter-relationships, between archaeology and cultural heritage and population and human health.

16.6.2 Summary of Potential Interactive Effects on Archaeology and Cultural Heritage

The principal receptors considered within archaeology and cultural heritage topic areas are the archaeology and cultural heritage assets and the human population, on which a number of effects could interact. However, effects identified within this EIA Report are not significant; construction effects, where assessed, have been assessed as not significant and operational effects identified as not significant. As a result of assessment and best practice mitigation measures, all effects identified are considered to be of a limited magnitude of change which are unlikely to interact with other effects on archaeology and cultural heritage to result in a significant effect.

No significant effects are anticipated as a result of interactive effects.

16.7 NOISE AND VIBRATION

As outlined in Table 16.1, the following technical areas have the potential to result in interactive effects on Noise and Vibration:

- Roads and Traffic; and
- Population and Human Health.

16.7.1 Potential Interactions

16.7.1.1 Material Assets – Roads and Traffic

Impacts on the roads and traffic resource within the construction phase of the Development have the potential to impact upon noise and vibration due to increased traffic and therefore noise emissions as a result of Development construction activities. These construction activities can impact upon noise receptors, including nearby residences and humans.

The roads and traffic assessment concluded that the construction effects are temporary in nature, limited to construction, and not significant; however, the CEMP still includes best practice mitigation in regard to roads and traffic. The noise assessment scoped out construction noise assessment due to the negligible nature of construction noise as a result of the Development.

Therefore, given the short-term, temporary nature of the Development construction, the roads and traffic effects being assessed as not significant, and as the Development will not give rise to significant construction noise effects, the Development will not result in any significant effects, in terms of interactions and inter-relationships, between roads and traffic, and noise and vibration.

No potential effects were identified during the operational phase of the Development in relation to the roads and traffic resource, and decommissioning would be assessed nearer the time, but effects are expected to be greatly reduced; therefore, there are no effects are predicted in relation to the interaction and inter-relationships with noise and vibration

16.7.1.2 Population and Human Health

Impacts on the noise resource within the construction phase of the Development have the potential to impact upon population and human health due to increased noise emissions as a result of Development construction activities. These construction activities can impact upon population and human health receptors, including residences and humans located within the vicinity of the Development.

The noise assessment within the EIA Report did not assess construction effects as the Development construction is a negligible magnitude of change when compared to the 2011 EIS for the Original Wind Farm; the noise assessment concluded that additional construction noise effects as a result of the Development does not change the significance of effects that was accepted within the 2011 EIS, which were not identified as being significant.

The noise assessment in the EIA Report assessed the Development's operational noise as still within the Consented Wind Farm's noise limits, and in line with recognised best practice, and therefore the Development's operational noise was assessed as not significant.

Therefore, given construction noise and operational noise as a result of the Development are both assessed as not significant, the Development will not result in any significant effects, in terms of interactions and inter-relationships, between noise and vibration, and population and human health

16.7.2 Summary of Potential Interactive Effects on Noise and Vibration

The principal receptors considered within the noise topic areas are the human population and residences, on which a number of effects could interact. However, effects identified within this EIA Report are not significant; construction effects, where assessed, have been assessed as not significant and operational effects identified as not significant. As a result of assessment and best practice mitigation measures, all effects identified are considered to be of a limited magnitude of change which are unlikely to interact with other effects on noise to result in a significant effect.

No significant effects are anticipated as a result of interactive effects.

16.8 ROADS AND TRAFFIC

As outlined in Table 16.1, the following technical areas have the potential to result in interactive effects on roads and traffic:

- Air Quality and Climate;
- Noise and Vibration;
- Population and Human Health; and
- Other Considerations.

Interactions and effects between Roads and Traffic, and Noise and Vibration are outlined in Section 16.7.1.1.

16.8.1 Potential Interactions

16.8.1.1 Air Quality and Climate

On the roads and traffic resource within the construction phase of the Development have the potential to impact upon air quality and climate due to increased traffic on local receptors (roads/road users). This increase in traffic during the construction of the Development can impact upon air quality and climate receptors, including the human population located within the vicinity of the Development.

The roads and traffic assessment concluded that the construction effects of increased traffic on local roads/road users, passing local receptors such as humans, residences and communities, is assessed as temporary and not significant. Any effects are further reduced through standard best practice mitigation within the CEMP. The air quality assessment scoped out the requirement of construction traffic effects on air quality for the Development, as the Development's increase in construction traffic is negligible. However, construction traffic effects on air quality were assessed cumulatively with the Consented Grid Route; the assessment deemed that due to a low magnitude of change and the short-term nature of construction traffic, that cumulative construction traffic effects on air quality are not significant.

Therefore, given the short-term, temporary nature of the construction works and all effects being assessed as not significant, due to low magnitudes of change, the Development will not result in any significant effects, in terms of interactions and inter-relationships, between roads and traffic and air quality and climate.

No potential effects were identified during the operational phase of the Development in relation to the roads and traffic resource, and decommissioning would be assessed nearer the time, but effects are expected to be greatly reduced; therefore, there are no effects are predicted in relation to the interaction and inter-relationships with air quality and climate.

16.8.1.2 Population and Human Health

Impacts on the roads and traffic resource within the construction phase of the Development have the potential to impact upon population and human health due to increased traffic on local receptors (roads/road users). This increase in traffic during the construction of the Development can impact upon population and human health receptors, including humans, residencies and communities located along or using the local road network.

The roads and traffic assessment concluded that the construction effects of increased traffic on local roads/road users, passing local receptors such as humans, residences and communities, is assessed as temporary and not significant. Any effects are further reduced through standard best practice mitigation within the CEMP.

Therefore, given the short-term, temporary nature of the construction works and effects being assessed as not significant, the Development will not result in any significant effects, in terms of interactions and inter-relationships, between roads and traffic and population and human health.

No potential effects were identified during the operational phase of the Development in relation to the roads and traffic resource, and decommissioning would be assessed nearer the time, but effects are expected to be greatly reduced; therefore, there are no effects are predicted in relation to the interaction and inter-relationships with population and human health.

16.8.1.3 Other Considerations

Impacts on the roads and traffic resource within the construction phase of the Development have the potential to impact upon other considerations (tourism) due to disruption of recreational activities as a result of increased traffic during Development construction activities. This increased traffic can impact upon other considerations receptors, including recreational attraction/activities and humans.

The roads and traffic assessment concluded that the construction effects are temporary in nature, limited to construction, and not significant. Any effects are further reduced through standard best practice mitigation within the CEMP. Additionally, the other considerations (tourism) assessment concluded that the area was of low sensitivity for tourism, therefore concluded that the Development had no significant effects of tourism.

Therefore, given the short-term, temporary nature of the construction works and effects being assessed as not significant, and that the Development is located within an area of low sensitivity for tourism, the Development will not result in any significant effects, in terms of interactions and inter-relationships, between roads and traffic and other considerations (tourism).

No potential effects were identified during the operational phase of the Development in relation to the roads and traffic resource, and decommissioning would be assessed nearer the time, but effects are expected to be greatly reduced; therefore, there are no effects are predicted in relation to the interaction and inter-relationships with other considerations (tourism).

16.8.2 Summary of Potential Interactive Effects on Roads and Traffic

The principal receptors considered within the roads and traffic topic areas are the human population and road networks, on which a number of effects could interact. However, effects identified within this EIA Report are not significant; construction effects, have been assessed as temporary and not significant; no operational effects were identified. As a result of assessment and best practice mitigation measures, all effects identified are considered to be of a limited magnitude of change which are unlikely to interact with other effects on noise to result in a significant effect.

No significant effects are anticipated as a result of interactive effects.

16.9 AIR QUALITY AND CLIMATE

As outlined in Table 16.1, the following technical areas have the potential to result in interactive effects on Air Quality and Climate:

- Biodiversity;
- Roads and Traffic;
- Population and Human Health.

Interactions and effects between Air Quality and Climate, and Biodiversity are outlined in Section 16.3.1.3.

Interactions and effects between Air Quality and Climate, and Roads and Traffic are outlined in Section 16.8.1.1.

16.9.1 Potential Interactions

16.9.1.1 Population and Human Health

Impacts on the air quality and climate resource within the construction phase of the Development have the potential to impact upon population and human health due to receptors (human population) being subject to increased air pollution as a result of construction activity.

The air quality assessment scoped out the requirement of construction effects on air quality for the Development, as the Development's construction activity, which would give rise to an increase in pollutants, is negligible. However, construction traffic air quality effects were assessed cumulatively with the Consented Grid Route; the assessment deemed that due to a low magnitude of change and the short-term nature of construction traffic, that cumulative construction traffic effects on air quality are not significant. Any effects are further reduced through standard best practice mitigation within the CEMP.

Therefore, given the short-term, temporary nature of the construction works, the low magnitude of change, and effects being assessed as not significant, the Development will not result in any significant effects, in terms of interactions and inter-relationships, between air quality and climate, and population and human health.

No population and human health-relevant potential effects were identified during the operational phase of the Development in relation to the air quality and climate resource, and decommissioning would be assessed nearer the time, but effects are expected to be greatly reduced; therefore, there are no effects are predicted in relation to the interaction and inter-relationships with population and human health.

16.9.2 Summary of Potential Interactive Effects on Air Quality and Climate

The relevant principal receptor considered within the air quality and climate topic areas is the human population, on which a number of effects could interact. However, effects identified within this EIA Report are not significant; construction effects, have been assessed as temporary and not significant; no relevant operational effects were identified. As a result of assessment and best practice mitigation measures, all effects identified are considered to be of a limited magnitude of change which are unlikely to interact with other effects on air quality and climate to result in a significant effect.

No significant effects are anticipated as a result of interactive effects.

16.10 POPULATION AND HUMAN HEALTH

As outlined in Table 16.1, the following technical areas have the potential to result in interactive effects on Population and Human Health:

- Landscape and Visual;

- Hydrology;
- Cultural Heritage and Archaeology;
- Noise and Vibration;
- Roads and Traffic;
- Air Quality and Climate; and
- Other Considerations

Interactions and effects between Population and Human Health, and Landscape and Visual are outlined in Section 16.2.1.2.

Interactions and effects between Population and Human Health, and Hydrology are outlined in Section 16.4.1.2.

Interactions and effects between Population and Human Health, and Cultural Heritage and Archaeology are outlined in Section 16.6.1.1.

Interactions and effects between Population and Human Health, and Noise and Vibration are outlined in Section 16.7.1.2.

Interactions and effects between Population and Human Health, and Roads and Traffic are outlined in Section 16.8.1.2.

Interactions and effects between Population and Human Health, and Air Quality and Climate are outlined in Section 16.9.1.1.

16.10.1 Potential Interactions

16.10.1.1 Other Considerations

Impacts on the other considerations (tourism) resource within the construction phase of the Development have the potential to impact upon population and human health due to construction activities and the disruption they can cause, for example interruption recreation activities. These impacts on other considerations (tourism) via construction activities can impact upon population and human health receptors, namely humans located within the vicinity of the Development.

The other considerations assessment concluded that the area was of low sensitivity for tourism, therefore concluded that the Development had no significant effects of tourism.

Therefore, given the short-term, temporary nature of the construction works and effects being assessed as not significant, the Development will not result in any significant effects, in terms of interactions and inter-relationships, between other considerations (tourism) and population and human health.

No potential effects were identified during the operational phase of the Development in relation to the other considerations (tourism) resource and therefore there are no effects are predicted in relation to the interaction and inter-relationships with population and human health.

16.10.2 Summary of Potential Interactive Effects on Population and Human Health

The principal receptors considered within Population and Human Health topic areas are the human population, on which a number of effects could interact. However, all effects identified within this EIA Report are not significant; all construction effects have been assessed as temporary, with limited operational effects identified. Despite no significant effects identified, best practice mitigation measures will ensure effects are further minimised. As a result of these mitigation measures, all effects identified are considered to be of such a limited magnitude and temporary period that they are unlikely to interact with other effects on population and human health to result in a significant effect.

No significant effects are anticipated as a result of interactive effects.

16.11 OTHER CONSIDERATIONS

As outlined in Table 16.1, the following technical areas have the potential to result in interactive effects on Other Considerations:

- Landscape and Visual;
- Roads and Traffic; and
- Population and Human Health.

Interactions and effects between Other Considerations, and Landscape and Visual are outlined in Section 16.2.1.3.

Interactions and effects between Other Considerations, and Roads and Traffic are outlined in Section 16.8.1.3.

Interactions and effects between Other Considerations, and Population and Human Health are outlined in Section 16.10.1.1.

16.11.1 Summary of Potential Interactive Effects on Other Considerations

The principal receptors considered within Other Considerations topic areas are the human population, on which a number of effects could interact. However, all effects identified within this EIA Report are not significant; all construction effects have been assessed as temporary, with limited operational effects identified. Despite no significant effects identified, best practice mitigation measures will ensure effects are further minimised. As a result of these mitigation measures, all effects identified are considered to be of such a limited magnitude and temporary period that they are unlikely to interact with other effects on other considerations to result in a significant effect.

No significant effects are anticipated as a result of interactive effects.

17 SUMMARY OF MITIGATION

17.1 INTRODUCTION

This revised Chapter summarises the combined mitigation measures for the Bilboa Wind Farm, combined with the Consented Grid Route.

Mitigation measures have been integral to the design evolution of the Development as outlined in **Chapter 4: Site Selection and Alternatives** and **Chapter 5: Project Description** of the EIA Report. The overall aim of the design strategy was to create a development with a cohesive design that relates to the surrounding landscape whilst taking account of the environmental characteristics of the area in which the Development is located, for example sensitive habitats and hydrological resources.

Table 17.1 presents a schedule of mitigation measures, including that of embedded mitigation, for the Development listed according to the relevant environmental topic, which would be applied during the construction operation and decommissioning of the Development.

For the avoidance of doubt, this summary includes mitigation measures collated from the EIA Reports, Further Information Reports, Technical Appendices and Natura Impact Statements of:

- 2011 EIS for the Original Wind Farm, including NIS;
- 2020 EIA and FI for the Consented Grid Route, including NIS; and
- 2020 EIA and FI for the Consented Modification, including NIS.

Table 17.1 is an exhaustive list of all mitigation measures proposed for all aspects of the Development including the Consented Grid Route.

Table 17.1: Summary of Mitigation from EIA Report, NIS and CEMP

Environmental Subject Area	Mitigation Proposed	Timing
Chapter 4: Site Selection and Alternatives	**Embedded Mitigation** Embedded mitigation measures incorporated as part of the Consented Wind Farm design, such as maintaining 50 m watercourse buffers from all crane hardstandings, will remain adhered to as part of the Development.	Pre-construction and during construction
Chapter 5: Project Description	**Construction Environmental Management Plan (CEMP)** The CEMP covers all elements of the Development, the Consented Wind Farm, and the Grid Application, and is provided as Technical Appendix A1 of this EIA Report, which details the proposed mitigation measures that are to be adopted to mitigate environmental effects throughout the project. The CEMP sets out how the Development would be constructed and additional mitigation commitments. The CEMP collates all measures required during construction to avoid and minimise environmental harm, including: • Site induction and training; • Working hours; • Enabling works; • Surface water and drainage management; • Waste management; • Wastewater and water supply monitoring and control; • Oil and chemical delivery and storage; • Water quality monitoring; • Ecological protection measures; • Construction noise management; • Cultural heritage protection measures; • Handling of excavated materials; • Reinstatement and restoration; • Traffic management; • Environment incident response and reporting; • Use and extent of borrow pits; • Method statements and risk assessments; Contractors will also be required to adhere to the following to minimise environmental effects of the construction process: • Conditions required under the Consent and deemed planning permission; • Requirements of statutory consultees; • Any other relevant mitigation measures identified in the EIA Report; and • All relevant statutory requirements and published guidelines that reflect 'good practice'.	Pre-construction and during construction

Environmental Subject Area	Mitigation Proposed	Timing
	In addition, the CEMP will typically be supported by the following documents which apply to the construction process: • Water Protection Plan; • Peat Management Plan; • Pollution Prevention Plan; • Traffic Management Plan; • Site Waste Management Plan; and • Restoration Plan. Wheel wash facilities will be located at the site entrance to reduce construction traffic fouling public roads. The wheel wash will come with an additional water tank which will be filled regularly. These units will be self-contained and will filter the waste for ease of disposal. Waste will be removed from each unit and from site by a permitted contractor to a licensed facility. Prior to leaving the site, every truck delivering concrete to the site must wash the chute only to a lined, and fully sealed pit at designated washing stations at least 50m of the stream zone or any sensitive habitats. Any diesel, fuel or hydraulic oils stored on site will be stored in bunded storage tanks – the bund area will have a volume of at least 110 % of the volume of such materials stored. Refueling of plant during construction will only be carried out at designated refueling station locations on site. No refueling will take place within 50m of the stream zone or any sensitive habitats. Appropriate spill control equipment, such as oil soakage pads, will be kept within the construction area and in each item of plant to deal with any accidental spillage. Portaloos and / or containerised toilets and welfare units will be used to provide toilet facilities for site personnel. Sanitary waste will be removed from site via a licensed waste disposal contractor.	
	Environmental Manager A suitably qualified Environmental Manager (competent in the implementation and management of environmental mitigation measures for wind farms) will be appointed to ensure the effective operation and maintenance of drainage and other mitigation measures during the construction process.	
	Security Access to the site will be limited using a gate to prevent illegal dumping on the site and use of off-road vehicles etc. This is unlikely to be an issue however given that a large portion of the proposed development lands are privately owned.	**Operation**
	Decommissioning All construction phase mitigation will be implemented during the decommissioning phase.	**Decommissioning**

Environmental Subject Area	Mitigation Proposed	Timing
Chapter 6: Landscape and Visual	**Embedded Mitigation** Key embedded mitigation of the Development is the maintenance of the Consented Wind Farm tip height of the proposed turbines, in order to maintain the visual effects as identified in the LVIA chapter within the 2011 Environmental Impact Statement (EIS) of the Consented Wind Farm (the 2011 EIS). These include: • The final colour of the turbines will be off-white / light grey; • All turbines will look the same and rotate in the same direction; • The number of turbines has been minimised; • A matt surface finish will ensure minimum light reflection; • Turbine towers shall be to industry standard; • The turbines, ancillary structures, access roads and transmission infrastructure has been sited to complement the landform.	Pre-construction
Chapter 7: Biodiversity	**Embedded Mitigation** The following measures are incorporated into the proposed wind farm design to reduce effects on designated sites, flora and fauna through avoidance and design: • The hard-standing area of the wind farm has been kept to the minimum necessary for the specified turbine rotor size, including all site clearance works to minimise land take of habitats and flora. • Site design and layout deliberately avoided direct effects on designated sites. • Care has been taken to ensure that sufficient buffers are in place between wind farm infrastructure and hydrological features such as rivers and streams.	Pre-construction
	Project Ecologist A Project Ecologist/Ecological Clerk of Works (ECoW) with appropriate experience and expertise (in implementing ecological mitigation measure for wind farm developments) will be employed for the duration of the construction phase to ensure that all the mitigation measures outlined in relation to the environment are implemented. The Project Ecologist/ECoW will be awarded the authority to stop construction activity if there is potential for significant adverse ecological effects to occur.	Construction
	Project Ecologist Communications A line of communication with IFI will be established by the ECoW and fisheries officers will be invited to inspect mitigation measures at the site.	Construction
	Development Footprint Restriction The area of the proposed works will be kept to the minimum necessary, including all site clearance works, to minimise disturbance to habitats and flora. All works will be restricted to the immediate footprint of The Development, which will be wholly within the development site boundary and kept separate from any key areas for biodiversity (see CEMP; Appendix A4.1 of this	Construction

Environmental Subject Area	Mitigation Proposed	Timing
	EIA Report). Machinery, and equipment will be stored within the site compound. Designated access points will be established within the site and all construction traffic will be restricted to these locations.	
	Invasive Species Surveys Preconstruction invasive species surveys of the main wind farm site and grid connection route will be undertaken to reconfirm the findings of the NIS.	Pre-construction
	Invasive Species Management Implementation of the invasive species management plan (ISMP) will prevent the spread and/or introduction of invasive species. Where invasive species are present within or adjacent to the footprint of works they will be treated and disposed of before construction, correctly in a manner which prevents further spread. General mitigation measures for the prevention and containment of species present are described below: **Prevention** • The full implementation of the invasive species management plan in conjunction with a competent and experienced Invasive Species Specialist Contractor. • Supervision of control measures and treatment works by an appropriately qualified ecologist or invasive species specialist. • Raising awareness of site workers via toolbox talks given by a suitably qualified person as part of site induction. • informing workers what to look out for and what procedure to follow if they observe an invasive species. • Only planting or sowing of native species within the proposed Bilboa Wind Farm site, Grid Connection and TDR will be allowed. • Where invasive species are physically removed, disturbed soil will be seeded or replanted (including 5cm deep mulch) with native plant species. This will prevent the colonisation of bare soil by invasive species in the area. This is of particular note in areas were redcurrant or snowberry form part of the hedgerow. In this case, native shrubs/trees will be planted to maintain and improve hedgerow structure. • Signs will warn people working there that there is invasive species contamination. • Stockpiles of soil contaminated by invasive species are to be indicated clearly with appropriate signs and isolated. • Ensure good hygiene practices. • Remove the build-up of soil on equipment. • Keep equipment clean. • Do not move fouled equipment from one site to another. • All vehicles exiting the site will be washed down with a pressure washer to prevent the transport of seeds, since this cannot be prevented comprehensively by any other measure. • Wastewater from washing facilities will be stored securely and treated to prevent spread outside the site.	Construction and Operation

Environmental Subject Area	Mitigation Proposed	Timing
	• Footwear and clothing of operatives working near invasive species will be checked for seeds, fruits, or other viable material before exiting the site. **Containment** • A pre-construction survey to reconfirm the findings of the EIAR during the growing season immediately prior to the construction phase. This will mark out the extent of invasive plant species. Prior to the construction phase, invasive species are to be treated in areas where works will occur. • No machinery or personnel shall be allowed within exclusion zones. Similarly, there shall be no storage of materials within or adjacent to exclusion zones. • No soil or vegetation shall be removed from this area unless it is contained and is transported via an appropriately licensed waste contractor to a suitably licenced facility for treatment. • Informing all site staff through toolbox talks as part of site inductions. • Any new sightings of invasive plant species shall be relayed to construction staff and the developer. These areas shall follow the same protocol as the current infected area. • It is possible, particularly in the first year of control, that new plants will sprout following the initial removal/treatment, either because shade suppression will be reduced or due to soil disturbance. As such, several additional visits may be required. Up to three visits during the following growing season, May/June, July/August and September/October are recommended. • Import only clean soil from known sources. • Ensure all vehicles and equipment are cleaned to avoid cross contamination. • Follow instructions provided for containment of invasive species. • Promote native species and biodiversity, only native species are to be introduced to the site. **Disposal** • Unwanted material originating from the site will be transported off site by an appropriately licensed waste contractor and disposed of properly at a suitably licenced facility. • Deep burial onsite may also be used. The requirements for individual species vary; these are detailed in the ISMP. **Treatment** Three treatment options are proposed for Japanese Knotweed. Where Japanese Knotweed is present along the grid route the following specific mitigation measures will be implemented: • Japanese Knotweed root systems can extend up to 7m in a lateral direction (but usually only up to 5 m), and 2m deep from the over ground parent plant. • Staff will be made aware of this buffer zone when working within areas of infestation. • Areas of infestation to be fenced off from other works areas including a buffering distance of up to 7m to create exclusion zones. • Construction works will only be allowed within exclusion zones following the eradication of Japanese Knotweed.	

Environmental Subject Area	Mitigation Proposed	Timing
	• No treatment measures to take place in these areas without supervision and agreement by appointed appropriately experienced ecologist or Japanese Knotweed eradication specialist. • All machinery and vehicles operating within areas of infestation to be thoroughly checked and if necessary, cleaned prior to leaving the area to protect against further spreading of Japanese Knotweed. • During vegetation clearance and the removal of rubbish and other waste materials from infested areas care must be taken to ensure that Japanese Knotweed is not carried with these materials out of the site. Japanese • Knotweed plants (or other invasive species) will not be removed along with other vegetation during clearance works. • No material shall be taken from areas of infestation (unless for disposal at a suitably licenced facility). All staff shall be made aware of nature of threat via toolbox talks as part of site inductions. Toolbox talks shall be undertaken with all personnel accessing the site to ensure that the details of the invasive species management plan are adhered to and to raise awareness of the potential treat of invasive species. • Wheel washes shall be put in place at entry and exit points, if considered appropriate. Wastewater from these facilities will be stored and treated to avoid further outbreaks. • If operating within an area of known infestation all machinery, vehicles, equipment, foot ware and clothing will be cleaned thoroughly (if necessary, using steam cleaners) in a contained area to avoid further contamination. • It is unlikely that one treatment will kill this plant. Treatment will be required for years before eradication is achieved. **Treatment option 1: Deep burial onsite** • Japanese knotweed will be treated, excavated and buried in a pit lined with root barrier membrane with minimum 5m ground cover. The disposal site shall be located at least 10m from the margins of the site or any engineering features, for example drains or bunds. **Treatment option 2: Moving soil and treated Japanese Knotweed off site** • Material (soil, vegetation, etc.) contaminated with Japanese Knotweed can only be transported offsite under licence from the NPWS. The material can only be removed to a prearranged EPA-licenced waste transfer facility by the licenced haulier. The final fate of Knotweed material transported off-site is deep burial or incineration at an appropriately licensed facility. **Treatment option 3: Stem injection** • In areas of small infestations, it may be feasible to inject glyphosate (ten to one solution) into stems with stem-injection applicators. Regrowth will be followed up by a knapsack sprayer. This method will only be carried out by a trained and certified individual.	
	Biosecurity Measures	Construction

Environmental Subject Area	Mitigation Proposed	Timing
	Strict biosecurity measures will be implemented if plant and machinery working in areas with invasive species along the Grid Application cable route is used at The Development. All machinery shall be disinfected and visually inspected before leaving works areas where invasive species are present.	
	Mammals Mitigation An ecologist will supervise areas where vegetation, scrub and hedgerow removal will occur prior to and during construction as appropriate (e.g., an ecologist may be required during some clearance works of areas where vegetation is too dense to check beforehand). This will ensure that any site-specific issues in relation to wildlife not currently present (e.g. Badger setts) on site will be reconfirmed prior to commencement of works so as to allow appropriate mitigation measures to be put in place. It is recommended to use ultrasonic mammal repellers prior commencing with the clearing activities. In the event that an issue arises, the NPWS will be updated, consulted with and the relevant guidelines will be implemented as appropriate. Construction operations will take place predominantly during the hours of daylight to minimise disturbances to faunal species at night. Some works may occur at night but the project ecologist/ECoW shall manage the timing and location of night-time works to avoid sensitive features.	Pre-construction & Construction
	Badger Mitigation A pre-construction mammal survey will be undertaken within the footprint of the development in order to reconfirm the existing environment; in the event that a badger sett should be encountered at any point, then NPWS will be informed and NRA *Guidelines for the Treatment of Badgers Prior To the Construction of National Road Schemes* will be followed. If planning permission is granted and a derogation/disturbance licence is required, the NPWS will be consulted with and a derogation/disturbance licence will be sought in order to implement mitigation measures prior to construction. Setts within the footprint of proposed infrastructure would require (following evacuation if active) controlled destruction under ecological supervision, while setts within tree felling buffers and in close proximity to the development would require temporary hard-blocking and exclusion for the duration of construction works to ensure that badgers potentially occupying these setts during construction works are not injured. No hard-blocking or sett exclusions will be undertaken during the badger breeding season (December-June inclusive). Construction of an artificial sett will be undertaken in consultation with NPWS in the case that sufficient alternative setts are not available due to hard blocking of setts near the development footprint. A report detailing evacuation procedures, sett excavation and destruction, and any other relevant issues will be submitted to the NPWS, in fulfilment of the wildlife licence conditions.	Construction

Environmental Subject Area	Mitigation Proposed	Timing
	Vegetation clearance There is the potential for setts to be discovered during vegetation clearance works. Care will need to be taken during this early stage of the development and a competent ecologist will be required on-site for these works. If setts are discovered all works within 30m of the sett shall cease including vegetation clearance. NPWS shall be contacted and a derogation/disturbance licence shall be sought. An activity survey shall be carried out to assess the potential for the sett to be used by badgers. Ultrasonic animal repellers will be used prior commencing the clearing activities. *Measures to prevent the injury of Badgers during proposed mitigation measures* In the event that a badger is found injured during the proposed mitigation measures, NPWS shall be contacted along with ISPCA and potentially a vet specified by NPWS capable of treating the species.	
	Red Squirrel Mitigation Any required felling of trees in forestry areas will be limited to time periods outside which red squirrel may have young in dreys (peak period January to March). If this is unavoidable then areas to be clear felled will be surveyed in advance by a suitable qualified ecologist to determine whether any occupied dreys are present. A license under the Wildlife Act will be sought as necessary.	Construction
	Pine Martin Mitigation Felling of trees in forestry areas will be limited to time periods outside which pine martens may have young in dens (March and April). If this is unavoidable than areas to be clear felled will be surveyed in advance by a suitable qualified ecologist to determine whether any occupied pine marten dens are present. A necessary license under the Wildlife act will be applied for should any sites have to be disturbed.	Construction
	Irish Hare, Pygmy Shrew, Irish Stoat and Hedgehog Mitigation An ecologist will check for the presence of hibernating hedgehog and or young mammals as appropriate, prior to vegetation clearance works prior to or during construction (as necessary). Where habitat is too dense the ecologist will supervise vegetation removal and grassland trimming/maintenance during clearance works as appropriate.	Construction
	Bats Mitigation *Supervision of vegetation clearance* An ecologist/ECoW will supervise areas where vegetation, scrub and hedgerow removal will occur prior to and during construction as appropriate (e.g., ecologist may be required during some clearance works of areas where vegetation is too dense to check beforehand). This will ensure that any site-specific issues in relation to wildlife not currently present (e.g., Bat roost locations) on site will be discovered prior to commencement of works to allow appropriate mitigation measures to be put in place. In the event that an issue arises, the NPWS will be informed and the relevant guidelines will be implemented as appropriate (e.g. NRA guidelines).	Construction

Environmental Subject Area	Mitigation Proposed	Timing
	<u>*Lighting restrictions*</u> Construction operations within the Site will largely take place during the hours of daylight to minimise disturbances to faunal species at night. Where lighting is required, directional lighting (i.e. lighting which only shines on work areas and not nearby countryside) will be used to prevent overspill. <u>*Pre-construction Survey*</u> If three years lapse from between planning-stage surveys in 2020 and installation of the wind turbines, it will be necessary to repeat one season of surveys during the activity period.	
	Bats <u>*Cut-in Speeds/Curtailment*</u> Cut-in speeds should be increased during the bat activity season (April-October) or where temperatures are optimal for bat activity to 5.5 m/s from 30 minutes prior to sunset and to 30 minutes after sunrise at turbines where surveillance shows high bat activity levels for High and Medium-Risk species and/or if bat carcasses are recorded. Further information is contained within **Chapter 7: Biodiversity** of the EIA Report and this EIA Report. <u>*Buffer zones*</u> The vegetation-free buffer zones around the identified turbines will be managed and maintained during the operational life of the development. Existing trees / scrub will be cleared around all five turbines to provide a vegetation-free buffer zone around each turbine. The minimum distance has been taken into consideration for felling of conifer plantation around wind turbines. All buffers will be maintained throughout the lifetime of the wind farm. The buffers will be kept open by mechanical means only. Chemical control methods will not be used. <u>*Monitoring of mitigation measures*</u> The success of the implemented mitigation measures for bats on the project should be monitored for a period of three years after construction. <u>*Bat fatality monitoring*</u> Whilst no significant residual effects on bats are predicted, the proposed development could provide an opportunity to gain baseline data on bat/turbine interaction and it is recommended that the scheme be monitored for bat fatalities for the first three years of operation.	Operation
	Avifauna Mitigation Subject to other environmental concerns (e.g., run-off), the removal of trees and scrub will be undertaken outside of the bird breeding season (March 1st to August 31st inclusive). Construction operations will take place during the hours of daylight to minimise disturbances to roosting birds, or active nocturnal bird species. Limited operations such as turbine erection may require night-time operating hours; these works will be supervised by the project ecologist/ECoW.	Construction

Environmental Subject Area	Mitigation Proposed	Timing
	That clearance of vegetation, including conifer forestry, from the site should only be carried out in the period September to February inclusive, i.e. outside the main bird breeding season. Where vegetation removal is required to be carried out outside this period, vegetation must be inspected for nesting birds, under licence issued by NPWS, by a suitably qualified Ecologist immediately prior to removal. Toolbox talks will be undertaken with construction staff on disturbance to key species during construction. This will help minimise disturbance. Kingfisher: Implement mitigation measures outlined in **Chapter 8: Hydrology and Hydrogeology** of the EIA Report, the CEMP and Aquatic Ecology Mitigation in below, to minimise and prevent the identified indirect effects to water quality. A re-confirmatory survey (March/April) will be conducted of the proposed turbine locations to assess any evidence of buzzard, kestrel, sparrowhawk and woodcock activity or taking up new territories. Should any new nests be recorded, works at these locations will be restricted to outside the breeding season (April-July) or until chicks are deemed to have fledged (following monitoring).	
	Avifauna Mitigation A post construction monitoring programme is to be implemented at the subject site in order to confirm the efficacy of the mitigation measures; the results of this will be submitted annually to the competent authority and NPWS. The colour, mode, intensity and density of lighting has been shown to influence the degree to which birds (specifically, nocturnally migrating passerines) are attracted to wind turbines at night. Guidance on mitigating the effects of aviation lighting on birds is provided in the information note 'The Effect of Aviation Obstruction Lighting on Birds at Wind Turbines, Communication Towers and Other Structures' (NatureScot 2020). Studies have shown that red lighting is more attractive to birds, and that steady burning lights are more attractive than flashing ones, while structures with no lighting were the least attractive (Kerlinger et al., 2010; Gehring et al., 2009). The directional intensity of lighting is also a factor in reducing the attraction of birds. As such, the following mitigation is proposed, pending approval by the IAA: • Lighting will not be installed on all turbines. The exact arrangement is subject to approval by the IAA, however it is considered that lighting can be limited to the minimum number of turbines to identify the outline of the wind farm (e.g. T1, & T5, or T1, T3 & T5). • Flashing white or green lights will be fitted. If red lights are required by the IAA, flashing lights will be used. • The most intense light will be focused within the horizontal plane, reducing the attraction of high and low-flying birds. Further to this, shielding will be fitted to prevent light emissions towards the ground. As for the previous measures, the viability and exact specifications for this aspect are subject to approval by the IAA.	Operation
	Aquatic Ecology Felling will be undertaken in accordance with the mitigation measures within the CEMP (Technical Appendix 4.1); in addition, felling will be subject to a felling license from the Forest Service and to the conditions of such a license.	Construction

Environmental Subject Area	Mitigation Proposed	Timing
	It is proposed to undertake felling in spring to facilitate the sowing of grass seeds post-harvest to aid sediment filtration and nutrient absorption, using native grass species Holcus lanatus and Agrostis capillaris. Trees will be felled away from aquatic zones. Branches, logs or debris will not be allowed to accumulate in aquatic zones and will be removed. Additional silt fencing will be erected along the banks of any watercourses in areas where tree felling is proposed. Where damage or serious rutting has started to occur, timber extraction will be suspended immediately. Relocation of the extraction rack will be used to remedy the situation. Removal of branch lop-and-top and other debris (brash) from felling areas within 20 m of forestry drains (i.e. up-slope of active pathways to larger downstream watercourses) will reduce nutrient seepage immediately post-felling and in the proceeding years after felling has occurred. Machine operations must not take place in the 48hour period before predicated heavy rainfall, during heavy rainfall or in the 48hour period following heavy rainfall (DAFM, 2018). Where imported materials are used in road construction, these are to be such as not to be liable to become crushed by vehicular movement, and lead to discharge of fine particulates to downstream receiving waters. A layer of compacted Cl 804 material will be placed on top to provide a suitable running surface. Loose track material generated during the use of access tracks will be prevented from reaching watercourses by maintaining an adequate cross fall on the tracks. During the operation of the excavations, excavation machinery will be regularly maintained to ensure that there is minimal potential for fuel or oil leaks / spillages to occur. All maintenance will be conducted on suitable absorbent spill pads to minimise the potential for groundwater and surface water pollution. All machinery will be equipped with drip pans to contain minor fuel spillage or equipment leakages. Drains around hard-standing areas will be shallow to minimise the disturbance to sub-soils. Cross-drains of 225 mm diameter will be provided to prevent a risk of clogging to crossings conveying flows from bog drains, agricultural drains and forestry drains across the access roads. Interceptor cut-off drains will be provided on the upslope side of the site access roads. These interceptor drains will discharge diffusely over land. Cut off ditches will be used where necessary at the perimeter of turbine base foundation excavations to divert the clean water away from the work areas thereby reducing the volume of water potentially requiring pumping/treatment in silt traps/settlement lagoons. Roadside swales will serve to attenuate any increase in surface water runoff. The routes for the proposed access tracks are laid out to follow existing tracks where practicable. Site access roads have been laid out to reduce the longitudinal slope of roadside drains and to follow natural flow paths. Where roadside drains are laid at slopes greater than 2%, check dams will be provided, as necessary. This is unlikely to occur as the site is relatively flat.	

Environmental Subject Area	Mitigation Proposed	Timing
	The following applies to man-made drains within the proposed main wind farm site only. No interference with natural watercourses will occur. Where existing tracks will be used to access the development, roadside drains alongside these tracks will be cleared of obstructions only where strictly necessary (i.e. if flooding occurs). Vegetation and other obstructions provide sediment arrest and flow attenuation functions and as such should not be interfered with unless absolutely necessary. In addition, clearance of drains generates extra sediment. Where obstruction removal is required, silt traps will be provided at regular intervals, as necessary. All measures for the protection of water quality within the proposed development site, as detailed in the CEMP (Appendix A1 of this EIA Report), will also protect the aquatic ecology and fisheries value of downstream watercourses.	
	Other Fauna In the event that construction is required to proceed during the breeding seasons of common frog/smooth newt, translocation will be undertaken where active breeding drains are within the development footprint. Protection of existing hydrological conditions where drains are adjacent to or within the zone of influence (i.e. could be impacted by drainage works elsewhere) are required. In the event that the hydrology of existing breeding areas within the zone of influence cannot be maintained, translocation to suitable receptor sites can be used. If necessary, suitable replacement habitats will be created. Amphibian fencing will be erected to prevent re-entry to areas which have been evacuated and any areas which could be occupied by amphibians during the construction period. Densely vegetated areas and other features offering hibernacula will be searched for hibernating lizard prior to clearance if works are scheduled to be carried out between November – March inclusive. If hibernating lizards are encountered a buffer will be established and clearance will be postponed in that area until April.	Construction
	Designated Nature Conservation Sites Implement mitigation measures outlined in the CEMP, in addition to the NIS to minimise and prevent the identified indirect effects on water quality as outlined previously. The CEMP and NIS mitigation measures are summarised in this table.	Operation
	Habitats and Flora Implement mitigation measures outlined in the CEMP, in addition to the NIS, to ensure that there will be no contamination of water bodies due to siltation or contaminated run-off during the operational phase. The CEMP and NIS mitigation measures are summarised in this table. The position of trenches will be marked out and the line stripped of turfs and soils which will be set aside for reinstatement. Ecologically sensitive areas will be avoided by construction plant or vehicles. The majority of cable installation will be undertaken adjacent to and within the track construction zone, to minimise intrusion into the surrounding areas.	Construction and Operation

Environmental Subject Area	**Mitigation Proposed**	**Timing**
	Where cables are laid in wetland areas or other zones that would negatively be impacted by dewatering as advised by the ECoW on the Site, backfill to cable trenches will include clay bungs at a maximum of 50 m intervals. The area of the proposed works will be kept to the minimum necessary, including all site clearance works, to minimise disturbance to habitats and flora. In this case, the footprint of the development has been kept to the minimum necessary, including the use of layout design methods to minimise excavation works. No disturbance to habitats or flora outside the development area will occur. All works and temporary storage of material will be restricted to the immediate footprint of the development, which will be wholly within the development site boundary. Designated access points will be established within the site and all construction traffic will be restricted to these locations.	
Chapter 8: Hydrology	**Embedded Mitigation** The following mitigation measures relating to the hydrological environment are embedded into the design and construction of the Development and were proposed as part of the Consented Wind Farm and would be included as part of the Consented Wind Farm: • Installation of settlement lagoons as detailed within the CEMP (Appendix A1 of this EIA Report); • 50 m buffer strips between watercourses and construction working areas will be established; • 20 m buffer strip around mapped artificial drains; and • Good practice methods and works for protection of hydrological receptors, to be implemented through the CEMP included within Technical Appendix A1. Good practice will be followed in all aspects of construction, operation and decommissioning, specifically through the CEMP, which incorporates a Pollution Prevention Plan (PPP). The site drainage has been designed to complement existing overland flow and existing bog, agricultural and forestry drainage. A three-stage treatment train (swale – settlement pond – diffuse outflow) is proposed where required to retain and treat the discharges from hard surface areas. Settlement lagoon outflow will be regularly inspected, and discharge may be pumped, when required, for maintenance purposes. Any pumping activities will be supervised and authorised by the Infrastructure Contractor's Project Manager. Treated water will be discharged onto vegetated surfaces and directed away from surface watercourses. Within all the catchments, irrigation techniques, which may include the use of perforated discharge hoses or similar, will be employed to rapidly distribute discharge across a vegetated slope.	Pre-construction and during construction
	Silt Traps and Silt Fencing Silt traps and silt fencing measures for the wind farm development are described in the CEMP and will be put in place in advance of works as construction progresses across the site.	Pre-construction and during construction

Environmental Subject Area	Mitigation Proposed	Timing
	Silt fencing will be erected at the location of stream crossings along the cable route and within the wind farm site.	
	Water Quality and Monitoring Baseline biological water quality sampling will be undertaken in watercourses downstream of the wind farm and grid connection prior to construction. Biological sampling (SSRS or Q sampling as applicable) will be carried out at established baseline sampling points on a weekly basis during construction. Surface water monitoring will be undertaken at locations on the watercourses downstream of Bilboa Wind Farm and Grid Connection infrastructure and upstream of other non-natural influences. The results of the environmental monitoring will be reviewed by the Contractor on an ongoing basis to enable trends and criteria to be established and corrective actions implemented if necessary. All personnel working on site will be trained in pollution incident control response. An emergency response plan will be prepared which will ensure that appropriate information will be available on site outlining the spillage response procedure and a contingency plan to contain silt. A regular review of weather forecasts of heavy rainfall is required, and a contingency plan will be prepared for before and after such events. A record will be kept of daily visual inspections of drains, silt ponds, etc onsite and weekly inspections of streams which receive flows from the development, during the construction phase. Wet concrete operations are not required for this site within or adjacent to watercourses. Daily visual inspections of drains, silt ponds, etc onsite and weekly inspections of streams will be performed during the construction period to ensure suspended solids are not entering the streams and rivers alongside the work area, to identify any obstructions to channels, and to allow for appropriate maintenance of the existing roadside drainage regime. If excessive suspended solids are noted, construction work will be stopped, and remediation measures will be put in place immediately. Major construction works including concrete pours onsite will be timed to occur outside periods where heavy rainfall would be expected. A regular review of weather forecasts of heavy rainfall is required, and the contractor is required to prepare a contingency plan for before and after such events. Horizontal directional drilling operations to be limited to periods of low rainfall. Standing water, which could arise during excavations, has the potential to contain a high concentration of suspended solids as a result of the disturbance to soils. This water will be pumped into the site drainage system (but not directly into settlement ponds), which will be constructed at site clearance stage, in advance of excavations for the turbine bases. In situations where space for drainage infrastructure or suitable treatment measures are not available (e.g. during grid cable installation) excess water from excavations will be required to be removed by tanker for disposal at a licensed facility). Drains around hard-standing area will be shallow to minimise the disturbance of sub soil.	Pre-construction and Construction

Environmental Subject Area	Mitigation Proposed	Timing
	Culverts will be sized in accordance with CIRIA C689 Culvert Design and Operation Guide, the Office of Public Works (OPW) guidance and the guidance provided by IFI in the design of the proposed stream crossings. Section 50 Applications will be prepared as necessary where works affecting new or existing crossings are required. The bases of borrow pits and earthworks will have a gravity drainage system and all water will drain to an adequately sized sump or settlement lagoon. If dewatering of borrow pits or excavations is necessary, wastewater will be treated by designed settlement lagoons and retention ponds. 'Siltbusters' will be used to treat pumped / surplus water from lagoons or retention ponds during periods of heavy or persistent rainfall. Flocculant (non toxic and safe for aquatic environment) could be employed in settlement lagoons and retention ponds to further facilitate the settlement of fine suspended solids before wastewater is discharged to rough vegetation. Wastewater discharge onto vegetated surfaces from borrow workings and earthworks areas will be directed away from watercourses and drainage ditches to avoid direct discharge and extended the treatment phases. Any sediment suspended within the treated water will be deposited amongst the rough surface vegetation. The Contractor will ensure that excessive sediment on vegetated surfaces does not accumulate. Silt mats will be used at the outfalls of settlement lagoons and retention ponds to further aid the settlement of sediment from earthworks drainage	
	Operation The operations management of the subject development will include regular monitoring of the drainage system and maintenance as required. On site quarterly inspections of the erosion and sediment control measures will be required until one year post construction and yearly thereafter during the operational phase. During the operation phase, oils will be required for cooling the transformers giving rise to the potential for oil spills within the site. Risks of potential oil leakage and pollutions draining to the watercourse from the installed transformer is mitigated with transformer interceptor bund wall. Settlement ponds will be left in place during the operational phase. Ponds will be fenced to restrict access.	Operation
	Further Mitigation Implementation of all measures within the CEMP (Appendix A1). No further additional mitigation measures to those outlined in the CEMP are required.	N/A
Chapter 9: Land and Soils	**Embedded Mitigation** Embedded mitigation in relation to the Development includes minimal upgrades to that of the Consented Wind Farm while still lying within areas of thin peat. The overall site layout design has sought to avoid the deepest peat	Pre-construction and during construction

Environmental Subject Area	Mitigation Proposed	Timing
	while maintaining use of the existing forestry track networks where possible, which in turn supports the Crane Hardstanding Modification. In addition, the best practice construction and drainage measures will be implemented during construction in line with the measures set out in the CEMP. On this basis, assessment and mitigation within the 2011 EIS remain applicable for the Development, and includes: • Placement of infrastructure (e.g. crane hardstandings) in shallow peat; • Peat and subsoils excavated on the site will be stored in borrow pits used as part of the Consented Wind Farm; and • Implementation of drainage measures to attenuate drainage water. Excavated material will be re-used on-site for berms etc. Surplus material will be removed from the site to an appropriately licensed or permitted facility or may also be removed in accordance with Article 27 of the European Communities (Waste Directive) Regulations 2011 (S.I. 126 of 2011). There will be no stockpiling of excavated material. A setback distance of at least 50m from watercourses will be adhered to when storing temporary spoil. No spoil stockpiles will be left on site after construction. Any contaminated soils will be handled, removed and disposed of in accordance with statutory requirements for the handling, transportation and disposal of waste. In particular, the following measure will be implemented: Contaminated material will be left in-situ and covered, until such time as WAC (Waste Acceptance Criteria) testing is undertaken in accordance with recommended standards and in-line with the acceptance criteria to a suitably licenced landfill or treatment facility. This will determine firstly the nature of the contamination and secondly the materials classification i.e. inert, non-hazardous or hazardous. Such materials will be excavated, transported by a contractor with a valid waste collection permit and recovered/disposed of at an appropriate facility. Exposed faces of the borrow pit will be covered securely with a geotextile to minimise erosion. The exposed faces shall be hydroseeded after all use of the borrow pit has ceased. Where peat less than 1m in thickness is extracted for access roads, a cut and fill method will be used. Lateral drains will be established on the uphill side of the road to drain water from the slops and cross drains will be established at regular intervals depending on site conditions. Where peat greater than 1m in thickness is extracted the peat will be required to be excavated down to rock level, leaving batters on each side and with angles sufficient to ensure stability. A cut off ditch can be established uphill of the batter. The road surface will have a crossfall to drain run off into the ditches. A lateral drain will be made on the uphill side of the road with cross drainpipes at appropriate locations. The outlet of the drain will be at appropriate locations, with hessian/copra mats placed at the outfalls (where appropriate) in order to minimise erosion during periods of heavy rainfall or snow melt.	
	Handling and Storage of Peat	Construction

Environmental Subject Area	**Mitigation Proposed**	**Timing**
	Construction methods for excavating, handling and storing peat will be based on the following principles: • The surface layer of peat and vegetation will be stripped separately from the any catotelmic or other superficial soils. This will typically be an excavation depth of up to 0.5 m; • Careful handling is essential to retain any existing structure and integrity of the excavated materials and thereby maximise the potential for excavated material to be re-used; • To minimise handling and transportation of peat, acrotelmic and catotelmic will be replaced, as far as is reasonably practicable, in the locality from which it was removed. Acrotelmic material is to be placed on the surface of reinstatement areas; • Temporary storage of peat will be minimised, with restoration occurring in parallel with other works; • Suitable areas should be sited in locations with lower ecological value, low stability risk and at a suitable distance from water courses; • Reinstatement will, in all instances, be undertaken at the earliest opportunity to minimise storage of turves and other materials; • Managing the construction work to avoid periods when peat materials are likely to be wetter i.e. high rainfall events; and • Temporary storage and transport of peat on site from excavations to temporary storage areas will be minimised. Material excavated during track construction will either be stored adjacent to the track or within agreed spoil deposition areas and compacted in order to limit instability and erosion potential. Peat will not be allowed to dry out and silt fences will be employed if required to minimise sediment levels in run-off. The re-wetting of peat will be carried out, if there is a potential risk of the peat drying out. Material will be stored at least 50 m from watercourses in order to reduce the potential for sediment to be transferred into the wider hydrological system. Careful handling is essential to retain any existing structure and integrity of the excavated materials and thereby maximise the potential for excavated material to be re-used. To minimise handling and transportation of peat, acrotelmic and catotelmic will be replaced, as far as is reasonably practicable, in the locality from which it was removed. Acrotelmic material is to be placed on the surface of reinstatement areas. Temporary storage of peat will be minimised, with restoration occurring in parallel with other works. Reinstatement will, in all instances, be undertaken at the earliest opportunity to minimise storage of turves and other materials. The surface layer of peat and vegetation will be stripped separately from the any catotelmic or other superficial soils. This will typically be an excavation depth of up to 0.5 m. The Contractor will manage the construction work to avoid periods when peat materials are likely to be wetter i.e. high rainfall events. And temporary storage and transport of peat on site from excavations to temporary storage areas will be minimised. Where peat stockpiles are used silt fences and semi permeable obstructions will be used to prevent silt run off.	
	Peat Reinstatement	Construction

Environmental Subject Area	Mitigation Proposed	Timing
	The principles of re-instating peat and peat soils should be adhered to for all elements of the infrastructure, comprising the below: • Peat and peaty soils will be reinstated on track and infrastructure verges with turves placed on the upper horizons encouraging re-vegetation; • All peat, soil and turves excavated from beneath infrastructure will be re-instated in the vicinity of its original location; and • Restoration activities will be overseen by the Ecological Clerk of Works (ECoW) to ensure methods are properly adhered to. Peat restoration works - Drain blocking using peat dams to block the drain, will be carried out at every 10cm drop in elevation with a minimum of three and maximum of ten dams per 100m length of drain. Peat used for this purpose must be comprised of an intact sections of peat including both the acrotelm and catotelm as one complete piece. Peat dams should not be derived from peat excavated that is not fully intact. The dams must be keyed into drain sections to ensure a tight seal is maintained. See NPWS guidance document https://www.npws.ie/sites/default/files/publications/pdf/IWM99_RB_Restoration_Best%20Practice%20Guidance.pdf for reference to methodology. An alternative method of drain blocking on high bog includes the use of plastic sheet piling. This is inserted into a drain and pushed down into the peat to a sufficient depth that it remains securely in place (typically a minimum of 50cm below the base of a drain). When using plastic dams, drains should be blocked at every 10cm drop in elevation, with a minimum of three dams per 100m length of drain. Peat restoration activities will be overseen by the Ecological Clerk of Works (ECoW) to ensure methods are properly adhered to.	
Chapter 10: Cultural Heritage and Archaeology	**Embedded Mitigation** As the location of turbines and associated infrastructure remains unchanged from the Consented Wind Farm with only a slightly larger hardstanding proposed, the assessment and mitigation within the 2011 EIS remains valid for the Development. Mitigation measures in the 2011 EIS proposed archaeological monitoring of all ground works associated with construction and this remains valid for the Development. The following measures will be implemented during construction: • Cessation of works in the event of archaeological or architectural features or material being uncovered during the construction phase, to allow the monitoring archaeologist to assess, excavate and record any such material; • Should monitoring yield evidence of archaeologically significant features or material, preservation *in situ* may be recommended; • Should investigation yield evidence of archaeologically significant features or material that cannot be preserved *in situ*, archaeological excavation and recording, to full resolution, is recommended; and	Construction

Environmental Subject Area	Mitigation Proposed	Timing
	• Monitoring must be carried out under licence in accordance with Section 26 of the National Monuments Acts 1930 – 2014, and with a method statement agreed in advance with the National Monuments Service (Department of Culture, Heritage and the Gaeltacht) and the National Museum of Ireland.	
Chapter 11: Noise	**Noise Curtailment Strategy** Following the updated assessment undertaken as part of the EIA Report, there no longer a requirement for a noise curtailment strategy.	Operation
	Noise Monitoring When the project is operational, the above curtailment strategy will be implemented, and a 2-week noise monitoring programme will be undertaken within 12 months of commencement of operation to confirm compliance with the planning permission.	Operation
Chapter 12: Material Assets – Roads and Traffic	The Framework Traffic Management Plan is included within Appendix C of the CEMP (Appendix A1 of this EIA Report), which includes traffic management measures to be implemented during construction. This also includes the provision of passing places.	Construction
Chapter 13: Air Quality and Climate Change	**CEMP** The Development will be constructed in accordance with the CEMP (Appendix A1 of this EIA Report) which provides mitigation measures to combat potential emissions of construction dust.	Construction
Chapter 14: Human Health and Population	**Embedded Mitigation** No specific mitigation is required for population, employment and socio-economic effects, as a result of the Development; however, health and safety provisions will be in accordance with recognised best practice. Health and safety measures are detailed within the CEMP in Appendix A1 of this EIA Report.	Construction and Operation
Chapter 15: Other Considerations (Tourism and Recreation)	No mitigation is required and therefore no mitigation is proposed.	N/A
Chapter 15: Other Considerations (Electromagnetic interference, television	**Embedded Mitigation** The Consented Wind Farm was re-designed to address consultee concerns regarding communication signals; as the turbine layout of the Consented Wind Farm remains the same as the Development, this 2011 EIS mitigation forms embedded mitigation in regard to the Development and communication signals.	Pre-construction

Environmental Subject Area	Mitigation Proposed	Timing
and communication signals)	**Raidió Teilifís Éireann (RTÉ) Agreement** The 2011 EIS notes that an agreement was reached with Raidió Teilifís Éireann (RTÉ) which guaranteed that the developer would fix any problems which arise from the Consented Wind Farm with regard to television reception. The Applicant remains committed to the mitigation outlined in the 2011 EIS to ensure mitigation measures will alleviate any effects on infrastructure.	Construction & Operation
Chapter 15: Other Considerations (Air Navigation)	**Aviation Safety** In the interests of air navigational safety, turbines Modification, will require to be fitted with Type C, Medium Intensity, Fixed Red Obstacle lighting with a minim output of 2,000 candelas to be visible in all directions at all times. Lighting will not be installed on all turbines. The exact arrangement is subject to approval by the IAA, however it is considered that lighting can be limited to the minimum number of turbines to identify the outline of the wind farm (e.g. T1, & T5, or T1, T3 & T5).	Operation
Chapter 15: Other Considerations (Shadow Flicker)	**Shadow Flicker Mitigation System** The Applicant will install appropriate equipment and / or software to mitigate effects on Assessment Location 14. The final mitigation scheme will be agreed with the Carlow County Council prior to operation of the Development and may include control at source e.g. turbine software controls, or other measures agreed suitable with Carlow County Council.	Pre-construction